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PREFACE

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With all good wishes.

Sincerely



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Studies on Technological and Quality aspects of Chhana based sweet "Khurma"

Rajni Kant[®] and Ramesh Chandra⁺

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ABSTRACT

Different temperature of coagulation such as 85 and 80°C were investigated for getting good quality chhana suitable for preparation of Khurma. Among all, 85°C was found suitable as Khurma produced was hard, succulent and less spongy and got sensory scores as 8.6, 9.0 and 8.88 on 9-point Hedonic scale for flavour, body & texture and colour & appearance respectively. Amongst different cooking time of chhana cube such as 30 minutes and 45 minutes were studied for getting good quality of Khurma preparation. Among all, 45 minutes found suitable as Khurma produced was semi hard, slight spongy, pleasant flavour and brown colour and got sensory score as 8.14, 8.34 and 8.27 on 9-point Hedonic scale for flavour, body & texture and colour and appearance respectively. Effect of different milk ratio (buffalo milk: cow milk), such as, 80:20 and 85:15 of mixed milk on quality of chhana and Khurma were studied. Khurma sample prepared from mixed milk with 85:15 ratio was found suitable as Khurma produced was hard, slightly spongy and coarse and got maximum sensory scores as 7.89, 8.04 and 8.07 on 9-point Hedonic scale for flavour, body & texture and colour & appearance respectively, and also retain the cube shape of Khurma during cooking. They were observed for 15 percent dilution of buffalo milk with cow milk. Higher dilution caused slight reduction in flavour scores and cubes developed sponginess with a tendency to flatten during cooking in sugar syrup. Concentration of sugar syrup i.e. 70%, Khurma samples cooked in 70 percent sugar syrup were preferred most because of their light brown colour, cube shape, pleasant flavour and free from any surface crakes. A minimum cooking time of 45 min was recommended for manufacturing good quality Khurma as samples obtained on cooking for 30 min secured minimum scores for each sensory attribute except for flavour, standardization of milk with 85 part buffalo milk and 15 part cow milk and its heating to temperature 100°C, with slow and continuous agitation at temperature around 85°C, coagulation with 2.0 percent citric acid solution, draining, pressing for 15 min, chilling & forming into cube shape and cooking in 70 percent sugar syrup for 45 min followed by soaking in 60.0 percent sugar syrup and packaging.

Keywords: Buffalo Milk; Cow Milk; Chhana; Citric Acid; Sugar; Temperature.

INTRODUCTION

Khurma is one of the most popular sweets of Shahabad commissionary of Bihar, made from Chhana. Slowly, the product is increasing its popularity in other parts of the Bihar. It is obtained after making chhana in to a small cube shape and boiling them in clarified sugar syrup. The method of the Khurma preparation is a secret technique of particular sweetmakers. They neither divulge the recipe composition nor the exact technique of manufacturing to others under the fear of competition. Thus, in absence of requisite information, the quality of product varies shop to shop.

A good quality of Khurma is usually prepared from mixed milk chhana having hard body and slightly rough texture with very less water holding capacity. To commercialize the product of uniform quality there is an urgent need for standardizing the procedure of Khurma production from mixed milk. The Khurma made from buffalo milk, however, lack sponginess and smoothness as compared to that from mixed milk, may be due to compositional and structural differences. The presence of higher proportions of long chain saturated fatty acid makes the buffalo milk fat distinctly harder. Its casein micelles differ with respect to miceller size, voluminosity, compositional heterogeneity and mineral makeup. All these ultimately lead to differences in the quality of the end product. **Aneja**. *et.al.*, (2002)

There is a need to standardize a technique to manufacture Khurma of uniform quality from mixed milk, which should be simple, commercially adoptive to various scales of operations and cost effective. Also buffalo milk and / or its chhana require to be modified at certain stages of processing so as to obtain the Khurma of comparable quality.

MATERIAL AND METHODS

The experiment "Studies of Technology & Quality Parameters of Chhana Based Sweet "Khurma" will be carried out in the research Lab, Warner School of Food and Dairy Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad -211007, U.P. (India).

RAW MATERIALS

All the raw materials were collected from the local market of Allahabad. Potable water was used for preparing the product. It was ensured that the materials used were free from any kind of infestation. The quantity of materials required for preparation of Khurma has been given

Table - 1: Material required

Material	Quantity
Buffalo Milk	1 liter
Cow Milk	1 liter
Sugar	1 kg

Details of Treatment combination:

Two different ratios of buffalo milk and cow milk i.e. 80:20 & 85:15 were used for making chhana.

Two coagulation temperature i.e. 80 & 85°C were followed for making chhana.

Two different cooking time i.e. 30 & 45 min were undertaken for the preparation of Khurma.

Over all eight treatment combination were undertaken in present investigations which are as follows:

- T₁:- Khurma prepared from chhana obtained from mixed milk (80:20) at 80° C/with 30 min cooking time.
- T₂:- Khurma prepared from chhana obtained from mixed milk (85:15) at 80° C/ with 30 min cooking time.
- T₃:- Khurma prepared from chhana obtained from mixed milk (80:20) at 85° C/ with 30 min cooking time.
- T₄:- Khurma prepared from chhana obtained from mixed milk (85:15) at 85° C/ with 30 min cooking time.
- T₅:- Khurma prepared from chhana obtained from mixed milk (80:20) at 80° C/ with 45 min cooking time.
- T_6 :- Khurma prepared from chhana obtained from mixed milk (85:15) at 80°C/ with 45 min cooking time.
- T_7 :- Khurma prepared from chhana obtained from mixed milk (80:20) at 85°C / with 45 min cooking time.
- T_8 :- Khurma prepared from chhana obtained from mixed milk (85:15) at 85°C/ with 45 min cooking time.

Preparation of Khurma:

The process chart for preparation of Khurma is shown given in *Fig. 1*

Fig-1



CHEMICAL ATTRIBUTES Saampling of KHURMA

The Khurma samples were cut into very small pieces and mixed thoroughly in a suitable mixer separately for each container. The required quantity of this homogenized samples were taken for chemical analysis as described below.

Total solids

Total solids in chhana and Khurma were estimated by Gravimetric method as follows: (IS: SP: 18 (Part XI) - 1981b) for canned Khurma.

- Weigh clean and dry empty dish accurately.
- Add 5 gm sample in the dish and weigh it again accurately.
- Put the all dishes in the oven at 100 + 2°C temperatures for 3 hrs.
- After drying the samples in the oven, transfer it into a desiccators for cooling up to 30 min.
- After cooling weigh it.

Now, calculate the percent of total solids in the samples by following formula

% total solid in milk =
$$\frac{100 (W_1 - W_2)}{W_1 - W_2}$$

Where, $W_1 = Wt$ of empty dish $W_2 = Wt$ of empty dish + Wt of sample $W_3 = Wt$ of dish + Wt of sample after drying

Fat

Fat content in chhana and Khurma were estimated by Rose-Gottlieb method (IS; 4079, 1967).

Ash

The ash content in chhana and Khurma were estimated by Gravimetric method as follows (IS: SP: 18 (Part XI) - 1981b) for Khurma.

Take about 5g of the sample in a silica crucible and incinerate it on a heater till smoke free. The contents of the crucible are ignited at 550°C in a muffle furnace for 3- 4 hours and cooled for 30 minutes in desiccators.

Loss of weight $\times 100$

Weight of sample

Titratable acidity of chhana

Titratable acidity of chhana was determined by following the method prescribed for cheese by the **AOAC** (**1975**). 3.0 gm of chhana sample was accurately weighed into porcelain dish and ground into fine paste with 3 ml hot distilled water (65°C) using the pestle and mortar. Then 7 ml of hot distilled water were used to wash off the sample material from the pestle. The contents were mixed thoroughly using glass rod and cooled to room temperature. The contents were then titrated against standard N/10 NaOH using phenolphthalein as indicator. The acidity was expressed as percentage of lactic acid.

Method of microbial analysis of Khurma

The microbial analysis, i.e. yeast and mould count and presumptive coli form test of Khurma, were estimated by using standard procedure laid down in IS: 1847 (Part 2) and Manual of Dairy Bacteriology, I. C. M. R. Publication (2972).

Sensory evaluation of chhana and Khurma

The samples of chhana were evaluated for flavor, body & texture, color & appearance and overall acceptability and Khurma samples were evaluated for flavor, body & texture, color & appearance, sweetness and overall acceptability on a 9-point Hedonic scale by a sensory panel consisting of 8 judges.

RESULTS AND DISCUSSION

The present study was based to evolve "Studies of Technology & Quality Parameters of Chhana Based Sweet "Khurma" The data collected on different aspects were tabulated & analyzed statistically using the method of analysis of variance & critical difference. The significant & non significant differences observed have been analyzed critically within & between the treatment combinations.

The traditional sweet Khurma was prepared. The chemical and microbial analysis was determined during two different conditions. The findings are tabulated and discussed below:

Percentage fat of Chhana based sweet Khurma:-

It can be seen from *Table 2*. That the average Percentage fat of Chhana based sweet Khurma samples T_1, T_2, T_3, T_4, T_5 , T_6, T_7 and T_8 were 20.0%, 20.5%, 21.0%, 21.5%, 22.0%, 22.5%, 23.0% and 24.5% respectively.

Table 2. Average	fat percentage	of	Chhana	based	sweet
Khurma					

Treatment combination		R ₁	R ₂	R ₃	R ₄	R ₅	R ₆
T ₁	$M_1 T_1 C_1$	20.0	20.5	21.0	21.5	22.0	22.5
Τ ₂	$\mathbf{M}_2 \ \mathbf{T}_1 \ \mathbf{C}_1$	20.0	20.0	20.5	21.5	21.5	20.0
T ₃	$\mathbf{M}_1 \ \mathbf{T}_2 \ \mathbf{C}_1$	21.0	21.0	21.0	22.0	22.0	22.0
T_4	$\mathbf{M}_2 \ \mathbf{T}_2 \ \mathbf{C}_1$	22.0	22.0	22.0	22.0	22.0	21.0
Τ ₅	$\mathbf{M}_1 \ \mathbf{T}_1 \ \mathbf{C}_2$	22.0	22.0	24.0	24.0	24.0	21.0
T ₆	$\mathbf{M}_2 \ \mathbf{T}_1 \ \mathbf{C}_2$	24.0	24.0	24.5	24.5	23.0	22.0
T ₇	$M_1 T_2 C_2$	20.0	20.5	20.5	22.5	22.5	24.0
T ₈	$M_2 T_2 C_2$	22.5	22.5	23.0	23.0	23.5	24.0

M₁ - Buffalo milk: Cow milk (80:20)

 M_2 - Buffalo milk: Cow milk (85:15)

 T_1 - Coagulation temperature (80°C)

- T_2 Coagulation temperature (85°C)
- C_1 Cooking time (30 min)
- C_2 Cooking time (35 min)

It is evident from *Table 2*. That the treatment T_6 having combination of M_2 , T_1 , C_2 had an average fat percentage of 23.66 and the range was 22 to 24.5, treatment T₈ having combination of $M_2 T_2 C_2$ had an average fat percentage of 23.1 and the range was 22.5 to 24, treatment T_5 having combination of M_1 , T_1 , C_2 had an average fat percentage of 22.83 and the range was 21 to 24, treatment T_4 having combination of M₂ T₂ C₁ had an average fat percentage of 21.86 and the range was 21 to 22, treatment T_7 having combination of M₁ T₂ C₂ had an average fat percentage of 21.66 and the range was 20 to 24, treatment T3 having combination of M₁ T₂ C₁ had an average fat percentage of 21.5 and the range was 21 to 22, treatment T_1 having combination of $M_1 T_1 C_1$ had an average fat percentage of 21.1 and the range was 20 to 22.5 and where as treatment T2 having combination of $M_2 T_1 C_1$ had an average fat percentage of 20.6 and the range was 20 to 21.5.

Table 3. ANOVA for percent	fat in Chhana	based sweet
Khurma		

Source	d.f.	s.s.	M. S. S.	F. Cal.	F. Tab.	Result	S. Ed.	C.D.
					5%		(±)	5%
Replication	5	0.11	0.02	0.76	2.480	NS	-	-
Milk (M)	1	1.20	1.20	42.69	4.125	S	0.048	0.098
Temp.(T)	1	0.65	0.65	23.18	4.125	S	0.048	0.098
Cook Time(C)	1	2.08	2.08	73.90	4.125	S	0.048	0.098
Int. (M x T)	1	0.40	0.40	14.31	4.125	S	0.069	0.139
Int. (T x C)	1	0.40	0.40	14.31	4.125	S	0.069	0.139
Int. (M x C)	1	0.33	0.33	11.82	4.125	S	0.069	0.139
Int. MTC)	1	0.21	0.21	7.57	4.125	S	0.097	0.197
Error	35	0.99	0.03	-	-	-	-	-
Total	47	6.39	-	-	-	-	-	-

C.D. at 5% level- 0.197

M₂, T₁ and C₂ were found better for percent fat of Khurma.

The average fat percentage of chhana based sweet Khurma prepare from mixed milk M_2 coagulated at 80 °C and cooked for 35 min had higher fat percentage.

Data for average percent fat were statistically analyzed to find out its impact on the final quality of Chhana based sweet Khurma made. It was found that the calculated value (0.197) was lower than the tabulated value at 5 % level of significance. This indicates that retention of fat percentage of all combinations of experimental Khurma did not differ significantly.

 Table 4. The average Y/M count for Chhana based sweet

 Khurma

Treatment combination/	T ₇	Total	Range
Replication			
R ₁ (DAY 1)	10		
R_2	11		
R ₃	12	66	10-12
\mathbf{R}_4	10		
R ₅	12		
R ₆	11		
R ₁ (DAY 5)	13		
R ₂	14		
R ₃	13	81	12-14
\mathbf{R}_4	13		
R ₅	14		
R ₆	14		
R ₁ (DAY 10)	14		
R ₂	15		
R ₃	15	88	14-16
R ₄	15		
R ₅	15		
R ₆	14		
R ₁ (DAY 15)	15		
R ₂	16		
R ₃	15	93	16-17
R_4	15		
R ₅	16		
R ₆	17		
Total		328	10-17

Average Y/M count for Chhana based sweet Khurma

It is evident from *Table 4*. that Y/M count of replication R_1 and R_4 were 10 because higher moisture content in first days where as 5 day, 10 days and 15 days were 13, 13; 14, 15; 15 respectively. Yeast and mould count of R_6 was 17 on 15 days because lower moisture content compare to other treatment. That the average Y/M count for Chhana based sweet Khurma samples respectively.

Treatment combination		R ₁	R ₂	R ₃	R ₄	R ₅	R ₆
T ₁	$M_1 T_1 C_1$	8.51	8.96	7.91	8.50	8.42	7.87
T ₂	$M_2 T_1 C_1$	8.43	8.37	7.64	8.34	8.30	7.47
T ₃	$M_1 T_2 C_1$	8.52	8.46	7.91	8.50	8.42	7.87
T ₄	$M_2 T_2 C_1$	8.43	8.37	7.69	8.34	8.30	7.47
T ₅	$M_1 T_1 C_2$	8.52	8.46	7.91	8.50	8.42	7.47
T ₆	$M_2 T_1 C_2$	8.43	8.46	7.64	8.34	8.30	7.47
T ₇	$M_1 T_2 C_2$	8.52	8.46	7.91	8.50	8.42	7.47
T ₈	$M_2 T_2 C_2$	8.43	8.46	7.64	8.50	8.42	7.47

Table 5: Overall acceptability for Chhana based sweet Khurma

Overall acceptability for Chhana based sweet Khurma:-

It can be seen from *Table 5*. that the Overall acceptability for Chhana based sweet Khurma samples T_1 , T_2 , T_3 , T_4 , T_5 , T_6 , T_7 and T_8 were 7.64%, 7.69%, 7.91%, 8.37%, 8.43%, 8.46%, 8.50% and 8.51% respectively.

CONCLUSION

Organoleptic evaluation shows that Khurma prepared at temperature 85°C was found to be more acceptable as compared to that at 80°C as it gave good colour, flavour, aroma, taste, mouth feel and overall acceptability. Khurma is ideal sweet. Khurma is regarded as regimen for man all seasons without discrimination of nature, time, place and age.

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Studies on preparation of Rosogolla from a blend of Cow Milk and Soya Milk

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ABSTRACT

The highest mean score for Moisture (%) of rasogolla (46.24) was obtained for treatment T_0 (control). followed by T_1 (44.59), & T_2 (43.11). The minimum score (42.11) was obtained by T_3 the difference in score for moisture of rasogolla was significant. The highest mean score for fat (%) of rasogolla (6.91) was obtained for treatment T_0 (control) followed by T_1 (5.92), & T_2 (5.77). The minimum score (5.38) was obtained by T_3 the difference in score for fat of rasogolla was significant. The highest mean score for protein (%) of rasogolla (6.82) was obtained for treatment T_3 followed by T_2 (6.48), & T_1 (6.12). The minimum score (5.88) was obtained by T_0 (control) treatment. The difference in score for protein of rasogolla was significant. The highest mean score for ash (%) of apple butter (2.66) was obtained for treatment T_3 followed by T_2 (2.45), & T_1 (2.02) the minimum score (1.63 was obtained by T_0 (treatment). The difference in score for ash of rasogolla was significant. The highest mean score (39.34 was obtained by T_0 (treatment). The difference in score for carbohydrate of rasogolla was significant. The highest mean score for overall acceptability of rasogolla (8.20) was obtained for treatment T_1 followed by T_0 (8.12), & T_1 (7.76). The minimum score (7.64) was obtained by T_1 (treatment). The difference in score for overall acceptability of rasogolla (8.20) was obtained for treatment T_1 followed by T_0 (8.12), & T_3 (7.76). The minimum score (7.64) was obtained by T_1 (treatment). The difference in score for overall acceptability of rasogolla (8.20) was obtained for treatment T_1 followed by T_0 (8.12), & T_3 (7.76). The minimum score (7.64) was obtained by T_1 (treatment). The difference in score for overall acceptability of rasogolla was significant.

Key Words: Cow Milk; Soya Milk; Sugar; Treatment; Citric acid; Wheat Flour; Backing Powder.

INTRODUCTION

Soybean is one of the nature's wonderful nutritious gifts. It is one of the few plants those provide a high quality protein with minimum saturated fat. Soybean helps people feel better and live longer with an enhanced quality of life. Soybean is both a useful pulse and an oilseed. Soybean contains all the three macronutrients viz; carbohydrate, protein and fat required for good nutrition, as well as fiber, vitamins, minerals. Soybean provides all the essential amino acids in the amounts needed for human health. Almost 40 % of the calories from soybean are derived from protein making soybean higher in protein than any other legume and many animal products. Soybeans have more than two times the amount of the minerals, especially calcium, iron, zinc, and phosphorus than any other legume and very low sodium content. Soybean has all the vitamins and is very good source for vitamin C and vitamin E, Nande P. et.al (2008).

In spite of the theories for and against consumption of milk, it remains the most common commodity of any Indian household, rich or poor. Cow and buffalo milk are preferred, although other types of milk such as standardized milk, and homogenized milk are also available.

Rasogolla is the most important pleasant and charming foods to most of the people of the country. In Eid, Puja, birthday, marriage ceremony and in any party or any kind of entertainment either in domestic or national level, rasogolla area sued as one of the famed and demandable items. It is very nutritious for accounts of its fairly high protein, fat, minerals specially calcium and phosphorus and also fatsoluble vitamins particularity vitamin A and D. **Despite and Datto (1993)** Rasogolla prepared from the blend of cow milk and soymilk is a rich source of high quality proteins, fat, carbohydrate, vitamins, minerals, ash. This approach gave relatively cheaper product in the domestic market.

MATERIALAND METHODS

The present investigation "Studies on preparation of rasogolla from a blend of cow milk and soy milk" was conducted in the Research laboratory Department of Dairy Technology. Warner School of Food and Dairy Technology, Sam Higginbottom institute of Agriculture, Technology and Sciences Allahabad.

COLLECTION OF INGREDIENTS

Cow Milk - Cow Milk was purchased from the local market of Allahabad.

Soya Seed - Soya Seed Was purchased from the local market of Allahabad.

Sugar - Sugar was purchased from the local market of Allahabad.

Department of Dairy Technology, Warner School of Food and Dairy Technology, Sam Higginbottom Institute of Agriculture, Technology and Science (Formerly Allahabad Agricultural Institute) (Deemed University) Allahabad- 211007, U.P., India

Assistant Professor, *Ph. D. Scholars (Food Science & Technology) and Dean & Head

Wheat Flour - Wheat Flour was purchased from the local market of Allahabad.

Backing Powder - Backing Powder was purchased from the local market of Allahabad.

Citric acid - Citric acid was collected from the laboratory of the Department of Dairy Technology, Warner School of Food & Dairy Technology, SHIATS - Allahabad.

Calcium sulphate - Calcium sulphate was collected from the laboratory of the Department of Dairy Technology, Warner School of Food and Dairy Technology, SHIATS- Allahabad.

Details of Treatment combination:

Ingredient Used :- For the preparation of rasogolla by blending soya milk and cow milk in different ratios.

T_a:- Rasogolla prepared from cow milk.

- T_1 :- Rasogolla prepared from by blending soya milk and cow milk (70:30) in different ratios.
- T_2 :- Rasogolla prepared from by blending soya milk and cow milk (60:40) in different ratios.
- T_3 :- Rasogolla prepared from by blending soya milk and cow milk (50:50) in different ratios.

Preparation of rasogolla from blending of cow milk and soya milk is shown given in *Fig. 1:*





RESULT AND DISCUSSION

The present study was based to evolve "Studies on preparation of rasogolla from a blend of cow milk and soy milk". The data collected on different aspects were tabulated & analyzed statistically using the methods of analysis of variance & critical difference. The significant & nonsignificant differences observed have been analyzed critically within & between the treatment combinations.

Chemical parameters:

Moisture percentage

The highest mean score for Moisture (%) of rasogolla (46.24) was obtained for treatment T_0 (control). followed by T_1 (44.59), & T_2 (43.11). The minimum score (42.11) was obtained by T_3 the difference in score for moisture of rasogolla was significant.

Fat percentage

The highest mean score for fat (%) of rasogolla (6.91) was obtained for treatment T_0 (control) followed by T_1 (5.92), & T_2 (5.77). The minimum score (5.38) was obtained by T_3 the difference in score for fat of rasogolla was significant.

Protein percentage

The highest mean score for protein (%) of rasogolla (6.82) was obtained for treatment T3 followed by T_2 (6.48), & T_1 (6.12). The minimum score (5.88) was obtained by T_0 (control) treatment. The difference in score for protein of rasogolla was significant.

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Ash percentage

The highest mean score for ash (%) of apple butter (2.66) was obtained for treatment T_3 followed by T_2 (2.45), & T_1 (2.02) the minimum score (1.63 was obtained by T_0 (treatment). The difference in score for ash of rasogolla was significant.

Carbohydrate percentage

The highest mean score for carbohydrate (%) of rasogolla (43.03) was obtained for treatment T_3 followed by T_2 (42.18), & T_1 (41.34) the minimum score (39.34 was obtained by T_0 (treatment). The difference in score for carbohydrate of rasogolla was significant.

Table 1: The different parameters of control and experimental samples of rasogolla.

Parameters	Treatments						
	T ₀	T ₁	T ₂	T ₃	CD		
					Value		
1. Chemical	analysi	s(in p	ercent	:)			
Moisture	46.24	44.59	43.11	42.11	0.37		
Fat	6.91	5.92	5.77	5.38	0.06		
Protein	5.88	6.12	6.48	6.82	0.09		
Total Carbohydrate	39.34	41.34	42.18	43.03	0.40		
Ash	1.63	2.02	2.45	2.66	0.10		
2. Organoleptic sc	ores (9	point l	nedoni	c scale	e)		
Flavour & taste	7.96	8.36	7.36	7.18	0.36		
Body & texture	8.24	8.28	7.80	7.72	0.28		
Colour & Appearance	7.96	8.16	7.68	7.44	0.22		
Overall Acceptability	8.12	8.20	7.64	7.76	0.20		

Organoleptic parameters:

Flavor and Taste:

The highest mean score for flavor and texture of rasogolla (8.36) was obtained for treatment T_1 followed by T_0 (7.96), & T_2 (7.36). The minimum score (7.16) was obtained by T_3 (treatment). The difference in score for flavor and texture of rasogolla was significant.

Body and texture:

The highest mean score for body and texture of rasogolla (8.28) was obtained for treatment T_1 followed by T_0 (8.24), & T_2 (7.80). The minimum score (7.72) was obtained by T_3 (treatment). The difference in score for body and texture of rasogolla was significant.

Colour and appearance:

The highest mean score for colour and appearance of rasogolla (8.16) was obtained for treatment T_1 followed by T_0 (7.96), & T_2 (7.68). The minimum score (7.44) was obtained by T_3 (treatment). The difference in score for colour and appearance of rasogolla was significant.

Overall acceptability score for rasogolla samples

Overall acceptability:

The highest mean score for overall acceptability of rasogolla (8.20) was obtained for treatment T_1 followed by T_0 (8.12), & T_3 (7.76). The minimum score (7.64) was obtained by T_1 (treatment). The difference in score for overall acceptability of rasogolla was significant.

The data regarding Overall acceptability score in rasogolla sample of different treatments are presented in *table 2.and table 3*.

 Table 2: Overall acceptability score for control and experimental rasogolla.

Replication	Treatments					
		T ₀	T ₁	T ₂	T ₃	
R ₁		8.2	8.4	7.4	7.8	
R ₂		8	8.2	7.6	7.8	
R ₃		8.2	8.2	7.8	7.6	
R ₄		8.2	8.2	7.6	7.8	
R ₅		8	8	7.8	7.8	
	Mean	8.12	8.20	7.64	7.76	
Range	Minimum	8	8	7.4	7.6	
U	Maximum	8.2	8.4	7.8	7.8	
F- test		S				
S. Ed. (±)		0.09				
C. D. $(p = 0.0)$)5)	0.20				

From the perusal of data on Overall acceptability score in Rasogolla samples of different treatments and control the highest mean Overall acceptability score was recorded in the Rasogolla sample of T_1 (8.20) followed by T_0 (8.12), T_3 (7.76) and T_2 (7.64).

Table 3: ANOVA for Overall acceptability score for
control and experimental rasogolla of different
treatments.

ANOVA:						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab.	Result
					5%	
Replication	4	0.0123	0.003	0.138462	3.259167	NS
Treatment	3	1.11	0.37	17.08	3.49	S
Error	12	0.26	0.02	-	-	-
TOTAL	19	1.382	-			-

*Significant

As evident from the result of ANOVA given in *Table 4*. 2.4.b. the F (Cal) value (17.08) was greater than the table value of F (3.49) at 5% level of significance. Therefore; the difference was significant, indicating significant effect of treatments on Overall acceptability score.

Table 4: Critical difference in Overall acceptability scores for control and experimental rasogolla of different treatments.

Treatments		Average	T ₀	T ₁	T ₂	T ₃
			8.12	8.20	7.64	7.76
T ₀		8.12		0.08	0.48	0.36
T ₁		8.20			0.56	0.44
T ₂		7.64				0.12
T ₃		7.76				
C.D.=	0.20					

It is therefore concluded that there was significant difference $b/w T_0 - T_1$ and $T_2 - T_3$ non-significant difference b/w w the all other treatments which may be ascribed to Preparation of rasogolla from a blend of soya milk and cow milk.



Fig 1: Overall acceptability scores for control and experimental rasogolla of different treatments.

 T_0 - Rasogolla prepared from a blend of cow milk.

 T_1 - Rasogolla prepared from a blend of cow milk and soya milk (70:30).

 T_2 - Rasogolla prepared from a blend of cow milk and soya milk (60:40).

 T_3 - Rasogolla prepared from a blend of cow milk and soya milk (50:50).

CONCLUSION

The results obtained from the present investigation revealed that value addition of Rasogolla can be done by blending cow milk and soya milk in different ratios satisfactorily.

Though significance difference was found in most of parameters with respect to the different treatments, T_1 (70% cow milk and 30% soymilk) was found to be the best in terms of sensory characteristics.

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Effect of different pre-hand milking treatments of Neem leaf extract on bacteriological quality of raw milk

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ABSTRACT

The present study was undertaken to find out the effect of different pre-hand milking treatments of Neem leaf extract on bacteriological quality of raw milk on 12 healthy cross-bred cows at SHIATS, dairy farm, Allahabad with treatments as T_1 (control), T_2 , T_3 and T_4 (prepared by boiling 100,150 and 200 g green Neem leaves in 1 litre water for 5 minutes, respectively). Collected milk samples were analyzed to determine Standard plate count (SPC), Lactic acid bacterial count (LABC), Lipolytic bacterial count (LBC), Proteolytic count (PBC) and coliforms in milk. Statistical analysis of different bacterial parameters in pre-hand milking treatments of neem leaf extract revealed significant difference in SPC, LABC, LBC, and PBC but shown non-significant difference in coliform count of milk. Results of the experiment clearly indicated that the bacteriological quality of raw milk adjudged on the basis of SPC and physiological groups of of bacteria was best in T_4 followed by T_3 , T_2 and control indicating there by superiarity of T_4 over rest of the pre-hand milking treatment of Neem leaf extract.

INTRODUCTION

Milk is nature's most ideal and nearly perfect food considered essential for newly born and young mammals. In true sense, there is no substitute of milk but due to possibility of it being potent source of biological and chemical hazards, it cannot be considered totally safe, if not produced and handled under sanitary conditions. Sanitary production of milk is the need of time due to ever increasing awareness among its consumers and global competition prevailing in local, national and international market of dairy sector.

Health of the cow and hygiene are two main criteria for sanitary milk production. Considering the health of cow she should be free from any type of harmful disease like tuberculosis, brucellosis and udder infection of mastitis etc. Considering the hygiene, main sources of contamination arising from external environment like feeds, barn, cow's udder, belly, hind quarter, milker's hand, methods of milking, milking utensils and methods of milk handling etc. need to be given utmost attention. The problem of unhygienic production of milk is of tremendous public health importance in developing country like India where the existing condition of milk production at most of the places is far below the level of satisfaction. . Micro-organisms including both saprophytic and pathogenic bacteria passes easily to milk from external environmental factors such as feeds, barn, cow's udder, belly, hind quarters, milker's hand, methods of milking, utensils and methods of milk handling etc. (Pandey and Prasad, 1991).

Milk being an ideal medium for the growth of microorganisms, strict control over its production, handling, processing and distribution is necessary. Under conventional methods of milking it has been observed that traces of milk are left on the teat opening. Bacteria which get deposited from the nearest possible source find an opportunity to multiply and enter into teat canal. The bacteria getting entry in the milk in the udder through teat canal find their normal habitat and start multiplying at body temperature in a perfect normal way. The bacteria may cause chemical changes in milk rendering deterioration in quality.

Hand milking is the common method used for milking of cows in India. Almost every cow owner/milker in Indian sub continent washes the hind quarters and udder of cows with water prior to milking as a mean of common cleanliness. Use of common commercial antiseptic solutions (dettol, savlon, benzytol etc.) into water as pre-udder wash of cows in India is seldom practiced, probably due to their cost and local unavailability related constraints. Use of Neem (Azadirachta indica) in various forms as leaves, bark seeds and oil etc. has been commonly practiced in India as a potent herbal bactericide and germicide both for personal and community health as well. Therefore the present experiment was conducted to determine the extent of total bacteria and different physiological groups of bacteria in raw milk as influenced by different pre-hand milking treatments of Neem leaf extract as udder wash.

MATERIALS AND METHODS

From the herd consisting of cross-bred cows at SHIATS dairy farm, Allahabad, twelve healthy cows free from mastitis as detected by Californian Mastitis Test (**Schalm and Noorlander, 1957**) and other noticeable udder infection or

injuries were randomly selected for this experiment. All selected cows were housed in tail to tail barn prepared for milking and dry full hand method of milking was followed. Samples of milk were collected for control and different prehand milking treatments of Neem leaf extract. Twelve replications were made under each treatment including control. First two streams of milk from all quarters were discarded as a measure of recommended routine practice (Singh and Prasad, 1987). Milk samples collected were tested for determining the total bacterial count per ml in raw milk by Standard plate bacterial count (SPC) and population density of four physiological groups of bacteria viz. Lactic acid bacterial count (LABC), Lipolytic bacterial count (LBC), Proteolytic bacterial cont (PBC) and Coliform count. Representative samples of 200 ml raw milk were collected in sterile conical flasks of 250 ml. capacity and plugged aseptically with cotton plugs. These samples were brought immediately to the laboratory for determination of bacterial quality of raw milk.

The data collected on bacterial parameters were collected recorded, tabulated and analyzed statistically using Analysis of Variance Technique (ANOVA) as per **Snedecor and Cochran (1994)**.

RESULTS AND DISCUSSION

Mean values of different parameters used to determine the effect of different pre-hand milking treatments of Neem leaf extract as udder wash on bacteriological quality of raw milk of cross-bred cows are presented in the *Table-1*.

<i>Table - 1:</i>	Mean value of bacterial Parameters influenced
	by different Pre-hand milking treatments of
	Neem leaf extract as udder wash

Parameters	Pre-hand milking treatments of Neem leaf extract as udder wash					
	T ₁	T ₂	T ₃	T ₄		
SPC (10 ⁴)/ ml	42.66	36.41 ^b	35.83 ^{bc}	35.00°		
LABC $(10^3)/ml$	8.75 ^b	8.03 ^{bc}	9.58 ^b	7.66°		
LBC (10 ²)/ ml	31.00	17.85ª	19.00 ^b	18.85 ^{ab}		
PBC (10 ²)/ml	8.91ª	8.5ª	7.75ª	7.41ª		
Coliform (10)/ml	0.25ª	0.08ª	0.16 ^a	00.00ª		

^{*}Values with similar alphabets show non-significant difference between the values within the parameter

Lowest mean SPC (10⁴) per ml milk was observed as 35.00 in T_4 followed by 35.83 in T_3 , 36.41 in T_2 and 42.66 in T_1 . The differences in these values were found significant indicating thereby a significant effect of pre-hand milking treatments of

Neem leaf extract on SPC/ml of milk. Results revealed that SPC per ml in milk of T_4 was significantly lowest than in milk of other pre-hand milking treatments of Neem leaf extract. However differences in the values of SPC between T_4 and T_3 , T_3 and T_2 were found at par. The observations with regard to SPC/ml in raw milk are in agreement with **Pandey and Prasad** (2001) but not in line with **Banka** *et al.* (2007) reporting higher SPC/ml milk.

Lowest mean LABC (10³) per ml milk was recorded as 7.66 in T_4 followed by 8.08 in T_2 , 8.75 in T_1 and 9.58 in T_3 . The differences in these values were found significant indicating thereby a significant effect of pre-hand milking treatments of Neem leaf extract on LABC/ml of milk. Results revealed significantly less count of LABC/ml in milk of T_4 compared to all other Pre-hand milking treatments indicating thereby superiority of T_4 over rest of the treatments. The differences in values of LABC between T_4 and T_2 , T_2 and T_1 , T_1 and T_3 were found at par. The average LABC/ml in raw milk obtained in the present study is in agreement with the reports of **Singh and Prasad (1987)**, **Pandey and Prasad (2001)**. However, **Pandey and Prasad (1991)** observed relatively lesser densities of LABC in milk.

Lowest mean LBC (10²) per ml milk was recorded as 18.00 in T_4 followed by 17.85 in T_2 , 19.00 in T_3 and 31.00 in T_1 . The difference in these values were found significant. However differences in the values of LBC between T_2 and T_4 , T_4 and T_3 were found at par. Mean LABC/ml in present study is somewhat in line with the reports of **Pandey and Prasad** (2001).

Lowest mean PBC (10^2) per ml milk was 7.41 in T₄ followed by 7.75 in T₃, 8.5 in T₂ and 8.91 in T₁. The differences in these values were found non-significant indicating there by a non significant effect of pre-hand milking treatments of Neem leaf extract as udder wash on PBC/ml of milk However lowest value of PBC in raw milk was recorded in T₄. These results are in line with the observations made by **Singh and Prasad** (**1987**) and **Pandey and Prasad** (**2001**).

Lowest mean Coliforms (10) per ml milk was nil in T_4 followed by 0.08 in T_2 , 0.16 in T_3 and 0.25 in T_1 . The differences in the values of coliform were found non-significant. **Pandey and Prasad (2001)** did not find presence of this group of bacteria in raw milk of post-milking treatments.

The experimental findings revealed significant effect of different pre-hand milking treatments of Neem leaf extract as udder wash on Standard plate count, Lactic acid bacterial count, Proteolytic bacterial count and on Lipolytic bacterial count except Coliforms in raw milk. Overall rating of quality of raw milk as determined by various bacterial parameters was found best in T4 indicating its superiority over remaining pre-hand milking treatments of udder wash. Therefore use of Neem leaf extract as pre-hand milking udder wash may be recommended to the dairy farmers as an alternative of costly antiseptic solutions available in the market to produce milk of low bacterial count.

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Studies on Yield Gap Analysis of Fish in Composite Fish Farming through Front Line Demonstrations

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ABSTRACT

Front line demonstrationon composite fish culture was carried out to evaluate growth, yield,technological gap, extension gapand technological index, analysis of fish culture during three successive years 2010-11; 2011-12 and 2012-13 in Allahabad district of Uttar Pradesh. Total 61demonstrations were conducted and48.05 ha water area was covered. The average data for three years revealed that an average yield of demonstration plot was 34.72q/ha. over local check 23.67q/ha. The additional yield was 11.05 q/ha and the increase average fish productivity was 46.68%. Average technological gap and average technological index were found to be 25.80q/ha and 42.13 %, respectively. Vast yield gap exists between potential yield and yield under real farming situation are seen .in Allahabad district of U.P. The poor productivity is because resource poor farmers are very reluctant toward proper scientific management of fish.

Key words : FLD, Composite fish farming, Technological gap, Extension gap, Technological index,

INTRODUCTION

Krishi Vigyan Kendra, aninnovative science-based institution, plays an importantrole in bringing the research scientists face to face withfarmers. The main aim of Krishi Vigyan Kendra is toreduce the time lag between generation of technologyat the research institution and its transfer to the farmersfor increasing productivity and income from theagriculture and allied sectors on sustained basis. KVK sare grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different' micro farming' situations in a district (**Das, 2007**). Frontline demonstration (FLD) is a long term educationalactivity conducted in a systematic manner in farmers' fields to worth of a new practice/technology.

Allahabad is situated in the South-Eastern part of the State Uttar Pradesh. It lies between the parallels of 24° 77' and 25° 47' north latitudes and 81° 19' and 82° 21' east longitudes. Topographically, the district of Allahabad belongs to the central plane zone of Uttar Pradesh. It has tropical climate that the average maximum temperature ranges between 43°C - 47°C which may go as high as 48°C during peak summers. The minimum average temperature is 2-4°C which may fall as low as 1.5°C during peak winter months (Dec.-Jan.) The average rainfall of the district is 960 mm and the monsoon season is spread between July-September.

Sound technological inputs, entrepreneurial initiatives and financial investments in fresh water fish culture have significantly increased the pond productivity from about 600kg/ha/yr in 1970s to present level of 2500 kg/ha/yr.on a national basis. Production levels 6-8t/ha/yr in intensive fish farming, were found in the states of AP, Punjab, Haryana in India, whereas 4-6 t/ha was found under semi intensive composite fish farming (**Eknath** *et al.*, 2009). Yield gap studies can demonstrate how close farm yields are to the maximal potential yield with the available technology. Yield gap studies also suggest how to improve production more efficiently through the extension of present available technology or by developing newtechnologies.

METHODOLOGY

District Allahabad:

Topographically, the district of Allahabad belongs to the central plane zone of Uttar Pradesh. The district Allahabad may be divided in four different agro-ecological situations AES : Black and Coarse-grey land, Jamuna khaddar and Alluvial, Ganga Low land and Sodic, Ganga plain. The northern part of Allahabad district popularly known as Ganga par provides rich loam soil for cultivation of food grains, pulses, oilseeds and vegetables. The Southern part of Allahabad district also known as Yamuna par is partly rocky and somewhat agriculturally backward. Out of total cultivated land 64% of the area is irrigated (Canal, Tube well Govt. & Public) and 36% is rainfed.

Status of fishery in Allahabad:

District Allahabad has a large number of confined water, which offers good potential for fishery development pogramme. According to survey, conducted by FFDA, the district has 3467 rural tanks and ponds, covering an area of 3381ha. Ponds are mostly community ponds. Farmers got leased from tehsil for ten years. Farmers are mostly belongs to SC /ST, and Mallha, Kewat who adopted fish farming as secondary business. Fish farming are composite fish culture type.

PRA survey and problem identification in traditional fish culture:

During PRA survey by KVK Allahabad, while interacting with fish farmers of the village, there was general consensus amongst the fish farmers that low yield of fish needs to be increased. Problem diagnosed that low yield of fish in fish farming system due to lack of knowledge of composite fish farming.

Study area:

The study was carried by KVK Allahabad from 2010-11 to 2012-13 (Three consecutive years) in the farmers field six blocks (Chaka, Jsara, karchhana, Koundhiyara, Manda and Bahadurpur) of Allahabad district. During these three years of study, water area of 48.05ha. was covered under FLD with active participation of 61 farmers.

Selection of fish farmer:

Before conducting FLDs, a list of farmers were prepared from group meeting and specific skill training wasimparted to the selected farmers regarding differentaspects of cultivation (Venkatta Kumar *et al.*, 2010). The necessary step for selection of site andfarmers, layout of demonstration etc. were followed as suggested by Choudhary (1999).

Package practices:

Package practices of CFC were conducted as per guideline of CIFA, Bhubaneswar. Visits of the farmers and the extension functionaries were organized at demonstration plots to disseminate the message at large. Yield data were collected from local check pond (Farmer's practice) and demonstration ponds. Cost of production, net income and benefit cost ratio were computed and analyzed also.

Data Analysis :

Finally the extension gap, technology gap and technology index were worked out (**Samui** *et al.*, **2000**) as given below:

- 1. Technology gap = Potential yield-Demonstration yield
- 2. Extension gap= Demonstration yield- Farmers yield

Potential yield-Demonstration yield

3. Technology index =-----x 100

Potential yield

RESULTS AND ANALYSIS

Front line demonstrationon composite fish culture was carried out to evaluate growth, yield,technological gap, extension gap and technological index, analysis of fish culture during three successive years 2010-11; 2011-12 and 2012-13 in Allahabad district of Uttar Pradesh. Total 61 demonstrations were conducted and 48.05 ha water area was covered.

The data of *Table.1* revealed that the yield of fish fluctuated successively over the years in demonstration. Maximum FLD yield was recorded 36.26q/ha, during 2012-13 and minimum FLD yield was recorded in year 2010-11 (33.20q/ha) and the average yield for three years was recorded 34.72q/ha of FLD over local check (23.67q/ha). The increase in percent yield was ranging between 44.35-48.00q/ha during three years of study. On an average basis, 46.68 per cent increase in yield was recorded. The results clearly indicated the positive effects of FLDs over the existing practices toward enhancing the yield of fish in Allahabad district with its positive effect on yield attribute (*Fig.1*)

Year	No. of farmers	Area (ha)	Fish yield (q	ı∕ha)		% Increase over	Techno. gap (g/ba)	Ext. gap (g/ha)	Techno. index (%)
			Potential*	FLD.	Local Check (Farmer's yield)	control	(grint)	(q int)	
2010-11	14	12.00	60.00	33.20	23.00	44.35	26.80	10.20	44.67
2011-12	22	16.55	60.00	34.71	23.50	47.70	25.30	11.21	42.16
2012-13	25	19.50	60.00	36.26	24.50	48.00	23.74	11.76	39.57
Average	61**	16.02	60.00	34.72	23.67	46.68	25.28	11.05	42.13

Table 1. Yield performance and yield gap analysis of FLD on composite fish culture.

*Semi-intensive fish farming

**Total No.

The extension gap shown an increasing trend. The extension gap ranging between 10.20-11.76q./ha. during the period of study emphasized the need to educate the farmer through various means for adoption of improved fish production to reverse the trend of wide extension gap. The trend of technology gap (ranging between 26.80-23.74q ./ ha.) reflects the farmers cooperation in carrying out such demonstrations with encouraging results in subsequent years (*Fig.1*) The technology gap observed may be attributed to the dissimilarity in soil fertility status, resource characteristics, water scarcity and weather conditions. Similar finding was recorded by **Eknath** *et al.*, (2009), Mitra *et al.* (2010).



Figure 1: Fish yield (FLD & Local check) and Technological yield gap in different years.

The technology index had shown the feasibility of the evolved technology at the farmer's field. Lowerthe value of technology index, more is the feasibility of technology. Such fluctuation in technology index(ranging between 44.67 %-39.57%) during the study period, may be attributed to the dissimilarity in soil fertility status, weather condition, non-availability of irrigation water and disease attack.

CONCLUSION

From the above findings it can be concluded that the use of scientific methods offish farming can reduce the technology gap to a considerable extent, thus leading to increased productivity of fish in the district. The poor productivity is because resource poor farmers are very reluctant toward proper scientific management of fish.Moreover, extension agencies in the district needto provide proper technical and financial support to the fishfarmers through different educational and extension methods to reduce the extension gap for better fish production in the district.

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A study on bacterial quality of raw milk of buffalo cow, sheep and goat

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ABSTRACT

A comparative study on bacterial quality of raw milk of buffalo, cow, sheep and goat was conducted at Chitrakoot,Satna (M.P.) during May, 2014. The samples of raw milk of three animals in each group were replicated ten times and tested to determine the standard plate count (SPCX10⁴), lactic acid bacterial count (LABCX10³), lipolytic bacterial count (LBCX10²), proteolytic bacterial count (PBCX10²) and coli-form t in per ml raw milk. The data obtained were subjected to statistical analysis. The results of the statistical analysis showed that the differences in mean values of SPC, LABC, LBC, and PBC in the raw milk of buffalo, cow, sheep and goat were significant. It was, therefore, concluded that bacterial quality of raw milk of buffalo, cow, sheep and goat was significantly influenced. The bacterial quality of milk of sheep was found best followed by goat, buffalo and cow milk. No coli-form was present in any of the milk samples.

Key Words: Raw milk, bacterial quality, buffalo, cow, sheep, goat

INTRODUCTION

Dairying contributes close to a third of the gross income of rural households and in the case of those without land nearly half of their gross income (**Bhasin, 2012**). An estimated 70 million rural households are engaged in milk production, which has shown a rapid growth between 4 to 5% per annum during the last two decades It is encouraging to note that annual milk production in India has grown to an anticipated level of 140.6 million tones in 2014, and per capita milk availability has reached to a level of 290 g/day (**Makwana** *et. al.*, **2011**)

Economy grew and incomes rose between 1983 and 2006, the share of milk and milk products in household expenditure increased from 11.5 to 15.1% in rural areas and from 15.7 to 17.5% in urban areas (**Bhasin, 2011**) Today, India is world's largest milk producer. Milk accounts for about 18% of agriculture GDP and in terms of value of output, is now the single largest contributor in the country.

The contamination of microorganisms depend upon the conditions at the time of production (**Panday and Neeraj**, **2003**). Contamination of milk with spoilage and disease producing microorganisms may occur at any stage from production to distribution. The magnitude and diversity of microbial population varies considerably and depends upon the specific conditions associated with the production and handling of milk.

It is well estimated that consumer wants clean wholesome and nutrients food that is produced and processed in a sound sanitary manner and is free from pathogens. Milk synthesized in the udder is sterile but when drown out of udder in general carry greater number of bacteria than stripping. Contamination of milk takes place from sources outside the udder such as milker, animals, skin, flanks, method of milking, utensils, feed, water, barn etc. The number and types of microorganism in milk with the nature of conditions at the time of production of milk (Macy *et.al.*, 2006).

An increasing number of people, even in poverty stricken developing countries, are looking for quality, healthy and natural food stuff and do not mind paying little extra for quality assurance.

MATERIALS AND METHODS

The study was conducted in the Livestock Production Unit, Department of Natural Resource Management, Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot ,Satna (M. P.), during May, 2014. All sanitary precautions were followed to produce clean milk. The samples of raw milk were collected for ten days. Samples were collected from the milking pail separately in sterile 250 ml conical flasks and plugged aseptically with cotton plug. The samples were then brought immediately to the laboratory for determination of total viable count as standard plate count (SPC) and their four physiological groups viz. lactic acid bacterial count (LABC), proteolytic bacterial count (PBC), lipolytic bacterial count (LBC) and coli-form count (CC) as per the procedure and norms set by **A. O. A. C. (2000**).

Following were the bacterial parameters determined as per method of **Chalmers (1953)**:

- i. Standard plate count/ml (SPC) for total bacteria.
- ii. Lactic acid bacterial count (LABC)
- iii. Proteolyticbacterial count (PBC)
- iv. Lipolytic bacterial count (LBC)
- v. Coliform count (CC)

STERILIZATION OF GLASS WARES:

Conical Flasks :

Prior to use all the conical flasks were thoroughly cleaned dried plugged with absorbent type cotton and then sterilized in an autoclave at 120 °C for an hour.

Pipettes :

Prior to use all the bacteriological pipettes of 1 ml and 10 ml capacity were immersed in chromic acid solution over night, washed with tap water and dried. They were wrapped in paper and sterilized in hot air oven at 120 °C for an hour.

Test tubes :

Test tubes were washed thoroughly with detergent and tap water. Then test tubes were used for preparing 9 ml blanks of Ringer's solution for dilution at the sample they were plugged with sterile absorbent cotton and then sterilized in autoclave at 120 $^{\circ}$ C at 1.2 kg/cm2 for 20 minutes.

Petri Plates :

These were thoroughly washed with detergent then tap water and kept on a clean table in inverted position for drying. Dried plates were wrapped in paper in block of 4 in each. These were sterilized in hot air oven at 120 °C for an hour.

The data obtained for the aforesaid tests were subjected to statistical analysis.

RESULTS AND DISCUSSION

The mean standard plate count (10^4) per ml in the milk of buffalo, cow, sheep and goat (average of three animals each) in ten replications, ranged from 204.33 - 207.13, 210.20 -213.09, 198.85 - 201.58, and 200.76 - 203.51, respectively. The overall mean SPC (10⁴) in buffalo milk was found 205.90, 211.82, 200.38, and 202.30, respectively and the difference between the mean values was significant. Minimum mean SPC (10⁴) was recorded in the milk of sheep (200.38) and the maximum was in cow milk (211.82) followed by buffalo (205.90) and goat milk (202.30). [*Table-1*]

The mean Lactic acid bacterial count (10^3) per ml in the milk of buffalo, cow, sheep and goat (average of three animals each) in ten replications, ranged from 38.76 - 39.23, 38.97 - 39.43, 38.56 - 39.00, and 38.67 - 39.10, respectively. The overall mean LABC (10³) per ml in buffalo milk was found 38.94, 39.15, 38.73, and 38.82, respectively, and the difference between the mean values was significant. Minimum mean LABC (10⁴) was recorded in the milk of sheep (38.73) and the maximum was in cow milk (39.15) followed by buffalo (38.94) and goat milk (38.82). [Table-1]

Bacterial Buffalo Result Cow Sheep Goat Parameters 202.3 $SPC(10^4/ml milk)$ 205.9 211.82 200.38 S 204.33-210.20-198.85-200.76-Range(min.-max.) 207.13 213.09 201.58 203.51 LABC $(10^3/\text{ml milk})$ 38.94 39.15 38.73 38.82 S 38.76-38.97-38.56-38.67-39.23 39.00 39.10 Range(min.-max.) 39.43 LBC (10²/ml milk) 40.59 39.39 39.77 S 41.31 40.30-41.00-39.17-39.50-39.57 Range(min.-max.) 41.03 41.79 40.07 $PBC(10^2/ml milk)$ 34.45 36.47 33.72 34.04 S 34.30-36.30-33.53-33.93-33.97 34.67 36.67 34.27 Range(min.-max.)

 Table 1 Comparative study of bacterial quality of raw milk of Buffalo, Cow, Sheep and Goat.

S = Significant

The mean Lipolytic bacterial count (10^2) per ml in the milk of buffalo, cow, sheep and goat (average of three animals each) in ten replications, ranged from 40.30 - 41.03, 41.00 -41.79, 39.17 - 39.57, and 39.50 - 40.07, respectively. The overall mean LBC (10²) in buffalo milk was found 40.59, 41.31, 39.39, and 39.77, respectively and the difference between the mean values was significant. Minimum mean LBC(10²) was recorded in the milk of sheep (39.39) and the maximum was in cow milk (41.31) followed by buffalo (40.59) and goat milk (39.77). [Table-1]

The mean Proteolytic bacterial count (10^2) per ml in the milk of buffalo, cow, sheep and goat (average of three animals each) in ten replications, ranged from 34.30 - 34.67, 36.30 - 36.67, 33.53 - 33.97, and 33.93 - 34.27, respectively. The overall mean PBC (10^2) in buffalo milk was found 34.45, 36.47, 33.72, and 34.04, respectively, and the difference between the mean values was significant. Minimum mean PBC (10^2) was recorded in the milk of sheep (33.72) and the maximum was in cow milk (36.47) followed by buffalo (34.45) and goat milk (34.04). *[Table-1]*. Coli-form was not present in any of the samples of Buffalo, Cow, Sheep and Goat milk.

CONCLUSION

The mean values of bacterial count of SPC, LABC, LBC and PBC in the raw milk of buffalo, cow, sheep and goat were significant and within the safe limit for consumption. It can be concluded from this research work that quality of raw milk of all four animals were good due to low bacterial counts and absence of coli-form .The bacterial quality of milk of sheep was found to be the best due to minimum bacterial count of SPC, LABC, LBC and PBC; and absence of coli- form; followed by goat, buffalo and cow milk.

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Generation of Autoregressive time series models for prediction of Rainfall and Runoff for Ningthourok Catchment of Manipur

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ABSTRACT

Rainfall-Runoff data of Ningthourok catchment from the year 2000-2009 have been analyzed and a stochastic time series model was developed for prediction of rainfall and runoff of Ningthourok catchment in Manipur. Autoregressive (AR) models of orders 0, 1 and 2 proposed by Kottegoda (1980) were tried. The goodness of fit and adequacy of models were tested by Box-Pierce Portmonteau test, Akaike Information Criterion (AIC) and various statistical characteristics. It was observed that AIC value for AR (1) model developed for rainfall and runoff prediction satisfies the selection criteria of model. The analysis shows that model can be effectively used for prediction of rainfall and runoff of Ningthourok catchment and similar catchment.

Keywords: Time series, rainfall, runoff, autoregressive models, Ningthourok catchment

INRODUCTION

Rainfall-runoff models are becoming an increasingly indispensable tool in flood studies and operational flood forecasting for integrated catchment planning and flood emergency management. Mathematical models are one of the possible tools when statements about the future are needed and in many cases public policy has to rely on such models. On the other hand, the reliability of mathematical models can be questioned and the obtained results may rather be called prophesy than prediction. Both forecasts and predictions of the likely future states of hydrological variables are of importance for optimal operation in water management. Forecasting is mainly done in real-time and is specified in time, whereas predictions are more general and focus less on the exact timing (**Klemes, 1986a**).

Early studies by Hazen (1914) and Sudler (1927) showed the feasibility of using statistics and probability theory in analyzing river flow sequences. Hurst (1951) investigated the Nile River for the Aswan Dam project; reported studies of long records of river flows later tremendously impacted the theoretical and practical aspects of time series analysis of hydrologic and geographical phenomena. (Thomas and Fiering, 1962; Quimpo, 1968) used autocorrelation and spectral analysis techniques to model time series and showed that spectral techniques in analyzing the series of river flows coupled with harmonic analysis can be effectively used to investigate the structure of time series. Box and Jenkins (1970) pioneered in evolving methodologies for time series modeling in the univariate case often referred to as Univariate. Box-Jenkins (UBJ) ARIMA modeling. **Klemes (1978)** points out that the deterministic modeling is simply a category of stochastic modeling that disregards the uncertainties in the model, its parameters, and its inputs **Langu (1993)** used Time series analysis to detect changes in rainfall and runoff patterns to search for significant changes in the components of a number of rainfall time series. **Haltiner and Salas (1998)** developed a time series model of the ARMA class for seasonal and multi site applications.

In the present study a stochastic auto-regressive time series model for prediction of rainfall and runoff was developed and their validity was tested for observed rainfall and runoff for performance evaluation.

MATERIALS AND METHODS

Description of the study area and collection of Data

Ningthourok catchment is located in the northen part of the Senapati District, Manipur. The watershed is about 3.926 sq.km and falls between 23°800 to 28°819' N Latitude and 93°772 to 93°805' E longitude and elevation varying from 900m to 1500m above sea level. The area has come under humid sub-tropical climate, the average maximum and minimum temperatures are 34°C and 1°C respectively. Rainfall is caused by the South-West Monsoon coming from over the Bay of Bengal. The major source of livelihood in this area is cultivation through agriculture nearly 21 percent of the total area of the watershed is under agriculture, 2.52 percent under exposed soil, medium vegetation 14.28 percent, 11.39 percent under plantation, settlement 7.62 percent, 37.72 percent under

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scrub land and 3.47 percent under thick vegetation. The data related to the characteristics of the Ningthourok were collected from the Department of Earth Sciences, Manipur University. In this study, rainfall and runoff data (2000-2009) were used to estimate the Autoregressive Time Series Models.

Autoregressive (AR) Model

The pth order autoregressive model AR (p), representing the variable Yt is generally written as.

$$Y_{t} = Y + \Phi_{1}(Y_{t-1} - Y) + \Phi_{2}(Y_{t-2} - Y) + \dots \Phi_{p}(Y_{t-p} - Y)\varepsilon_{t} \quad (1)$$
$$Y_{t} = \overline{Y} + \sum_{j=1}^{p} \Phi_{j}(Y_{t-j} - \overline{Y}) + \varepsilon_{t} \quad (2)$$

Where,

 Y_{t} = The time dependent series (variable)

- ε_{t} = The time dependent series independent of Y_{t} normally distributed with mean zero variance σ^{2}
- F = Mean of annual rainfall and runoff data

Autoregressive parameter

Estimation of Autoregressive parameter maximum likelihood estimate

For estimation of the model parameter methods of maximum likelihood were used (Box and Jenkins, 1970). The sum of cross-products written as

$$ZiZj + Zi + 1Zj + 1 + \dots + ZN + 1 - JZN + 1 - 1$$
 (3)

N+1-(i+i)

$$D_{ij} = D_{ji} = \frac{N}{(N+2-i-j)} \sum_{l=0}^{N-1} Z_{i+l} Z_{j+l}$$
(4)
where,

D = difference operator

N =sample size

i, j = maximum possible order

The maximum likelihood estimates of the parameters Φ_1

$$Dij = \Phi_1 Dj2 + Dj3 + \dots + \Phi_1 D_{j,p+1}, j=2, \dots, p+1$$

for $\Phi_1, \dots, \Phi_p,$

in particular,

....

AR(1):
$$\Phi_1 = \frac{D_{1,2}}{D_{2,2}}$$
 (5)

AR(1):
$$\Phi_1 = \frac{D_{1,2}D_{3,3} - D_{1,3}D_{2,3}}{D_{2,2}D_{3,3} - D_{2,3^2}}$$
 (6)

$$\Phi_2 = \frac{D_{1,3}D_{2,2} - D_{1,2}D_{2,3}}{D_{2,2}D_{3,3} - D_{2,3^2}} \tag{7}$$

Parameter estimation of AR (p) models

The average of sequence Yt was computed by following equation:

$$\overline{Y} = \frac{1}{N} \sum_{t=1}^{N} Y_t$$
(8)

The average σ_{ε}^2 of Yt was computed by the following equation:

$$\sigma^{2}_{\varepsilon} = \frac{1}{(N-1)} \sum_{t=1}^{N} (Y_{t} - \overline{Y})^{2}$$
(9)

After computation of \overline{Y} and σ_{ε}^{2} , the remaining parameters were estimated by solving the p system of following linear equations (Yule and Walker equation):

$$\mathbf{r}_{k} = \Phi_{1} r_{k-1} + \Phi_{2} r_{k-2} + \dots + \Phi_{p} r_{k-p} \quad \text{K>0}$$
(10)
or
$$\mathbf{r}_{k} = \sum_{t=1}^{n} \Phi_{j} r_{k-j} \quad \text{K>0}$$

Where, r_1, r_2 , were computed from equation

Statistical characteristics

Mean Forecast Error

$$MFE = \frac{\sum_{i=1}^{n} [\chi_c(t) - \sum_{l=1}^{n} \chi_0(t)]}{\eta}$$
(11)
Where,

 χ_c (t) = Computed stream flow value

 $\chi_{a}(t) = Observed stream flow value$

 η = Number of observations

Mean Absolute Error

MAE =
$$\frac{\sum_{i=1}^{n} [\chi_c(t) - \chi_0(t)]}{n}$$
 (12)

Mean Relative Error

$$MRE = \frac{\sum_{i=1}^{n} [\chi_c(t) - \chi_0(t)]}{\eta}$$
(13)

Mean Square Error

$$MSE = \frac{\sum_{i=1}^{n} [\chi_{c}(t) - \chi_{0}(t)]^{2}}{n}$$
(14)

Root Mean Square Error

$$\mathbf{RMSE} = \left| \frac{\sum_{i=1}^{n} [\chi_{c}(t) - \chi_{0}(t)]^{2}}{\eta} \right|^{1/2}$$
(15)

Integral Square Error

N

$$ISE = \frac{\sqrt{\sum_{i=1}^{n} [\chi_{c}(t) - \chi_{0}(t)]^{2}}}{\sum_{i=1}^{n} \chi_{0}(t)}$$
(16)

Goodness of fit of autoregressive (AR) models Box-Pierce Portmonteau lack of fit test

The Box-Pierce Portmonteau lack of fit test was used to check whether the residual of a dependence model for correlation. The test statistic was computed by using the following equation:

$$\mathbf{Q} = \mathbf{N} \sum_{k=1}^{L} r_k^2 \tag{17}$$

[20]

Where,

N = Number of observations

 $r_k = Serial \text{ correlation or autocorrelation of series } Yt$

The statistic Q follows χ^2 distribution with r=K-p degree of freedom. The estimated value of χ^2 was compared with tabulated values of χ^2 .

Akaike Information Criterion

The Akaike Information Criterion (**Akaike**, **1974**) was used for checking whether the order of the fitted model is adequate compared with the order of dependence model. Akaike Information Criterion for AR(p) models was computed using the following equation.

AIC (P) = N 1n
$$\begin{pmatrix} & & \\ \sigma_{\varepsilon} \end{pmatrix}$$
 +2(P) (18)

Where,

N = Number of observations

 $\sigma_{\varepsilon}^{^{^{2}}}$ = Residual variance

A comparison was made between the AIC (p) and the AIC (p-1). If the AIC (p) is less than both AIC (p-1) and AIC (p+1), then the AR(p) model is best otherwise, the model which gives minimum AIC value was the one to be selected model.

Generation using AR (P) models

The fitted autoregressive AR (P) model is used for generation of synthetic series.

RESULTS AND DISCUSSION

Akaike Information Criterion test for AR models

In order to choose the better model among these three models, Akaike Information Criterion (AIC) for all three models were computed by equation 3.18. The computed values of AIC for rainfall and runoff are presented in *Table 1*. It is clear from the table that AIC value of AR(1) has a minimum value as compared with AR(0) and AR(2) model therefore it was considered suitable model for future prediction of rainfall and runoff.

Table 1. Akaike Information Criterion test for AR models

Akaike Information Criteria								
Model	Model AR(0) AR (1) AR (2)							
Rainfall	129.46	126.05	141.18					
Runoff	91.14	90.82	111.64					

Evaluation of AR (1) model for rainfall and runoff

The relation between the predicted and measured values of rainfall and runoff were presented in *Fig 1* and *Fig. 2*. The graphical representation of data shows the strong relation between measured and predicted values for both rainfall $(R^2=0.9084)$ and runoff $(R^2=0.8531)$. These values also prove the accuracy of the developed model for prediction of rainfall and runoff in Ningthourok catchment.



Fig 1: Comparison between measured and predicted annual rainfall of Ningthourok catchment



Fig 2: Comparison between measured and predicted annual runoff of Ningthourok catchment

Statistical characteristics of data

The mean, standard deviation and skewness of historical and generated data for rainfall and runoff are presented in *Table 2* and *Table 3*. The mean and standard deviation values for measured and predicted values of rainfall and runoff are almost equal. The results clearly shows that the skewness of generated data AR (1) model and historical data lies between -1 to +1 and therefore AR (1) model indicates better mean, standard deviation and skewness.

Table 2. Statistical characteristics of measured and predicted rainfall

S. No	Statistical characteristic	Measured	Predicted
1	Mean	1879.656	1871.173
2	Standard deviation	258.8319	248.8311
3	Skewness	0.900705	0.820019

S.No	Statistical characteristic	Measured	Predicted
1	Mean	219.9727	209.9204
2	Standard deviation	65.92763	65.14584
3	Skewness	0.900705	0.86706

 Table 3. Statistical characteristics of measured and predicted runoff

Statistical errors

The different errors for both rainfall and runoff generated by AR (1) model were calculated and presented in Table 4. The tabular data clearly represents that for stream flow prediction AR (1) model is giving the best results. Since all the errors are comparatively very less than the historical one, it indicates that AR (1) model can used for rainfall and runoff prediction in Ningthourok catchment.

Table 4.	Evaluation of regeneration performance	with
	statistical errors	

S.N.	Statistical error	Autoregressive (AR 1) mode		
		Rainfall I	Runoff discharge	
		(mm)	(m ³ / s)	
1	Mean Forecast Error	-9.483	-9.959	
2	Mean Absolute Error	9.483	9.959	
3	Mean Relative Error	0.050	0.437	
4	Mean Square Error	899.284	991.743	
5	Root Mean Square Error	29.988	31.492	
6	Integral Square Error	0.477	4.550	

CONCLUSION

The predicted values were found very near to the observed values of rainfall and runoff. The result shows that the statistical characteristics were found to be almost equal to zero. Thus, the AR (1) model is best suited model for the Ningthourok catchment.

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Development and Quality Evaluation of Ragi Fortified Cake

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ABSTRACT

The study was done on formulation of ragi fortified cake from ragi flour. The ragi was used for cake preparation. The ragi flour was incorporated in the traditional recipe to replace wheat flour at levels of 0, 90-10, 80-20, and 70-30 percent in preparation of cakes. Result of sensory (appearance, color, flavour, texture, taste, and overall acceptability) evaluation revealed that the 80-20% addition of the ragi flour is having higher overall acceptability, taste, texture and flavour and it was accepted by the panelists members. However, a declining trend in acceptability was observed with increasing level of ragi flour for all the sensory characteristics. The nutritional value of the cake (as determined through nutrient analysis of Moisture, Protein, Fat, and Ash,) with 70-30 percent of ragi flour was best according to nutritional value. The cake prepared by supplementation with ragi flour will be beneficial for growing children, teenagers, pregnant women, lactating women and anaemic patients.

Key Words: Cake, Ragi flour, Nutritional value, Sensory parameters.

INTRODUCTION

Ragi (Elexsina coracan) belongs to family Graminae. It is also called as finger millet. Finger millet (Ragi) is one of the most nutritious crops among the major cereal crops. It has many applications such as bread, malt, beverages, porridge and roti making. In recent years, Finger millet has gained importance, because of its nutritional strength in terms of dietary fiber, functional fiber, starch pattern, as well as high Calcium and Iron contents. The nutritive value is higher than rice and equal to wheat. Ragi meal is an ideal for diabetics and obese, because its digestion is slow and due to this the carbohydrate takes longer time to get absorbed. Ragi is rich in cellulose; therefore, its regular use is an excellent medicine for chronic constipation. Ragi is an excellent tonic for all age groups children also grow healthy with strong bones and look rosy due to new blood form by the additional supply of iron It supplies abundant of calcium, Phosphorous, iron, vitamin B, and B2 and prevent malnutrition in spite of restricted food. Eating of roasted green ragi is a tonic for high blood pressure, lever diseases, nervousness, heart, weakness, asthma and during pregnancy. Ragi malt has high nutritional value than whole ragi flour.

In India ragi accounts for 25 % production of overall food grain production .Ragi is the reddish mustered like grain are harvested during December and January. India and South Africa are leading countries in cultivation of ragi. In India Karnataka (1630 MT), Tamilnadu and Maharashtra (161 MT) is a higher cultivation state in production of ragi.Ragi is a staple food of a labour class i.e., consumed in form of ragi ball and unleavened bread, roti. Prolonged digestion of real meal helps labours to work longer without feeling tired and hungry. It is rich in calcium and iron. In ragi phytic acid, tannin, and trypsin inhibitor are the main antinutritional factor normally present. Ragi is rich in prolamine and glutamine protein. Ragi is use for reduction of sugar in urine and blood. It is used for diabetes patient because due to slow digestions carbohydrates slowly get absorbed. It can also use as medicine for general weakness, insomnia, mental irritability, weakness of memory hepatitis etc. It is also given with excellent result in tuberculosis. Many products prepared from ragi in India are Idli, Pasta, Unleavened bread, Ragi ball, Ragi malt, Ragi dosa, etc.

Traditionally ragi is processed either by malting or fermentation (**Muralikrishna**, 2000). Malting of finger millet improves its digestibility, sensory and nutritional quality as well as pronounced effect in the lowering the anti nutrients. Malting characteristics of finger millet are superior to other millets and ranks next to barley malt. (**Malleshi and Desikachar**, 1986).

There are various benefits of malting such as vitamin-C is elaborated, phosphorus availability is increased and lysine and tryptophan are synthesized The malted and fermented ragi flour are extensively used in preparation of weaning food, instant mixes, beverages and pharmaceutical. (**Dulby and Tsai, 1976**).

MATERIALS AND METHODS

Refined wheat flour, Ragi flour and Sugar were purchased from the local market of Allahabad. The flour was of creamy white colors and free from bean fragment. Sugar was used as

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sweetener and also plays an important role in caramalization. Sunflower hydrogenated vegetable oil was used for cake making as a leavening agent, which was purchased from local market of Allahabad. Shortening is used as tenderizing agent, moisturizing agent and emulsifying agent, it provide structure and texture to the product. The Eggs and Baking powder were purchased from local market of Allahabad. Baking powder lightens the product and make it easy to digest. It acts as buffer between soda and acid and prevents reaction when expose to air by absorbing moisture.

METHOD

Table 1. Formulation table for preparation of ragi fortified cake

Ingredients	Control	Sample A	Sample B	Sample C
Wheat flour (g)	100	90	80	70
Ragi flour (g)		10	20	30
Sugar(g)	70	70	70	70
Veg oil (g)	60	60	60	60
Baking powder (g)	1	1	1	1
Egg (nos)	2	2	2	2
Vanilla Essence (ml)	2	2	2	2

Preparation of cake

Weighed all the raw material required for preparation of ragi cake according to the formulation. Sieve the dry ingredients i.e. flour and baking powder together. The cream mixture was prepared by mixing weighed amount of hydrogenated vegetable oil and sugar together. Then foam the whole egg by beating with beater followed by addition of few drops of essence. The batter was prepared by mixing cream mixture, foamed egg and dry ingredients with vigorously mixing. The batter was transferred to greased pan and baked it for 30-35 min. at 185°C. Inserted the clean toothpick to the centre of cake to check proper baking. Allowed the cake to cool by reinserting it and packed it into polyethylene bag.

Receiving of raw material ↓ Sieve together flour, baking powder ↓ Combine hydrogenated vegetable oil and sugar to form cream mixture ↓ Beat the whole egg to form foam ↓ Mix the cream mixture with beaten egg (Add essence) ↓

Add the dry mixture of flour to above mixture slowly by constant mixing Transfer the mixture in greased mold.

> ↓ Bake for 30-35 min. at185 °C ↓ Cool it for 15-20 min and pack it.

Sensory quality evaluation of cake

The cakes prepared by incorporating ragi flour were evaluated for their sensory characteristics: appearance. colour, aroma, texture, taste, and overall acceptability, by a panel consisting of ten judges. The judge included the teachers and students of Food Process Engineering Department, VSAET, SHAITS, Allahabad. The score card method was used to determine the sensory characteristics of the cake made. All samples of cakes (prepared from 0-30 % ragi flour) were given different code numbers. The quality factors such as appearance, colour, aroma, texture and overall acceptability were allotted a maximum score of 10 each. The scoring scale was: 1-2 (very poor), 3-4 (poor), 5-6 (fair), 7-8 (good), and 9-10 (very good).

Proximate composition

Moisture, crude fat, protein (using the factor 6.5 x N) and ash content in different cake samples were determined as per standard methods of AOAC, 2000.

RESULTS AND DISCUSSION

The present research work deals with incorporation of Ragi flour along with refined wheat flour to improve nutritional quality of cake. The main purpose behind using the Ragi flour is its nutritive value and to study its acceptability in bakery products. The cake prepared from ragi is a complete package of nutrition. In order to evaluate the quality and acceptability of ragi flour cake, the chemical analysis as well as organoleptic evaluation was followed in present investigation. In this study four samples were taken: T0 as control in which only wheat flour was used while as in other three samples named T1, T2, & T3 Ragi flour was added as 10%, 20% & 30% respectively.

Proximate composition of ragi fortified cake

The present data in *Table 2* indicatess that the average protein content of different samples T0,T1,T2,T3 of ragi cake was found to be 7.41%, 7.53%, 7.74% and 7.85% respectively.

Estimation of protein content of samples showed improvement in nutritional value of ragi flour incorporated cake with maximum value of 7.85 %, 30 % ragi based cake compared to control samples containing 7.41 % of protein. The results obtained for protein content of the ragi cakes are similar to the works of other researchers incorporating the ragi flour (**Singh. P 2005**).

The data presented in *Table 2* indicates that the average ash content of different samples T0, T1, T2, T3 of ragi cakes were found to be 0.58%, 0.87%, 1.44% and 1.54gm respectively. The ash content of cake increased significantly due to higher ash content of ragi flour.

The results of proximate composition of ragi based cakes are similar with the results obtained by **Majumder (2006)**. Where as there was slight reduction in fat content with increase in ragi flour incorporation.

The data presented in *Table 2* indicates that the average moisture content of different samples T0, T1, T2, and T3 of ragi flour cakes were found to be 12.83%, 12.74%, 12.65%, and11.81% respectively.

It showed that the moisture content of different samples decreases significantly which is due to less moisture content of ragi flour.

The moisture content of cake decreased linearly with increase in concentration of ragi flour, this may be attributed to low water binding capacity of ragi flour which does not retain higher moisture content in the final product. The results obtained for moisture content of the cakes are similar with the results obtained by other researchers who incorporated ragi flour. (Pawar et al 2007)

The data presented in *Table 2* indicates that the average fat content of different samples T0, T1, T2, and T3 of ragi flour cakes were found to be 17.10%, 17.14%, 17.21% and 17.24% respectively.

Both refined wheat flour and ragi flour were having lower fat content and hence the total fat content in samples were similar.

The results obtained for fat content of the cake are similar with the results obtained by other researchers who incorporated ragi flour. (Wadikar 2007).

Treatments	Protein content (%)	Ash content (%)	Moisture content (%)	Fat content (%)
T0	7.41	0.58	12.83	17.10
T1	7.53	0.87	12.74	17.14
T2	7.74	1.44	12.65	17.21
T3	7.85	1.54	11.81	17.24

Table 2 Proximate composition in ragi fortified cakes



Fig 1 Proximate Composition of Cake

Sensory evaluation of ragi fortified cake

The Sensory characteristics of the product such as general appearance, colour, taste, flavor, and overall acceptability were evaluated by panel of judges using nine point hedonic scale as per IS: 6273 (PART - II), 1971. The cake quality was assessed by a test panel of 10 judges. Each product was evaluated by the panel of judges on a 9-point hedonic scale where 9 represented liking extremely and 1 represented disliking extremely.

Table 3.Score for Sensory Evaluation of ragi fortified cake.

Treatments	Color	Appearance	Flavor	Taste	Over all acceptability
Т0	6.60	7.60	7.63	7.01	7.40
T1	7.75	7.34	7.41	7.68	7.54
T2	7.82	7.79	7.85	7.77	7.83
Т3	8.0	7.28	7.40	7.88	7.42



Fig 2 Score for Sensory Evaluation of ragi fortified cake

The data presented in *Table 3* indicates that the average rating for color of different samples T0, T1, T2, and T3 of ragi cakes were found to be 6.60, 7.75, 7.82 and 8.0 respectively. It showed that the rating for color of T3 was highest i.e.8.0 followed by sample T1 i.e.6.60. The colour of cake was darker

with increased concentration of ragi flour enhanced consumer appeal (up to 30 percent of ragi flour incorporation). Results obtained for colour of the cake are similar with the results obtained by other researchers. The average rating for appearance of different samples T0, T1, T2, and T3 of ragi cakes were found to be 7.60, 7.34, 7.79 and 7.28 respectively. It showed that the rating for appearance of sampleT2 was highest i.e.7.79 It was observed that ragi flour incorporated cake had grainy appearance preferred by panellist members (up to 20 percent) while in case of 30 percent ragi cake, excessive grainy appearance had lower preferences. The lower value of appearance may be due to decrease in sponginess of cakes resulting from the decrease in gluten content. The average rating for flavor of different samples T0, T1, T2, and T3 of ragi cakes were found to be 7.63, 7.41, 7.85 and 7.40 respectively. The average rating for taste of different samples T0, T1, T2, and T3 of ragi flour cakes were found to be 7.01, 7.68, 7.77 and 7.88 respectively. It shows that the rating for taste of sample T3 was highest i.e.7.88. Rating for flavor of sample T2 was highest i.e.7.85. The average rating for overall acceptability of different samples of ragi flour cakes were found to be 7.40, 7.54, 7.83 and 7.42 in T0, T1, T2 and T3 respectively. It shows that the rating for overall acceptability of sample T2 was highest i.e.7.83. It is due to combination of ragi flour at moderate level that is 20% ragi flour.

CONCLUSION

The present research work deals with the study of utilization of ragi flour in preparation of ragi cake. The utilization of ragi along with refined wheat flour increases the nutritional value of cake. Hence the cake does not remain only delicious but also nutritious. The analytical work shows increase in the amount of protein as well as fat. From all the trials it was seen that the ragi cake with 20% ragi flour was accepted by panel judges depending on sensory evaluation and from all the replication it was seen that the ragi cake with 30% ragi flour was best according to nutritional value. The cake prepared by supplementation with ragi flour will be beneficial to growing children, teenagers, pregnant women, lactating women and anaemic patients.

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Utilization of Whey for the Preparation of Mango-Based Beverage

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ABSTRACT

An investigation was carried out with the objective of preparing nutritionally enhanced mango beverage by incorporation of whey, cane sugar, mango pulp and to assess the sensory acceptability of the product with its enhanced nutrient content. Control and experimental treatments were prepared with varying proportion of whey and mango pulp in three different combinations i.e. $T_1 = 90:10$, $T_2 = 85:15$ and $T_3 = 80:20$. @ 12% cane sugar was used for each treatment. Each treatment replicated five times. Sensory evaluation of the product was carried out using 9 point hedonic scale. The data obtained during the study were analyzed statistically using analysis of variance and critical difference techniques. On the basis of findings it was concluded that T_3 (80:20) was found to be the best in terms of taste and flavour, colour and appearance, consistency and overall acceptability and chemical attributes. The treatment can be rated as $T_3 > T_2 > T_1 > T_0$.

INTRODUCTION

Whey is a yellow-green watery liquid that separates from the curd during the cheese making process. It is also a major byproduct of paneer and chhana industry which contains nearly half of all solids found in whole milk (Chandan et. al., 1982). These solids include protein, fat, minerals and lactose. Whey is an excellent beverage base and genuine thirst quencher, full of nutrients and possess medicinal properties but treated as waste dairy byproduct (De 1988). On one side, it controls the pollution and on the other hand, adds value to the product. Channa whey soup increases the appetite and it is helpful in case of diarrhea and liver problems. As far as mango is concerned it is a juicy fruit with an excellent flavour, attractive fragrance, delicious taste and high nutritional value that made it one of the best fruits. The present investigation is an alternate to make an acceptable quality of mango whey beverage using different levels of channa whey by adopting the technique of manufacture as recommend by Rodwan (2001).

MATERIALS AND METHODS

The ingredients used for preparation of whey-mango beverage were whey, sugar and mango pulp. The ripe mango were collected, washed, peeled, blended and filtered. Then whey was pasteurized at 71°C for 15 seconds. Mango pulp and whey was added together in 90:10 (T_1), 85:15 (T_2) and 80:20 (T_3) ratio. Sugar was added uniformly to all the treatments @12%. Pulp and whey were mixed and blended and Packaged in sterilized glass bottle. The beverage stored at 5°C. The samples were analyzed for physicochemical, microbial and organoleptic qualities as per procedure laid down by IS:2802 (1964), IS: 1479, Part II 1961(20) and ICAR manual for Dairy Chemistry and Dairy microbiology (1972) respectively.

RESULT AND DISCUSSION

The data on different aspects as per plan were tabulated and statistically analyzed as per **chandel (1991).**

PHYSICOCHEMICAL PROPERTIES

Table -1 showed average data obtained on different parameters. The highest mean for protein percentage in whey based mango beverage was found in T₃=0.59, followed by $T_2=0.55$, $T_0=0.51$ and $T_1=0.48$. The difference were non significant among the treatments. The highest mean value for carbohydrate percentage was found in $T_3=22.09$, followed by $T_2=20.68$, $T_1=19.49$ and $T_0=16.58$. Therewere significant differences found among the treatments, which may be attributed to addition of whey in different ratio. The highest mean value for moisture was found in $T_0 = 82.06$, followed by $T_1 = 78.80$, $T_2 = 77.35$ and $T_3 = 75.60$. The treatment was significantly different. The highest mean value for ash content in mango based beverage was found in $T_3=0.64$, followed by $T_2=0.50$, $T_0=0.50$ and $T_1=0.46$. The treatments did not differ significantly. The highest mean value for total solids content was found in $T_3=24.40$, followed by $T_2=22.65$, $T_1=21.20$ and $T_0 = 17.94$. The treatments were significantly different. This may be due to the addition of whey in different proportions. The highest mean value for acidity percentage was found in $T_3=0.58$, followed by $T_2=0.55$, $T_1=0.52$ and $T_0=0.52$. The treatments did not differ significantly. The highest mean for fat percentage in whey based mango beverage was found in $T_3=1.08$, followed by $T_2=0.92$, $T_1=0.77$ and $T_0=0.35$. The treatments were significantly different.

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Parameters(%)		Treatments				
	T ₀	T ₁	T ₂	T ₃		
Protein	0.51	0.48	0.55	0.59		
Carbohydrate	16.58	19.49	20.68	22.09		
Moisture	82.06	78.80	77.35	75.60		
Ash	0.50	0.46	0.50	0.64		
Total Solids	17.94	21.20	22.65	24.40		
Acidity	0.52	0.52	0.55	0.58		
Fat	0.35	0.77	0.92	1.08		

Table-1: Average of different physiochemical parameters.

Table-2:	Microbial	parameters
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Parameters	Treatments			
	T ₀	T ₁	T ₂	T ₃
SPC (cfu ⁻³ /g)	72.80	74.20	69.20	69.00
Yeast and mould (cfu ⁻² /g)	11.80	11.80	18.40	19.00
Coliform (cfu ⁻¹ /g)	Nil	Nil	Nil	Nil

The highest mean value for SPC in whey based mango beverage was found in $T_1=74.20$, followed by $T_0(72.80)$, $T_2(69.20)$ and $T_3(69.00)$. There were no significant differences found among the treatments. The highest mean value for Yeast and mould count was found in $T_3=19.00$, followed by $T_2(18.40)$, $T_1(11.80)$ and $T_0(11.80)$. There were no significant differences found among the treatments. All samples of whey based mango beverage did not show the presence of coliform, thus the product was good in quality.

Organoleptic Parameters

The highest mean for colour and appearance in whey based mango beverage was found in $T_3=8.60$, followed by T_2 (8.00), $T_1(7.60)$ and $T_0(7.00)$. The treatments differed significantly. The highest mean value for flavour and taste was found in $T_3=8.60$, followed by $T_2(7.80)$, $T_1(7.80)$ and T_0 (6.60). The treatments did not differ significantly. The highest mean value for consistency of the product was found in $T_3=8.80$, followed by $T_2(8.20)$, $T_1(7.60)$ and $T_0(7.00)$. There were significant difference found among all treatmments.

Table-3: Organoleptic Parameters(score)

Parameters	Treatments			
	T ₀	T ₁	T_2	T ₃
Colour and Appearance	7.00	7.60	8.00	8.60
Flavour and Taste	6.60	7.80	7.80	8.60
Consistency	7.00	7.60	8.20	8.80

Replication	Treatments				
	T ₀	T ₁	T ₂	T ₃	
R ₁	6.33	7.33	8.00	9.00	
R ₂	6.66	7.33	7.66	9.00	
R ₃	6.66	7.33	8.00	9.00	
R ₄	8.00	8.00	9.00	8.00	
R ₅	8.00	7.66	7.66	7.66	
Mean	7.13	7.53	8.06	8.53	

Table-4: Overall acceptability of the product

Figure 1: Overall acceptability of the product



Table 4 and *Fig-1* showed mean for overall acceptability of the product. The highest mean values found in $T_3(8.53)$, followed by $T_2(8.06)$, $T_1(7.53)$ and $T_0(7.13)$. There were significant differences found among the treatments that prove the quality of the beverage improved along with the higher ratio of whey addition.

CONCLUSION

In view of experimental results it may be concluded that whey based mango beverage has a great marketing potential in Indian market. The treatment with 20% mango pulp and 80% whey gave the best overall acceptability among the treatments.

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Preservation of Carrot for 180 days through Hurdle Technology

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ABSTRACT

Hurdle technology is a combination of different treatments. To develop suitable hurdle treatment for preservation of carrot, first fresh carrot was blanched at 100°C for 60 sec., followed by dipping into 0.25% potassium metabisulphite for 10 minutes. Then blanched carrot were steeped into different concentrations & combinations of preservatives- P_0 (Control sample-fresh without treatment), P_1 (35°Brix Syrup+8% Salt+500 ppm Potassium metabisulphite), P_2 (35°Brix Syrup+10% Salt+400 ppm Potassium metabisulphite), P_3 (35°Brix Syrup+8% Salt+500 ppm Potassium metabisulphite), P_4 (25°Brix Syrup+8% Salt+500 ppm Potassium metabisulphite+200 ppm Sodium benzoate) and P_6 (25°Brix Syrup+12% Salt+400 ppm Potassium metabisulphite+300 ppm Sodium benzoate) and P_6 (25°Brix Syrup+12% Salt+400 ppm Potassium metabisulphite+300 ppm Sodium benzoate). Steeped carrot were aseptically packed into food grade polyethylene pouches & stored at two different temperatures T_1 (30-37°C) & T_2 (5-7°C) for different time intervals i.e. 0, 30, 60, 90, 120, 150 and 180 days respectively. Thus there are 14 combinations of treatments under study- P_0/T_1 , P_0/T_2 , P_1/T_1 , P_1/T_2 , P_3/T_1 , P_3/T_2 , P_4/T_1 , P_4/T_2 , P_5/T_1 , P_5/T_2 , P_6/T_1 & P_6/T_2 for 180 days of storage period. Among 14 different treatments, the treatments which remained microbial safe for 180 days of storage period were P_6/T_1 , P_6/T_2 and P_5/T_2 . Among these three, treatment P_0/T_2 was scored lowest in physical and highest in highest in sensory & nutritional evaluation. So best hurdle treatment for preservation of carrot till 180 days of storage period was P_6/T_3 .

Keyword: Hurdle, ppm, Carrot, Treatment

INTRODUCTION

India is a leading vegetable producing country in the world with the production of 113.5 million tons. The overall productivity of vegetables is 14.4 tons per hectare. The production of vegetables increases due to advancement of hybrid varieties. But our market strategy is not equipped with the handling of large quantity of vegetables as a result quantities of vegetables get spoil. It varies between 5-39% of the total production. The shelf life of perishable vegetables is very low. In brinjal, carrot and chilly post harvest losses were found to be high (**Jayanthi M., 2008**).

Preservation is to maintain foods with desired properties as long as possible. Preservation lies at the heart of Food Science & Technology & it is the main purpose of Food Processing (**Barnettand M. & Blanchfield J. R., 1995**). The Hurdle concept was first introduced by Prof. Luthar Leistner of Germany & his colleagues in 1978. The hurdle governs many preservation processes. Intense heat (F) preserves canned foods, low water activity prevents microbial growth in dried products and low pH is responsible for prolonged shelf life of fermented foods. This preservation technique is also called combination techniques or barrier technology or metodascombinados in Spanish, technologia degli ostacoli in Italian, Hurdle Technology in German. Potential hurdles for food preservation are - Temperature (High or Low), pH (High or Low), Water activity (High or Low), Modified atmosphere (Co₂, N₂ etc), Packaging (Vacuum packaging, aseptic packaging, edible coating etc.), Radiation (UV, microwave, irradiation etc), Preservatives (Class I & II). Hurdle Technology is a technology by which 2 or more hurdles are employed in a suitable combination and every hurdle is used at an optimum level so that damage to the overall quality of food is kept to the minimum. Hurdle Technology foods are defined as "Products whose shelf-life and the microbial safety are extended by use of several factors none of which individually would be totally lethal towards spoilage or pathogenic microbes" (**Berwal, 1994).**

1.1 OBJECTIVES OF THE RESEARCH

1.1.1- To study the impact of hurdle technology (different concentration & combinations of preservatives, storage temperatures & storage periods) on the microbial(Yeast & mold count, Total plate count and E-coli) content of preserved carrot.

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- **1.1.2** To study the impact of hurdle technology (different concentration & combinations of preservatives, stor age temperatures and storage periods) on the physical (Water activity and pH) parameters of preserved carrot.
- **1.1.3** To study the impact of hurdle technology (different concentration & combinations of preservatives, stor age temperatures & storage periods) on the sensory properties of preserved carrot.
- 1.1.4 To study the impact of hurdle technology (different concentration & combinations of preservatives, storage temperatures & storage periods) on the nutrient (Protein, Vitamin A & Vitamin C) content of preserved carrot.

2.0 MATERIAL AND METHODS:

- 2.1 Materials used in preservation
- 2.1.1 Carrot: Carrot was procured from local market of Naini.
- **2.1.2 Chemicals used in preservation:** Food grade (potassium metabisulphate, sodium benzoate) chemicals were used.
- 2.1.3 Polyethylene pouches: Food grade pouches were used.
- 2.1.4 Reagents used in analysis: Analytical grade reagents were used.

2.2 Method of preservation:

First carrots were shorted and washed thoroughly in tap water. Washed carrots were cut into round shape to the size of $2 \times 2 \times 0.5$ cm. pieces with the help of sharp edged stainless steel knife. Then finally washed with distilled water. After washing, carrot pieces were blanched at 100°C for 60 sec., followed by dipping into 0.25% potassium metabisulphite for 10 minutes. Then blanched carrot were steeped into different concentrations & combinations of preservatives - P_{0} (Control sample-fresh without treatment), P_{1} (35°Brix Syrup +8% Salt +500 ppm Potassium metabisulphite), P₂ (35°Brix Syrup + 10% Salt + 400 ppm Potassium metabisulphite), P_{2} (35°Brix Syrup + 12% Salt + 300 ppm Potassium metabisulphite), P₄ (25°Brix Syrup+8% Salt + 500 ppm Potassium metabisulphite + 100 ppm Sodium benzoate), P₅ (25°Brix Syrup + 10% Salt + 400 ppm Potassium metabisulphite + 200 ppm Sodium benzoate) and P_6 (25°Brix Syrup + 12% Salt + 400 ppm Potassium metabisulphite + 300 ppm Sodium benzoate). Then steeped carrot were further aseptically packed into food grade polyethylene pouches and stored at two different level of temperatures- T1 (ambient temperature - 30 to 37 °C) & T2 (refrigeration temperatures - 5 to 7 °C) for 180 days. There are 14 combinations of treatments under study-P0/T1, P0/T2, P1/T1, P1/T2, P2/T1, P2/T2, P3/T1, P3/ T2, P4/T1, P4/T2, P5/T1, P5/T2, P6/T1& P6/T2 for 180 days of storage period (where P0, P1, P2, P3, P4, P5 & P6 are different

combination of preservatives and T1 & T2 are different level of temperatures, all are explained above). This preserved carrot was studied for their microbial, physical, sensory, & nutritional properties and data obtained after analysis were statistically analyzed.

2.3 Analysis Performed

- **2.3.1- Microbial analysis:** Yeast & mold (YMC), Total plate count (TPC) and E-coli were determined by Conventional method (**Ranganna 2005**).
- 2.3.2- Physical test: Water activity (aw %) was determined by using Water Activity Meter (Aqua Lab Series 4TE-2007), Operators manual). pH was determined by using pH meter (Electronic Corporation of India, Model 5652) as per procedure described in Ministry of Health & Family Welfare, Manual of methods of analysis of foods- Fruit and Vegetable Products, (2005).
- 2.3.3- Sensory analysis: Sensory properties (color, flavor, texture & overall acceptability) were determined by 9 Point Hedonic Scale method (Ranganna 2005).
- 2.3.4- Nutritional properties: Protein determined by Micro-Kjeldahl / Kjeltec method (Ranganna, 2005), Vitamin A determined by method mentioned in (Ranganna 2005), Vitamin C determined by 2, 6-dichlorophenol-indophenol visual titration method, (Ranganna 2005).
- 2.3.5- Statistical analysis: Obtained data were analyzed for ANOVA (3 Way Classification) & critical difference (C.D.) technique, described by (Imran and Coover 1983). In statistical analysis, data used were average of replicates, total no. of treatments combinations were 14 P0/T1, P0/T2, P1/T1, P1/T2, P2/T1, P2/T2, P3/T1, P3/T2, P4/T1, P4/T2, P5/T1, P5/T2, P6/T1, and P6/T2. Level of significance was checked at 5% probability level.

3.0 RESULTS AND DISCUSSIONS

- **3.1 Microbial analysis of preserved carrot-** Scores of microbial analysis [Yeast & mold (YMC), Total plate count (TPC) & E.coli] of preserved carrot given in *Table-1*.
- **3.1.1- YMC Analysis -** Treatments in which average YMC were found lowest with a storage period of 180 days are P6/T1 (21.14 count/gm), P5/T2(19count/gm) & P6/T2 (7.57 count/gm). There were significant difference between YMC of treated samples due to combination of preservatives & storage temperatures while there was not significant difference due to days of storage at 5% probability levels.

Increase in YMC was observed in all treatments at both the temperatures. In most of the treatments YMC were found above from the standard (as per 6 Food Safety & Standard

Treatments with its	YMC/gm	TPC(cfu/ml)	E.coli
Shelf life (in days)			
P0/T1-180	22*	17.43*	Nil
P0/T2-180	22*	17.43*	- do -
P1/T1- 90	50.6	58.4	- do -
P1/T2-120	46.33	55.33	- do -
P2/T1- 60	35	42.25	- do -
P2/T2 - 90	27.8	35.4	- do -
P3/T1- 30	51	56.66	- do -
P3/T2- 60	46.75	53	- do -
P4/T1-120	25.33*	31.17*	-do -
P4/T2-150	29.14	36.29*	- do -
P5/T1-150	37.9	47.57	- do -
P5/T2-180	19*	31.14*	- do -
P6/T1 -180	21.14*	27.43*	- do -
P6/T2-180	7.57*	14.43*	- do -

Table-1: Scores of	f microbial	analysis	<i>(YMC</i> ,	TPC	æ
E.coli) of	preserved ca	rrot in dif	ferent tr	eatme	nts
with its sh	elf life				

YMC/gm-Yeast & mold count/gm; TPC(cfu/ml)-Total plate count (colony formation unit/ml); E.coli- Escherichia coli; All values are MEAN; *Significant values

Authority of India, 2010-Yeast/Mold not more than 100 count/ gm) with increase in storage period, which may be attributed during addition of preservatives or during packaging which could have been a carrier of microbes. While in some treatments counts remained under control as per above mentioned standard till 180 days of storage, it might be due to better handling procedure or different concentration & combinations of class I & II preservatives & low temperature of storage. The results are in agreement of previous finding of Gould G. W. (1995), observed that the food preservation through hurdle technology cause interference with the homeostasis of yeast & mold. Alzamora S. M. et al. (1996), also noticed that yeast and mould counts remained below 100 cfu/gm during 4 months of storage of pineapple slices preserved through hurdle technology at 5°C. Lopez- Malo et al. (1995), preserved papaya through hurdles technology, found yeast & mold counts < 10 CFU/g during 5 months storage at 25°C.

3.1.2- TPC Analysis- Average TPC count of the treatment P6/T2 (14.43 cfu/ml) was found lowest in comparison of other treatments in a storage period of 180 days. There were significant difference between TPC scores of treated samples due to combination of preservatives & storage temperatures while there was not significant difference due to days of storage at 5% probability levels.

In case of TPC analysis, the increase in count was observed in all treatments at both the temperatures but the count was found within standard (as per 6 Food Safety & Standard Regulation, 2010- TPC not more than 1000cfu/ml) till 180 days of storage period. YMC of all the preserved sample (except treatments- P6/T1, P6/T2 & P5/T2) were found above from the above mentioned standard of YMC in 180 days of storage period so all the preserved samples were discarded one by one on the basis of their YMC count & not considered for further analysis of sensory. The results of TPC are in agreement of previous findings of Alzamora S. M. et al. (1996) noticed that TPC remain below 100 cfu/ml during 4 months of storage of pineapple slices preserved through hurdle technology at 5°C. Barwal et al. (2005), preserved carrot by using hurdle technology, by different concentrations & combinations of salt (5, 10, 15%), potassium metabisulphite (KMS-0.2%), and citric acid (1.0%) after blanching. The carrot steeped in 10 & 15 % salt containing 0.2% KMS were chemically, sensory microbial safe among all treatments during the entire period of storage.

3.1.3- E.coli- E.coli count of fresh & preserved samples was found Nil. In the present investigation E.coli were found to be absent in fresh as well as preserved carrot samples. This result is also supported by Food Safety & Standard Regulation 2010- E-coli- must be Nil. This indicates that the carrots which were used in preservation were free from fecal contamination and also proper hygienic precautions had been taken during preservation as well as during packaging of treated samples.

Treatments with its	Water activity (%)	pH
Shelf life (in days)		•
P0/T1-180	0.94*	5.8*
P0/T2-180	0.94*	5.8*
P1/T1- 90	0.75	4.1
P1/T2-120	0.74	3.97*
P2/T1- 60	0.71	4.3
P2/T2- 90	0.68*	4.12
P3/T1- 30	0.76	4.5
P3/T2- 60	0.73	4.2
P4/T1-120	0.69*	4.0*
P4/T2-150	0.67*	3.8*
P5/T1-150	0.74	4.0*
P5/T2-180	0.68*	3.8*
P6/T1-180	0.7*	3.6*
P6/T2-180	0.64*	3.5*

 Table-2: Scores of Water activity (%) & pH of preserved carrot in different treatments with its shelf life

All values are MEAN; *Significant values

3.2- Physical analysis of preserved carrot: Scores of water activity (aw %) & pH of preserved carrot given in *Table-*2. Lowest water activity (0.64%) & pH (3.5) were found in P6/T2 in a storage period of 180 days. There were significant difference between water activity & pH scores of treated samples due to combination of preservatives, storage temperatures and days of storage at 5% probability levels.

In physical test, the reduced water activity (aw %) & pH of preserved sample were found as compare to initial or fresh commodity. Reduced water activity & pH were found effective for long time storage. The results are in agreement of previous finding of **Vibhakara** *et al.* (2007), maintenance of pH< 4.5 helped in controlling multiplication and survival of spores & also helpful in achieving shelf stability. Low pH and water activity solutions are used as antimicrobial agent or as antioxidant to prevent browning, to reduce discoloration of pigments, and to protect against loss of flavor, changes in texture (**Wiley, 1994**).

3.3- Sensory analysis of preserved carrot: Scores of sensory analysis of preserved carrot given in *Table-3*. In preserved samples, treatment P6/T2 scored highest in color & appearance (7.42), flavor & taste (7.85), body & texture (7.71) & overall acceptability (8.14) with a storage period of 180 days. There were significant difference between color & appearance, flavor & taste, body & texture & overall acceptability scores of treated samples due to combination of preservatives & days

 Table- 3: Scores of sensory analysis of preserved carrot in different treatments with its shelf life

Treatments with its	Color &	Flavour	Body &	Overall
Shelf life(in days)	appearance	& Taste	Texture	acceptability
P0/T1 -180	9*	9*	9*	9*
P0/T2 - 180	9*	9*	9*	9*
P1/T1 - 90	7*	7*	7*	7*
P1/T2 -120	7.2*	7*	6.66	7.4*
P2/T1 - 60	6.66	6	6	6.66
P2/T2 - 90	7.0*	6.25	6	6.75
P3/T1 - 30	6.75	6.25	6.25	7.3*
P3/T2 - 60	6.8	6.8	6.6	7.8*
P4/T1 -120	7.28*	7.14*	7.14*	6.8
P4/T2 -150	8.14*	8*	8*	7.5*
P5/T1 -150	7.16*	7*	7*	7.16*
P5/T2 -180	7.0*	7.3*	7.16*	8*
P6/T1 -180	6.6	6.6	6	7.43*
P6/T2 - 180	7.42*	7.85*	7.71*	8.14*

All values are MEAN; *Significant values

of storage while there was not significant difference due to storage temperatures at 5% probability levels.

Table-4:	Protein,	Vitamin-A	&	Vitamin-C	scores	of
	preserved	carrot in di	ffer	ent treatme	nts with	its
	shelf life					

Treatments with its	Protein	Vitamin-A	Vitamin-C
shelf life (in Days)	(mg/100gm)	(mg/100gm)	(mg/100gm)
P0/T1 -180	0.95*	3.2*	3.56*
P0/T2 -180	0.95*	3.2*	3.56*
P1/T1 - 90	0.81	2.4	1.03
P1/T2 -120	0.83	2.8	1.16
P2/T1 - 60	0.89	2.6	1.15
P2/T2 - 90	0.89	2.7	1.3
P3/T1 - 30	0.91	2.8	1.5
P3/T2 - 60	0.92	2.9	1.6
P4/T1-120	0.64*	1.6	0.64*
P4/T2 -150	0.67*	1.8*	0.9
P5/T1 -150	0.48*	2.0*	0.64*
P5/T2 -180	0.52*	2.1*	0.6*
P6/T1 -180	0.46*	1.9*	0.46*
P6/T2 -180	0.6*	2.3*	0.72*

All values are MEAN; * Significant values

In sensory evaluation, the difference & decrease in color & appearance, flavor & taste, body & texture & overall acceptability scores were observed which may be attributed due to increase in microbial count with increase in storage period. But treatments P6/T1, P6/T2 & P5/T2 which remained microbial safe till 180 days of storage period were scored highest among all treatments & from 3 of them, P6/T2 was scored highest in sensory evaluation in 180 days of storage period. The results are in agreement of previous finding of Pruthi (1990), the vegetables like potatoes, carrot, carrot, cabbage, bitter guard, peas, mushroom and animals foods (meat, fish and poultry) preserved in an acidified sulphited brine solution through steeping can be used for pickling or home cooking after leaching out the salt and acid. Barwal et al. (2005) standardized the low cost and low energy processing technology for preservation of carrot involving different concentration and combination of salt (5-10%), potassium metabisulphite (0.2%) and citric acid (1%) after blanching. The preserved carrot was accepted in sensory evaluation after 90 and 180 days of storage by reconstituted in running water for half an hour & evaluated for the preparation of pickle and pakora

3.4- Nutritional analysis of preserved carrot: From *Table-4* - highest retention of protein, vitamin A and vitamin C were found in treatment P6/T2 in a storage period of 180 days. There were significant difference between protein, vitamin A and vitamin C scores of treated samples due to combination of preservatives, storage temperatures & days of storage at 5% probability levels.

In nutritional evaluation, loss of nutrients were found in each treatments but on other hand better retention of protein, vitamin A and vitamin C were also observed in treatments of 180 days of storage period. The results are in agreement of previous finding of **Srivastava & Kumar (2002)**, sulphur dioxide is widely used throughout the world in the preservation as it acts as an antioxidant and bleaching agent. These properties help in the retention of vitamin C, vitamin A and other oxidizable compounds. Sulphur dioxide with potassium metabisulphite (if added in the solution) helps to retain vitamin C content of the preserved material (21Verma & Joshi, 2000). Low pH and water activity solutions were also effective towards nutrient retention (**Wiley**, **1994**).

5.0- CONCLUSION

From 14 different steeping treatments (P0/T1, P0/T2, P1/T1, P1/T2, P2/T1, P2/T2, P3/T1, P3/T2, P4/T1, P4/T2, P5/T1, P5/T2, P6/T1& P6/T2), only 3 treatments - P6/T1, P6/T2 & P5/T2 were microbial safe till 180 days of storage period. Among these 3, only P6/T2 was found best in physical, sensory & nutritional evaluation in 180 days of storage period. So best hurdle treatment for preservation of carrot for 180 days was P6/T2.

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Study of Management of Risk in Civil Engineering Project

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ABSTRACT

The present investigation is undertaken in the department of civil engineering, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, during the year 2013-2014. The experiment was To assess the foremost major and customary risks that cause unhealthy impact on construction amount to study management of risk in construction industry and to work out affordable and cheap solution.

Keywords: risks,

INTRODUCTION

Project management is the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. Project risk management includes the processes concerned with identifying, analyzing, and responding to project risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events. Generally, risk is a choice in an environment rather than a fate. BS 6079 (British Standard Institution 1996) defines risk as 'It is the uncertainty inherent in plans and possibility of something happening that can affect the prospects of achieving, business or project goals'. The word "risk" was known in the English language in the 17th century. It is believed that the word was originally a sailor's term that came from the Spanish and meant "to run into danger or to go against a rock." The money spent to fund shipments overseas was the first example of risk business in the early days of travel. Each and every activity we do involve risk, only the amount of risk varies.

Prof. Kent Miller of Purdue University defines risk as "Unpredictability in corporations/businesses outcome variables". About Uncertainty he defines as "Unpredictability of environmental and organizational variables that impact the corporations/businesses performance." Consequences of uncertainty and its exposure in a project, is risk. In a project context, it is the chance of something happening that will have an impact upon objectives.

It includes the possibility of loss or gain, or variation from a desired or planned outcome, as a consequence of the uncertaintyassociated with following a particular course of action. Risk thus has two elements: the likelihood or probability of something happening, and the consequences or impacts if it does. Managing risk is an integral part of good management, and fundamental to achieving good business and project outcomes and the effective procurement of goods and services. Risk management provides a structured way of assessing and dealing with future uncertainty. Project risk management includes the processes concerned with identifying, analyzing, and responding to project risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events.

MATERIALS AND METHODS

Method of Surveying

The general methodology of this study relies largely on the survey questionnaire which will be collected from the local building contractors of different sizes by mail or by personnel meeting. A thorough literature review was initially conducted to identify the risk factors that affect the performance of construction industry as a whole. This study has adopted the more general and broad definition of risk as presented by **Shen et al (2001)** on China's construction joint ventures and more risk factors from other literature. Also some interviews with industrial practitioners were conducted to produce to check effectiveness of questionnaires.

Questionnaire Structure

The structured interview questionnaire is shown in Appendix A. The questionnaire was tested with a pilot survey for clarity, ease of use, and value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of general information like type of company, experience, value of their project e.t.c. and the second part consists of the construction risk factors for

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evaluation. Risk factors for this study are classified into eight categories, namely:

- 1. Financial risk
- 2. Legal risk
- 3. Management risk
- 4. Market risk
- 5. Policy and political risk
- 6. Technical risk
- 7. Environmental risk
- 8. Social risk?

Questionnaire Design

The survey questionnaire is designed to probe the cross-sectional behavioural pattern of construction risks construction industry. The questionnaire was prepared for the pilot survey was formulated by seeing the relevant literatures in the area of construction risk. The interviewer was free to ask additional questions that focused on issues arising during the course of the interview. The freedom to follow the interviewee, to ask for clarifications, and to focus on specific projects, risk practices and knowledge, made the interviews insightful.

1. Risk Rating

A Likert scale of 1-5 was used in the questionnaire. A Likert scale is a type of psychometric response scale often used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use (Likert, 1932). The respondents were required to indicate the relative criticality/ effectiveness of each of the probability of risk factors and their impact to the management. (In Appendix-A details of evaluation made in the questionnaire survey are given).

2. Design of Survey

The respondents were requested to judge the significance or "expected loss" of each risk. There are many criteria that respondents may need to consider. One alternative approach adopted by previous researchers (Shen et.al 1998) is to consider two attributes for each risk: the probability level of the risk occurrence, denoted by α ; and the degree of impact or the level of loss if the risk occurs, denoted by

 β . The same type of evaluation is followed in this study also. Therefore, risk significance, denoted as RS, can be described as the function of the two attributes $RS = f(\alpha, \beta)$. By applying this approach, the respondents were asked to respond to the two attributes for each risk. For considering β , the respondents were required to judge the probability level of risk occurrence by selecting one from among five

levels, namely, Very small, Small, Normal, Large and Very large. For considering β , the respondents were required to judge the degree of impact if the risk concerned occurs, by selecting one from among five grades, namely, Very low, Low, Medium, High, and Very high.

3. ANALYSIS OF SURVEY RESULTS

To assess the relative significance among risks, previous literatures study suggests establishing a risk significance index by calculating a significance score for each risk. For calculating the significance score is to multiply the probability of occurrence by the degree of impact. Thus, the significance score for each risk assessed by each respondent can be obtained through the model Tarek M. Zayed (2002).

$$S_j^i = \alpha_j^i \beta_j^i$$

where

 S_{j}^{i} = significance score assessed by respondent j for risk i; α_{j}^{i} = probability of occurrence of risk i, assessed by respondent j; and

 β_i^i = degree of impact of risk i, assessed by respondent j. By averaging scores from all the responses, it is possible to get an average significance score for each risk, and this average score is called the risk index score and is used to rank among all risks. The model for the calculation of risk index score can be written as

Where

 RS^{i} = index score for risk i;

 $\mathbf{S}_{j}^{i} = \text{significance score } \mathbb{RS}^{i} = \frac{\sum_{j=1}^{T} S_{j}^{i}}{T}$ assessed by respondent j for risk i and

T = Total number of responses. To calculate Si, the five point scales for α and β , this will be converted into numerical (Likert scale) scales.

4. PILOT STUDY

A pilot survey with the questionnaire in the previous phase and follow-up interviews with local contractors were conducted. The purpose was to identify the factors out of the 81 factors that applied overseas could also apply to the local construction industry. The small number interviews and the structure of the questionnaire in the pilot study does not allow for statistical analysis.

Responses to the interviews have been used to identify consistent themes, common practices, and insight provided by active and influential project participants that would provide additional guidance and assistance to the research team.

The survey results formed the basis of modifying the questionnaire for the subsequent full-scale survey. The pilot study attempts to short-list locally relevant factors. The criteria for a short-listing are that the chosen factors are relevant in the local construction industry. As a result, only important and relevant factors were chosen for inclusion in the full-scale survey in the second phase of the research.

RESULTS AND DISCUSSION

Totally for twenty companies the questionnaires were given, out of which twelve had an effective reply and two were rejected due to improper answering. Thus the response rate is 60% which is considered a good response in this type of survey. In those twelve companies surveyed, four are contractors and eight are owners. All the questionnaire survey was done from project manager of the project or project engineer at the site. In some cases, consultant gave the answers on behalf of their clients, both from the owner and the contractor side. Even telephonic and email reply was accepted since it was difficult to get the direct one to one meeting with the Project managers. Sub-contractor related problems, time constraint, and increase in inflation were the major problems concerned with both the contractor and owner. The full results were shown in the table 4.1. As far as the contractor is concerned shortage of skilful workers has the maximum risk rating and other risks which have maximum risk rating are time constraint, sub-contractor related problems, project delay, improper verification of contract documents, and competition from other companies. For the owners time constraint has the maximum risk rating and other risks which have maximum risk rating shortage of skilful workers, project delay, errors in design drawings, Improper project planning and budgeting, loss due to fluctuation of inflation rate. The least risk rating given by both owners and contactors are environmental risk, relation with government departments, local protectionism and industrial disputes Artem Aleshin (2001).

Overall ranking of risks

S.No	Sub Risk	Mean	SD
1	Shortage of skilful workers	4.58	3.61
2	Time Constrain	4.12	4.58
3	Sub-contractor related problems	3.94	5.72
4	Project delay	3.94	6.39
5	Improper verification of contract	3.83	3.6
6	Competition from other Companies	3.51	6.31
7	Improper project planning and budgeting	3.25	2.92
8	Increase of materials price	3.07	4.73

9	Loss due to fluctuation of inflation	3.05	3.45
	rate		
10	Poor communication between clients	3.03	4.47
11	Loss due to fluctuation of interest rate	2.99	6.17
12	Increase of labour costs	2.95	6.88
13	Materials shortage	2.94	4.82
14	Internal management problems	2.93	4.19
15	Breach of contract by project partner	2.91	1.99
16	Improper project feasibility study	2.86	5.07
17	Unknown site conditions	2.83	2.32
18	Improper project organization structure	2.79	3.99
19	Loss due to rise in fuel prices	2.75	5.5
20	Design changes	2.74	3.76
21	Site distance from urban area	2.6	6.27
22	Team work	2.56	3.52
23	Errors in design drawings	2.53	4.78
24	Any adverse impact on project due to climatic conditions	2.5	4.24
25	No past experience in similar	2.45	2.97
26	Poor quality of procured materials	2.39	348
27	Wastage of materials by workers	2.3	4.19
28	Cost increase due to changes of	2.24	3.37
	Govt policies		
29	Technical risk	2.15	6.18
30	Lack arbitration clause in agreement	2.13	7.1
31	Poor relation and disputes with	2.09	3.76
32	High degree of difficulty in	2.07	5.04
33	Stiff environmental regulations	1.02	3 63/
34	Incompetence of transportation	1.93	2.98
25		1 70	4.02
35 26	Shortage in supply of water	1.78	4.93
30 27	Equipment failure	1.//	3.12
21 20	Inadequate choice of project partner	1.75	2.23
38	approvals	1.75	1.49
39	Architect Vs Structural Engineer dispute	1.73	4.84
40	Surplus materials handling	1.71	3.78
41	Following government standards and codes	1.7	4.95
42	Bankruptcy of project partner	1.69	7.53

43	Accidents on site	1.57	3.52
44	Increase of accessory facilities price	1.54	3.65
45	Loss due to fluctuation of exchange	1.43	3.34
	rate		
46	Change of Top management	1.43	2.54
47	Shortage in supply fuel	1.43	1.38
48	Inadequate forecast about market	1.33	3.88
	demand		
49	Lack of enforcement of legal	1.26	2.71
	judgment		
50	Unfairness in tendering	1.26	4.07
51	Theft of materials at site	1.2	3.99
52	Fall short of expected income from	1.15	4.47
	project		
53	Uncertainty and unfairness of	1.04	2.51
	court justice		
54	Local protectionism	0.98	2.93
55	Changes in Bank formalities and	0.93	3.78
	regulations		
56	Industrial disputes	0.89	3.57
57	Low credibility of shareholders	0.86	5.06
	and lenders		
58	Short tendering time	0.86	3.27
59	Obsoleteness of building equipment	0.85	2.36
60	Any impact on the environment due	0.8	3.43
	to the project		
61	Healthy working environment for	0.8	3.83
	the workers		
62	Loss incurred due to corruption	0.78	6.52
	and bribery		
63	Shortage in supply electricity	0.77	2.65
64	Loss incurred due to political	0.68	3.25
	changes		

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Study on development of value added product from citrus peel

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ABSTRACT

In preparation of citrus peel candy cut rectangular suitable size cube from the fully mature ripe washed peeled fruits the peels were than blenched in water for 10 minutes. 330g of sugar were dissolved in 500ml of distilled water & syrup concentration was 40% and the syrup solution was filtered the pieces were then dipped in syrup solution for a night. In the next day the syrup was boiled the raise the ^oBrix to 60% and peels where dipped in it over night the third day, the syrup was again boiled to raise the concentration of syrup to 75% ^oBrix the peels where then dipped in it for a week. The peels (pieces) were then dried in shead and then wrapped with powdered sugar than they were packaged and stored. From the experiment it was concluded that T_2 candy blanched first in water for 10 min. & then steeped in 40% sugar syrup was better in quality attributes & retained good Organoleptic attributes for up to 60 days.

INTRODUCTION

Citrus is one of the most popular fruits in the country. Likewise it is considered as an important crop and a top dollarearner industry. Citrus fruits constitute an important group of fruit crops produced all over the world. India is also a major producer of citrus fruits. These are produced all over India but the major producers are the states of Maharashtra, Tamil Nadu, Andhra Pradesh, Himachal Pradesh, Punjab and Haryana. Oranges of Nagpur are famous for their size and aroma. Citrus fruits are utilized mostly for table purposes, but a significant portion is processed into various products, such as squashes, cordials, single strength juices, juice concentrates, marmalades, pickles etc. The family of citrus fruits consists of Oranges, Kinnow, Khatta, Lime, Lemon (Galgal), Grapefruit, Malta, Mausami, Sweet orange etc.

Pectin is a polysaccharide having properties such as gelation and emulsion stabilization which make it useful in the manufacture of food, cosmetics, and medicine. It is a normal constituent of food and may therefore be safely ingested. Citrus peel, a by-product of the citrus processing industry, is a suitable source of pectin (Sakai and Okushima 1980). Pectin is a naturally occurring substance present in all plant tissue, calcium pectin being present between the cell walls and serving as a strengthening or building agent. Fruits naturally possessing relatively large amount of pectin include lemons, bitter oranges, apples, quinees, grooselevvies, currants and plums.

Lime (*Citrus auranliforia Swingle*), is one of the important sources of plant-derived medicinal herbs used in Thailand. Because of the unique flavor and range of medicinal properties of lime and its derivatives, it has been used both for enhancing the taste of various Thai foods and is popular for use in Thai traditional medicine. Moreover, d-limonin the major constituent of lime oil in lime peel has been shown to have cancer chemopreventive and anticarcinogenic properties (Crowel and Gould, 1994; Chaisawadi *et al.*, 1998). Thousands of tons of this fruit are consumed yearly, indicating its importance in Thai agricultural economy. Although this fruit grows all year round in Thailand, it has a short period on low production causing a great demand during the time of scarcity. It is, therefore considered desirable to process lime juice to freeze-dried lime powder. The freeze-dried lime powder that retains the same quality as fresh lime juice has been developed (Chaisawadi *et al.*, 2000).

Citrus is chiefly utilized for its pulp and juice but the rind, pressed pulp, covering each individual segment of the edible portion, and seeds are considered as wastes. To a small extent, the rind has been made into confection. The average annual per capita consumption in the Philippines is approximately 7.0%, during peak season there is an abundant supply of these fruits. Most of our food and drug industries utilize these products which are usually important. It is therefore; important to produce them locally in order to offset the cost of important and to provide a means of utilizing products which could otherwise be disposed of as waste.

Dried citrus peel is rich in carbohydrates, proteins and pectin; the fat content, however, is low. Various microbial transformations have been proposed for the utilization of food processing waste for producing valuable products like biogas, ethanol, citric acid, chemicals, various enzymes, volatile flavouring compounds, fatty acids and microbial biomass. Citrus peel contains an appreciable amount of pectin and thus can be used as a substrate for the production of pectinolytic enzymes by micro- organisms. Pectin acts as the inducer for the production of pectinolytic enzymes by microbial systems.

Citrus fruits were historically used for their high content of vitamin C. Various studies elucidate their total radicaltrapping anti oxidative potential (TRAP) that the TRAP was significantly higher in peels than in peeled fruits. These citrus fruits contain high concentrations of phenols, hydroxycinnamates, lavonoids, glycosides, herperidin and its flavones analogue, diosmin, etc., that all have exhibited anti carcinogenic activities in various in vivo studies. The objective of the research was to evaluate the chemical characteristics of the citrus peel candies.

MATERIALS AND METHODS

Research work was carried out in the Department of Food Process Engineering laboratory,

Fresh & mature citrus fruit were purchased from the local market of Allahabad. It was ensured that the fruit was free from any kind of damage and infestation. The citrus fruits were peeled and then peels were used for the manufacturing of candy.

 Table:1. Different pre-treatments used for preparation of candy, which are as follows:

Treatments	Description				
T1	Steeping of the orange peel in 40% sugar				
	solution after blanched in water for 10 min				
T2	Steeping of the lemon peel in 40% sugar solution after blanched in water for 10 min				
T3	Steeping of the mausambi peel in 40% sugar solution after blanched in water for 10 min				

For citrus peel preparation mature fruits were peeled and washed and cut into pieces and then blanched in water for 10 minutes. The candy was prepared by slow process of cooking in sugar syrup using 1-1/2 time the weight of sugar for fruit. Initially half quantity of sugar i. e. 750 g was evenly spread on the fruits and kept for 24 h. The next day the water was drawn out from the fruits to form syrup and the syrup consistency became thinner. The fruits were then removed from the syrup and 375 g of sugar was added to the syrup and it was heated to dissolve the sugar. The sugar was filtered through white muslin cloth to separate the dissolve impurities of sugar. The citrus peels were again dipped in the prepared concentrated syrup and left immersed in it for 24 h. On the third day the citrus peels were again removed from the syrup and the remaining 375 g of sugar was added and heated till it was completely dissolved. The syrup was again filtered by means of a white muslin cloth. The prepared syrup was with

65-700 Brix. Peels were again dipped in the syrup for another 24 h. On the fourth day the peels were again removed from the syrup and were boiled for about 3 minutes to raise its Brix by 10. Peels were again dipped in syrup for 24 h. On the fifth day the concentration of syrup was brought between 70-75⁰ Brix. On the sixth day the fruits were kept on a stainless steel sieve to drain out syrup and then fruits were coated with sugar. The fruits were then dried in the air at room temperature.



Fig. 3.1. Process flow chart for preparation of citrus peel candies

The citrus peel candy was stored for 2 months. Various physic-chemical properties, Organoleptic rating and shelf life were tested at 0, 20, 40 and 60 days after storage.

Regular observations at analysis interval of 20 days were made on various physico-chemical characters to judge the storage behavior for total period of 2 months.

Determination of total soluble solids (TSS): ⁰Brix

The estimation of total soluble solids gave the approximate amount of water soluble substance present in the sample. The total soluble content was determined by hand refractometer. The refractometer reading was taken by placing the prepared parts of candy on the prism and the reading was recorded and total soluble solids was expressed in ⁰Brix (Sethi, 1999).

Determination of ascorbic acid (mg/100g)

Three percent met phosphoric acid solution was made by dissolving exactly 30g of meta phosphoric acid in 80 ml of acetic acid and 500 ml distilled water was added and the volume was made up to 1000 ml. Fill the solution and store it.

Estimation of Reducing sugar (%)

A known weight of sample plus 100 ml distrilled water was boiled for analysis The samples were macerated and neutralized with NAOH. 10 ml of lead acetate was added and subsequently after waiting for 20 minute, it was freed from lead by the addition of 10 ml potassium oxalate. The volume was made up to 250 ml with distilled water and filtered. The filtrate was designated as (A). 5 ml each of Fehlings A and B plus 20-25 ml of distilled water was heated on burner and titrated against sugar solution using methylene blue as analysis indicator and percentage of reducing sugar was calculated using following equation-

0.05 x Volume made up

(Titrate value x weight of sample)

STATISTICALANALYSIS

The experiment was conducted by adopting completely randomized design of the data recorded. During the course of investigation, product of different formulations were analysed statistically by the analysis of variance' (ANOVA). The significant effect of treatment was judged with the help of F' (Variance Ratio). F values were compared with the table value of F at 5% level of significance. If calculated value exceeds the table value, the affect is considered to be significant. The significance was tested at 5% level.

RESULTS AND DISCUSSION

Total soluble solids (⁰Brix)

Mean values of total soluble of candies stored for 60 days are presented in *Table 2*, & results are depicted in *Fig. 2*.

The candy T3 had maximum amount of total soluble solids (TSS) i.e., 84.52 ^oBrix.

On storage, maximum TSS (84.52 ^oBrix) was found in 60 days followed by 40 days 83.56 (^oBrix). The storage could induce a significant increase in TSS content of all the candies.

The total soluble solids (TSS) content was found to be 3.8 ^oBrix in fresh peel. However, the average TSS content of the processed candies during storage were varied from 81.00 ^oBrix to 84.52 ^oBrix. With the above data it was clear that the processing employed for preparation of candy had forced out the water content to place to the soluble solids in terms of sugar. The reports by **Bhat** *et al.*, (1982) with the aonla candy also showed increasing TSS content of the fruit.

In all the 3 treatments of present investigation, TSS content of the candies followed a consistently increasing trend as the storage was increased. Similar results were reported by **Baramanary** *et al*, (1995) for guava nectar.

Table 2.Effect of storage period on the total	l soluble solid
(TSS) in ⁰ Brix of candies	

Treatment	0 Day	20 Days	40 days	60 Days
T ₁	79.60	81.20	83.09	84.04
T ₂	80.20	81.35	83.11	83.62
T ₃	81.30	81.92	83.66	84.52
F. Value	S	S	S	S
SEM±	-	0.005	0.00235	0.0016
CD at 5%		0.01345	0.00634	0.0044

 $T_1 = Orange, T_2 = Lemon, T_3 = Moshmi$



Fig. 2: Effect of storage period on the total soluble solid (TSS) in ^oBrix of candies

REDUCING SUGAR (%)

Table 3 & Fig 3 shows the reducing sugar content of different candies during storage. The reducing sugar varied from 42.93 to 41.19 in the fresh candy. There was a significant variation in reducing sugar content of the candies during storage. The candy T_2 was found to contain maximum reducing sugar (42.93%), followed by T_3 (42.54%) where as candy T_1 was found to retain minimum amount of reducing sugar i.e; 4.1.09%.

It was evident from the *Tabe 3* that there was gradual and significant increase in reducing sugar content throughout storage period. At 60 days after storage the reducing sugar range from 55.41% to 52.18%. The maximum (55.41%) was found in T_2 followed by T_3 while minimum sugar content was found in T_1 (52.18%).

The increase in reducing sugar might be due to breakdown of polysaccharide into oligosaccharides and monosaccharides.

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0 Day	20 Day	40 Day	60 Day
41.09	44.87	48.21	52.18
42.93	46.57	50.89	55.41
42.54	45.09	50.27	55.03
S	S	S	S
0.187	0.132	0.136	0.160
0.389	0.275	0.283	0.334
	0 Day 41.09 42.93 42.54 S 0.187 0.389	0 Day 20 Day 41.09 44.87 42.93 46.57 42.54 45.09 S S 0.187 0.132 0.389 0.275	0 Day 20 Day 40 Day 41.09 44.87 48.21 42.93 46.57 50.89 42.54 45.09 50.27 S S S 0.187 0.132 0.136 0.389 0.275 0.283

 Table 3: Effect of storage period on reducing sugar of candies

 $T_1 = Orange, T_2 = Lemon, T_3 = Moshmi$



Fig. 3: Effect of storage period on reducing sugar of candies

Texture

Mean score for texture of the candies are given in *table 4*. and depicted in *fig: 4*.

The data showed that candy T_2 rated best in texture with the maximum score of the (8.83) followed by the candy T_3 (7.8). The texture of candies during storage was decreased and it might be due to some moisture ingress in product. *Table 4. Effect of storage period on texture of candies*

Treatments	0 Day	20 Day	40 Day	60 Day
T ₁	7.26	7.73	8.26	7.70
T ₂	8.83	8.96	8.76	8.50
T ₃	7.80	7.76	8.26	8.03
F. value	S	S	S	S
SEM±	0.151	0.11	0.10	0.13
CD at 5% value	0.31	0.24	0.20	0.27



Fig. 4. Effect of storage period on texture of candies

Flavor

The Organoleptic scores for flavor are given in *table 5*. and graphically shown in *fig.5*. The maximum score was obtained in T_2 i.e; 8.90 followed by T_1 i.e; 8.46 at 40 days after storage. Slight decline was noted at 60 days after storage, except T_2 i.e; 8.96. During storage flavor decreased & it might be due to some oxidative and some physico-chemical changes during storage & also it is a sensory attribute it depends on human perception.

Treatments	0 Day	20 day	40 Day	60 Day		
T ₁	7.48	8.33	8.46	7.83		
T ₂	8.83	8.85	8.90	8.96		
T ₃	7.56	7.90	8.09	8.06		
F. value	S	S	S	S		
SEM±	0.15	0.13	0.13	0.31		
CD at 5% value	0.31	0.27	0.28	0.27		

Table 5. Effect of storage period on flavor of candies

 $T_1 = Orange, T_2 = Lemon, T_3 = Moshmi$



Fig.5. Effect of storage period on flavor of candies

Taste

The mean organoleptic score for taste is given in *table 6*. and graphically shown in *fig. 6*. Maximum score was obtained for T_2 (8.90) followed by T_3 i.e. 8.66 at 40 days after storage. However maximum score was still associated with T_2 i.e.; 8.96 at 60 days after storage. During storage there was a decreasing trend in taste of candies.

Table 6. Effect of storage period	on taste of	candies
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Treatments	0 Day	20 Day	40 Day	60 Day
T ₁	7.26	7.90	8.13	7.90
T ₂	8.46	8.80	8.90	8.96
T ₃	7.90	8.43	8.66	8.40
F. value	S	S	S	S
SEM±	0.13	0.12	0.07	0.12
CD at 5% value	0.28	0.26	0.16	0.26

 $T_1 = Orange, T_2 = Lemon, T_3 = Moshmi$



Fig. 6. Effect of storage period on taste of candies

OVERALLACCEPTABILITY

Mean score of overall acceptability of the candies is presented in *table 7*. and *fig 7*. It was obvious from data that the overall acceptability was significantly influenced by the panel of judge. In general the overall acceptability improved gradually with the storage period in all the candies upto 40 days after storage. There was a slight decline in score in 40 days after storage. The candy T_2 was rated as best for overall acceptability. There was a slight decline in score at 60 days after storage. T_2 was attributed to overall higher corresponding values of taste, flavour, texture etc.

However the organoleptic characters showed a gradual increase during the storage period upto 60 days. This finding was in conformity with guava cheese upto 60 days of storage and decreased thereafter, similar trend was also reported in Jamun jelly and beverage in Bael.

Table 7.Effect of storage period on overall acceptability of candies

Treatments 0 Day		20 Day	40 Day	60 Day	
T ₁	7.21	7.43	7.63	8.26	
T ₂	7.81	8.32	8.63	8.48	
T ₃	8.73	8.82	8.90	8.46	
F. value	S	S	S	S	
SEM±	0.09	0.10	0.10	0.10	
CD at 5% value	0.18	0.21	0.22	0.21	

 $T_1 = Orange, T_2 = Lemon, T_3 = Moshmi$



Fig. 7. Effect of storage period on overall acceptability of candies

CONCLUSION

In this study candies were prepared from peels of citrus such as orange, mausambi and lemon. On the basis of study conducted it can be concluded that the sensory attributes of the candy with lemon peel received the highest scores in Organoleptic evaluation and the same candy was also found best in chemical characteristics, Total Soluble Solid, 83.62 (⁰Brix), Ascorbic acid, 4.51 (mg/100g), Reducing sugar, 55.41(%). Candies can be prepared from peels of citrus. Thus value added product can be developed out of the citrus waste. Citrus peel candies can be stored for 60 days with good retention of Organoleptic quality.

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Marketing Supply Chain Management of Brinjal: Challenges and opportunities

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ABSTRACT

The study was carried out in Allahabad district, India from November, 2011 to March, 2012 to examine the existing four marketing supply chains (SC₁: Producer - Consumer; SC₂: Producer - Retailer - Consumer; SC₃: Producer - Commission agent - Retailer - Consumer and SC4: Producer - Commission agent - Wholesaler - Retailer - Consumer) for brinjal. The marketing supply chains had significant effect on net marketing price of producer, net profit of producer, total marketing cost, total marketing loss, total net marketing margin, marketing efficiency, producer share in consumer price and consumer purchase price for brinjal. The net price of producer, net profit of producer, marketing efficiency and producer share in consumer price were significantly higher in marketing supply chain SC, followed by SC, SC, and SC₄. The total marketing cost, total marketing loss, total net marketing margin and consumer purchase price for brinjal were significantly lower in marketing supply chain SC1, followed by SC2, SC3 and SC4. The standardized beta coefficient indicate that commission charges for marketing of brinjal was most dominant factor which influenced the marketing cost. The results revealed that net profit of producer, marketing efficiency and producer share in consumer price decreased significantly as well as marketing cost, marketing loss, marketing margin and consumer purchase price increased significantly with the increase of number of intermediaries in marketing supply chain. The most challenging issues in existing marketing supply chains for fresh vegetables in Allahabad district are high marketing cost, high marketing loss, low net profit of producer and low marketing efficiency caused due to high number of intermediaries, poor logistics, lack of coordination between chain partners and poor linkage of producer to potential market. In order to improve socio - economic condition of small and marginal farmers / producers and provide competitive price to consumer in Allahabad district, it is feasible to introduce cooperative marketing supply chain as well as to improve transportation, storage and marketing facilities and provide accurate marketing information, technical knowledge and financial support to producers and intermediaries.

Keywords: Supply chain, marketing cost, marketing loss, marketing margin, marketing efficiency, brinjal

INTRODUCTION

India is the second largest producer of fruits and vegetables in the world. India's production of fruits and vegetables currently stands at 64 million tons and 126 million tons respectively, making up for around 12% of fruits and 14% of vegetables world production. The major fruits and vegetables export from India are mango, guava, onion, potatoes, okra, bitter gourd and green chillies. Uttar Pradesh (U.P.) in India is fifth largest and most populous state, located in the North Western part of the country. The share of U.P. in total horticultural production of the country is 26%, second largest in the country after West Bengal. The major vegetables grown in Uttar Pradesh are peas, chillies, okra, tomato, brinjal, cauliflower, cabbage, spinach, melon, radish, carrot, turnip and cucurbits.Fruits and Vegetables are highly perishable and cannot be stored for long periodswithout proper

arrangement of post harvest facilities. The trading of fresh vegetables and fruits is very complicated due to its high perishability and therefore, it is a great challenge for the producers, supplier, processers, exporters and traders to maintain the desirable quality for domestic consumption and export. Apart from perishable nature of fruits and vegetables, the desired quality assurance, competitive global environment, stringent quality standards, etc. add to the vulnerability and complexity of business. The State Government of Uttar Pradesh has brought forward various schemes and policies in order to facilitate the production and marketing of horticultural crops. However, even after measures taken by the State Government, the economic condition of majority of the marginal and small-scale farmers has not improved significantly due to poor unevolved marketing systems, large numbers of intermediaries in supply

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chain, poor logistics and storage facilities, lack of food processing industries, inconsistency and high fluctuation in price, etc. In the present scenario, the farmer is most exploited due to lack of proper marketing supply chain system and linkage between farmer to potential market (**Berdegue** *et al.* **2008; Cavatassi** *et al.* **2009**).

Supply chain management is a wide business process encompassing planning, implementing and controlling the operations of the supply chain which aims at providing the consumers with desirable goods and commodities. Supply chain management includes movement and storage of raw materials, inventory and finished goods from producers to consumers. Supply chain management can be explained as the flow of plans, materials and services from the supplier to the consumer including the close cooperation between the various entities in supply chain. An efficient supply chain management contributes to improve efficiency in production, value additions, storage, transportation and marketing which in turn maximize the profitability of the chain partners and minimize the cost for consumers. The major issues in existing marketing supply chain of fresh vegetables in India and Uttar Pradesh are low marketing efficiency, low producer's share in consumer price and high consumer purchase price. The marketing cost, marketing loss and marketing efficiency of fresh vegetable in India is largely affected by the poor infrastructure and lack of linkages between producer and intermediaries in the supply chain. The marketing efficiency of fresh vegetables is also affected by the substantial amount of wastage, deterioration in quality, mismatch in supply and demand and fluctuation in price. High perishability, seasonal in nature and bulkiness make the marketing of fresh vegetables extremely complex Anil and Arora (1999); Gupta and Rathore, (1999); More (1999); Begum and Raha (2002); Sudha et al., (2002); Murthy et al., (2002); Singh and Chauhan (2004); Bala (2006); Lu (2006); Murthy et al., (2007); Rupali and Gyan (2010); Barakade et al. (2011).

The brinjal is an economically and fourth most important vegetable grown in India. The brinjal crop is primarily grown by small and marginal farmers in Uttar Pradesh. The brinjal is an important source of income for marginal and small scale farmers. Approximately 1.4 million small scale farmers in India grow brinjal crop, which provide them regular income **Chaudhary and Gaur (2009)**. The major producing state in India for brinjal are West Bengal, Orissa, Andhra Pradesh, Gujrat, Bihar, Madhya Pradesh, Maharashtra, Chhattisgarh, Karnataka, Haryana, Jharkhand, Assam, Tamil Nadu and Uttar Pradesh. The marketing supply chain for brinjal in Uttar Pradesh involves large number of intermediaries which results in high marketing cost, high marketing loss, low marketing efficiency, low producers share in consumer price and high consumer price **Chauhan** *et al.* (1998); Ladaniya *et al.* (2005); Pawar and Pawar (2005); Talathi et al. (2005); Zulfiqar et al. (2005); Murthy et al. (2007); Gangwar et al. (2007); Sidhu et al. (2010); Emam (2011); Pandey et al. (2011). Inspite of economic importance of brinjal production in Allahabad district, Uttar Pradesh, little information is available on marketing supply chain management. Therefore the objectives of the study were to evaluate existing marketing supply chains of brinjal in relation to producer net marketing price, net profit of producer, marketing cost, marketing loss, marketing margin, marketing efficiency, producer share in consumer price and consumer purchase price in order to identify major constraints and opportunities to develop efficient marketing system.

MATERIALS AND METHODS

The study was conducted in Allahabad district (25.45°N, 81.84°E, 98 m above mean sea level), Uttar Pradesh, India during November, 2011 to March, 2012 to examine the existing marketing supply chains for brinjal. The marketing supply chain of brinjal consist of various intermediaries such as commission agents, wholesalers and retailers who move the fresh produce from producer / farmer to consumer. The following marketing supply chains were analysed in the present study because these are commonly used supply chain for brinjal in Allahabad district, India.

- SC_1 : Producer \rightarrow Consumer
- SC_2 : Producer \rightarrow Retailer \rightarrow Consumer
- SC_3 : Producer \rightarrow Commission Agent \rightarrow Retailer \rightarrow Consumer
- SC_4 : Producer \rightarrow Commission Agent \rightarrow Wholesaler \rightarrow Retailer \rightarrow Consumer

The primary data for evaluation of four marketing supply chains of brinjal in relation to transportation, packaging and marketing costs, spoilage during transportation and marketing, loading, unloading and commission charges, cleaning, washing and grading charges, sale price, problems faced and expectations of producers, commission agents, wholesalers, retailers and consumers were collected by using well structured questionnaires. During the survey ten producers, ten commission agents, ten wholesalers, ten retailers and twenty consumers for each marketing supply chain were interviewed and data were collected.

The producer net marketing price (NMPP), net profit of producer (NPP), net marketing margin of wholesaler (NMMW), net marketing margin of retailer (NMMr), total net marketing margin (TNMM), total marketing cost (TMC), total marketing loss (TML), marketing efficiency (ME) as estimated by **Shepherd (1965)**, **Murthy** *et al.* (2007) and **Acharya and Agarwal (2011)** and producer share in consumer price (PSCP) for four marketing supply chains of brinjal were estimated by the following methods :(8)

$$NMP_{p} = GMP_{p} - [MC_{p} + PL_{p} \times GMP_{p}] \qquad \dots (1)$$
$$NP_{n} = GMP_{n} - (CP + MC_{n} + PL_{n} \times GMP_{n}) \qquad \dots (2)$$

$$NMM_{w} = SP_{w} - PP_{w} - (MC_{w} + PL_{w} \times PP_{w}) \qquad(3)$$

$$NMM_{r} = SP_{r} - PP_{r} - (MC_{r} + PL_{r} \times PP_{r}) \qquad \dots (4)$$

$$TNMM = NMM_{w} + NMM_{r} \qquad \dots (5)$$

 $TMC = MC_{p} + MC_{w} + MC_{r} \qquad \dots (6)$

$$TML = (PL_{p} \times GMP_{p}) + (PL_{w} \times PP_{w}) + (PL_{r} \times PP_{r}) \qquad \dots (7)$$

Shepherd, 1965 : ME = $\frac{CP}{TMC - 1}$

Murthy *et al.*,2007: ME =
$$\frac{\text{NMP}_{\text{p}}}{\text{TNMM} + \text{TMC} + \text{TML}} \qquad \dots (9)$$

Acharya and Agarwal, 2011 ME =
$$\frac{\text{NMP}_{p}}{\text{TNMM} + \text{TMC}}$$
 ...(10)

$$PSCP = \frac{NMP_{p}}{C_{p}} \quad x100 \qquad \dots (11)$$

Where,

 $NMP_p =$ net marketing price received by producer (Rs/kg); GMP_{p} = gross marketing price received by producer (Rs/kg); MC_{p} = marketing cost of producer for transportation, packaging, loading, unloading and commission (Rs/kg); PL_n = physical loss of brinjal by producer during transportation and marketing (kg/kg); NP = net profit of producer (Rs/kg), $CP = cost of production (Rs/kg); NMM_{...} = net marketing$ margin of wholesaler (Rs/Kg); SP_w = wholesaler sale price (Rs/kg); $PP_w =$ purchase price of the wholesaler (Rs/kg); MC_w = marketing cost of wholesaler for transportation, packaging, loading, unloading, commission, rent, electricity and labour (Rs/kg); $PL_w = physical loss of brinjal by wholesaler during$ transportation and marketing(kg / kg); NMM_r = net marketing margin of retailer (Rs/Kg); SP_r = retailer sale price (Rs/kg); $PP_r =$ purchase price of retailer (Rs/kg); MCr= marketing cost of retailer for transportation, packaging, loading, unloading, commission, rent, electricity and labour (Rs/kg); PL_r = physical loss of brinjal by retailer during transportation and marketing (Kg/kg); TNMM = total net marketing margin (Rs/kg); TMC = total marketing Cost (Rs/kg); TML= total marketing loss (Rs/kg); ME = marketing efficiency; Cp = consumer price (Rs/kg) and PSCP = producer share in consumer price (%).

The descriptive statistics, analysis of variance, post hoc tests for multiple comparisons of means and multiple regression were used to analyse the data. The analysis was performed with SPSS version 20.

RESULTS AND DISCUSSION

Gross marketing price, net marketing price and net profit of producer and consumer price between different marketing supply chains SC_1 (Producer - Consumer), SC_2 (Producer -Retailer - Consumer), SC_3 (Producer - Commission agent - Retailer - Consumer) and SC₄(Producer - Commission agent -Wholesaler - Retailer - Consumer) were highly significant. The gross marketing price of producer (Rs. 8.00 / Kg), net marketing price of producer (Rs. 7.35 / Kg) and net profit of producer (Rs. 5.21/Kg) were significantly higher in marketing supply chain SC₁, followed by SC₂, SC₃ and SC₄ due to involvement of commission agent, retailer and wholesaler in trading of brinjal. The consumer purchase price for brinjal was significantly minimum in marketing supply chain SC1 (Rs. 8.00 / Kg), because consumer purchased the brinjal directly from producer / farmer in local market. The consumer purchase price for brinjal increased significantly in marketing supply SC_2 , SC_2 , SC_4 due to the involvement of intermediaries fortrading of brinjal. Furthermore, the consumer purchase price was significantly higher in marketing supply chain SC (Rs. 10.80 / Kg) compared with SC₁, SC₂, SC₃, because in marketing supply chain SC4 maximum number of intermediaries such as commission agent, wholesaler and retailer were involved in marketing of brinjal (Table 1).

Table 1.Gross marketing price, net marketing price and net profit of producer and consumer purchase price of brinjal in different marketing supply chains

Marketing supply chains	Gross marketing price of producer (GMP _p) Rs/kg	Net marketing price of producer (NMP _p) Rs/kg	Net profit of producer (NP _p) Rs/kg	Consumer purchase price (C _p) Rs/kg
SC ₁	8.00 ^a	7.35ª	5.21ª	8.00 ^a
SC_2	6.75 ^b	6.14 ^b	4.00 ^b	10.00 ^b
SC ₃	5.95°	4.57°	2.43°	10.00 ^b
SC ₄	5.25 ^d	4.16 ^d	2.02 ^d	10.80°

Values followed by same letter in superscript have no significant difference (p < 0.05)

The overall results revealed that gross marketing price of producer (15.6 to 34.4%), net marketing price of producer (16.5 to 43.4%) and net profit of producer (23.2 to 61.2%)decreased as well as purchase price of consumer (25 to 35%) increased considerably with the increase in number of intermediaries in marketing supply chain of brinjal. In Allahabad as well as in Uttar Pradesh, major portion of fresh vegetables including brinjal are sold through marketing supply chain SC₂, SC₃ and SC₄. In order to improve net profit of producer / farmer and provide competitive price to consumer for brinjal, it is necessary to reduce number of intermediaries in marketing supply chain by introducing cooperative marketing supply chain which does not exist in Allahabad district as well as strengthening local / village market for direct sale of fresh vegetables particularly brinjal by producer to consumer. Similar results were reported by many researchers for wide variety of vegetables / fruits and marketing supply chains Chauhan et al. (1998); Radha and

Prasad (2001); Pawar and Pawar (2005); Murthy *et al.* (2007); Sidhu *et al.* (2010); Hena and Soni (2013).

Total marketing cost, total marketing loss and total net marketing marginbetween marketing supply chain SC, (Producer - Consumer), SC₂(Producer - Retailer - Consumer), SC₃(Producer - Commission agent - Retailer - Consumer) and SC (Producer - Commission agent - Wholesaler - Retailer -Consumer) were highly significant. The total marketing cost, which includes the expenses for transportation, commission packaging, loading, unloading, rent, electricity and labour was significantly lower in marketing supply chain SC₁ (Rs. 0.42 / kg) and it increased significantly in marketing supply chain SC₂ (Rs. 1.64 / Kg), SC₂ (Rs. 2.56 / Kg) and SC₄ (Rs. 3.07 /Kg). The total marketing cost which includes the marketing cost of producer and intermediaries increased considerably with the increase in number of intermediaries in marketing supply chain. The number of intermediaries in marketing supply chain SC₁, SC₂, SC₃ and SC₄ were 0, 1, 2 and 3 respectively (Table 2). The total marketing loss, which includes physical loss during transportation, loading, unloading and marketing by producer, wholesaler and retailer was significantly minimum in marketing supply chain SC, (Rs. 0.23 / Kg) and it increased significantly in marketing supply chain SC₂ (Rs. 0.56 / Kg), SC₃ (Rs. 0.74 / Kg) and SC₄ (Rs. 0.85 / Kg). This is due to fact that the total marketing loss of brinjal increased considerably with increase in number of intermediaries in marketing supply chain, because producer, wholesaler, retailer perform the transportation and marketing process separately (Table 2). The total net marketing margin, which includes net marketing margin of wholesaler and retailer, was significantly higher in marketing supply chain SC, because both wholesaler and retailer were involved in marketing of brinjal (Rs. 2.72/kg). However, no significant difference in net marketing margin between marketing supply chain SC₂ and SC₃ was found because in these supply chains only retailer was involved in marketing of brinjal (Table 2).

Table 2.Marketing cost, marketing loss and net marketing margin of brinjal in different marketing supply chains

Marketing supply chains	Total marketing cost (TMC)	Total marketing loss (TML)	Total net marketing margin (TNMM)
	Rs/kg	Rs/kg	Rs/kg
SC ₁	0.42ª	0.23ª	0.00ª
SC ₂	1.64 ^b	0.56 ^b	1.66 ^b
SC ₃	2.56°	0.74°	2.14°
SC_4	3.07 ^d	0.85 ^d	2.72 ^d

Values followed by same letter in superscript have no significant difference (p < 0.05)

The packaging, Transportation, loading, unloading, commission, rent, electricity and labour expenses had significant effect on marketing cost of brinjal. The multiple regression analysis for standardized Beta co-efficient indicate that commission charges (0.388) paid by producer and wholesaler / retailer to commission agent was the most dominant factor, which influenced the marketing cost of brinjal, followed by transportation (0.286), rent, electricity, labour (0.265), packaging (0.082), loading and unloading (0.075) charges. The results clearly revealed that in order to reduce the marketing cost of brinjal, it is necessary to minimize expenses for transportation, commission, packaging, loading, unloading, rent, electricity and labour by providing appropriate and effective logistic system to producer and intermediaries (*Table 3*).

Table 3.Multiple regression results to explain the effect of logistics on marketing cost of brinjal in different marketing supply chains

Mo	del	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		В	Std.	Beta		
			Error			
1	(Constant)	006	.012		499	.621
	Packaging	1.027	.069	.082	14.827	.000
	Transportation	.991	.026	.286	37.853	.000
	Loading and	1.052	.094	.075	11.216	.000
	Unloading					
	Commission	1.004	.014	.388	72.438	.000
	Charges					
	Rent, Electricity	.986	.027	.265	36.634	.000
	and Labour					

a Dependent variable: Marketing cost

The overall results revealed that marketing cost, marketing loss and marketing margin increased significantly (p < 0.05) with the increase in number of intermediaries in marketing supply chain, which in turn significantly reduced the net profit of producer as well as increased the consumer purchase price for brinjal. The results further revealed that transportation cost, commission charges and rent, electricity and labour expenses were the important factors, which influenced the marketing cost of brinjal. The lack of appropriate and efficient transportation, storage, grading, packaging, marketing facilities, mismatch between supply and demand as well as poor coordination between producer and intermediaries resulted in high marketing cost and high marketing loss of brinjal. The similar results were reported by many researches for fresh vegetables and fruits under wide range of marketing supply chains Sudha et al. (2002); Zulfigar et al. (2005); Murthy et al. (2007); Gangwar et al.

(2007); Sidhu et al. (2010); Pandey et al. (2011); Hena and Soni (2013).

The marketing supply chains had significant effect on marketing efficiency and producer share in consumer price for brinjal. The marketing efficiency estimated by Shepherd (1965), Murthy et al. (2007) and Acharya and Agarwal (2011) were significantly higher (p < 0.05) in marketing supply chain SC₁ (Producer - Consumer), followed by SC₂ (Producer -Retailer - Consumer), SC₃ (Producer - Commission agent -Retailer - Consumer) and SC (Producer - Commission agent -Wholesaler - Retailer - Consumer). The results revealed that marketing efficiency of brinjal decreased significantly with the increase in number of intermediaries in marketing supply chains. This is due to fact that marketing cost, marketing loss, marketing margin and consumer purchase price increased significantly as well as net marketing price of producer decreased significantly with increase in number of intermediaries in marketing supply chains, which in turn decreased the marketing efficiency of brinjal (Table 4). The producer share in consumer price for brinjal was significantly higher (p < 0.05) in marketing supply chain SC, (91.85%) due to significantly higher net marketing price of producer and lower consumer purchase price, followed by marketing supply chain SC₂ (61.42%), SC₃ (45.65%) and SC₄ (38.54%). The results revealed that producer share in consumer price decreased significantly (91.85% to 38.54%) with increase in number of intermediaries (0 to 3) in marketing supply chain due to significant decrease in net marketing price of producer (Table 4).

Table 4.Marketing efficiency and producer share in consumer price for brinjal in different marketing supply chains

Marketing efficiency

Marketing	Shepherd	Murthy et al.	Acharya and	Producer
supply	(1965)	(2007)	Agarwal (2011)	share in
chains				consumer
				price, %
SC ₁	18.22ª	11.31ª	17.67ª	91.85ª
SC ₂	5.12 ^b	1.60 ^b	1.88 ^b	61.42 ^b
SC ₃	2.90°	0.84 ^c	0.97 ^c	45.65°
SC ₄	2.52°	0.63°	0.72°	38.54 ^d

Values followed by same letter in superscript have no significant difference (p < 0.05)

The overall results revealed that marketing efficiency and producer share in consumer price decreased significantly as the number of intermediaries increases in marketing supply chain due significant increase in marketing cost, marketing loss, marketing margin and consumer purchase price as well as significant decrease in net marketing price of producer and net profit of producer. The results clearly indicate that marketing supply chain SC₁ was most efficient in terms of marketing efficiency and producer share in consumer price because no intermediarywas involved in trading of brinjal. Therefore, in order to improve the marketing efficiency and producer share in consumer price, it is necessary to reduce the number of intermediaries in marketing supply chain as well as to reduce marketing cost and marketing loss by providing appropriate and efficient logistic and marketing facilities to supply chain partners.Similar results were reported by many researches for wide varieties of fresh vegetables/ fruitsand marketing supply chains Ladaniya *et al.* (2005); Murthy *et al.* (2007); Gangwar *et al.* (2007); Emam (2011); Pandey *et al.* (2011); Gaurav (2011); Hena and Soni (2013).

CONCLUSIONS

The present study evaluated four existing marketing supply chains in relation to marketing cost, marketing loss, net marketing price of producer, net profit of producer, net marketing margin of intermediaries, marketing efficiency, consumer purchase price and producer share in consumer price, in order to develop policies and strategies for efficient marketing system for brinjal in Allahabad district, India. The net marketing price of producer, net profit of producer, marketing efficiency and producer share in consumer price for brinjal decreased significantly with the increase in number of intermediaries in marketing supply chain. Furthermore, the marketing cost, marketing loss, net marketing margin and consumer purchase price increased significantly with increase in number of intermediaries in marketing supply chain. The marketing cost was most important factor which influenced the marketing efficiency and producer share in consumer price. The commission paid by producer and retailer / wholesaler was the most dominant factor influencing marketing cost.

In order to improve net profit of producer and provide competitive price to consumer, it is necessary to reduce number of intermediaries in marketing supply chain which can be achieved by forming cooperative marketing supply chain system for brinjal. The cooperative marketing supply chain may be helpful to improve marketing efficiency and producer share in consumer price. To improve marketing efficiency and net profit of producer and to provide good quality and competitive price to consumer under existing marketing supply chain system, where large number of intermediaries are involved for marketing of brinjal in Allahabad district, it is important to provide accurate market information regarding supply and demand, proper grading, storage, packaging, transportation, credit and insurance facilitiesto producer, retailer and wholesaler.

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Development and Quality evaluation of Chick - Pea Flour based cookies

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ABSTRACT

The main aim of the study of this project was optimal incorporation of chick- pea flour in refined wheat flour cookie formulation with respect to sensory evaluation, quality and nutritional density. The flour was obtained from the local market of Allahabad, subsequent to which a mixture design involving incorporation of chick-pea flour into refined wheat flour was used. Experimentation and Sensory evaluation led to a result indicating that a ratio of 80% refined wheat flour & 20% chick-pea flour was optimal incorporation. The resultant product had a moisture content of 3.54%, 3.62%, 3.70%, 3.98% and 4.35% on the initial day, 15th day, 30th day, 45th day and 60th day of evaluation respectively. Protein content was found to be 5.78%, 5.10%, 4.78%, 4.03% and 3.90% on the initial day 15 day, 30 day, 45 day and 60 day of evaluation respectively.

Study on the shelf life of the product was done in packaging material LDPE : The critical evaluation of 5 results revealed that LDPE is a best barrier of moisture, air & microbes at refrigeration temperature thereby positively affecting shelf life.

Keywords: Chick- pea flour, refined wheat flour, optimal incorporation, LDPE, shelf life.

INTRODUCTION

The demand of bakery products is increasing day by day. India is a developing country with large segment of population depending on wheat as staple food and 25% of wheat is used in the preparation of baked foods.

Development of fortified cookies or other composite flour bakery products is the latest trend in bakery industry. The growing interest in these types of bakery products is due to their better nutritional properties and possibility of their use in feeding programs and in catastrophic situations such as earthquakes, floods etc.

The incorporation of chick-pea flour in the bread increases the fiber content of cookies, whose concentration is helpful in easy digestion and high fiber food is good for health of patients of high blood pressure, cholesterol and diabetes. The presence of chick-pea reduces systolic blood pressure and improves lipid profile beyond effects of weight loss in men and women. Keeping this in mind, this project "Development and Quality evaluation of Chick-pea flour based cookies" was undertaken with the following objectives:

- 1.1.1 To develop chick-pea flour based cookies.
- 1.1.2 To study the physico-chemical properties of developed cookies.
- 1.1.3 To study the shelf life of developed cookies by using LDPE as packaging material.

MATERIALS AND METHODS

The present work of dissertation entitled "Development and Quality evaluation of Chick-Pea flour based cookies" was undertaken in the laboratory at Department of Food Process Engineering. Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad.

Procurement of Ingredients : Flours sample and other ingredients were obtained from the local market of Allahabad.

Formulation of fortified cookies : The proportion of the ingredients used are mentioned in *Table 1*.

Sample	Chick pea flour	Wheat flour
T ₀	-	100
T ₁	5	95
T ₂	10	90
T ₃	15	85
T ₄	20	80
T ₅	25	75
T ₆	30	70
T ₇	35	65

Table : Composition of Trial Cookies (%)

Development of Cookies : As shown in Figure /all the ingredients needed for development of cookies were taken and they were prepared using Rice Bran Oil as a shortner

M.Tech. Student, *Professor and Head Department of Food Process Engineering, SHIATS, Allahabad-211007, U.P. Analysis of Cookies : The cookies were analyzed for moisture, protein, fat and ash content according to the method described in AOAC (1990).

Sensory Evaluation : The cookies were evaluated by a panel of judges for taste, colour, texture, flavor and overall acceptability at 0, 15, 30, 45 and 60 days interval of storage according to the procedure described in **Rangana (1994)**

Statistical Analysis : Data of physico - chemical properties were subjected to analysis of variance and significant difference at 5% level.

Figure I: Flowchart for preparation of cookies



RESULTS AND DISCUSSION

Sensory evaluation of developed cookies

The sensory evaluation is a very important criterion of the food industry. Cookies were prepared from wheat flour incorporated with chick- pea flour in different proportion (i.e. 0%, 5%, 10%, 15%, 20%, 25%, 30% and 35%). The sensory evaluation was done for colour, taste, texture and overall acceptability of cookies. Treatments had significant effect on taste and overall acceptability of cookies.

Protein Content (%) On critical evaluation of results it was found that protein content of the cookies was considerably increased. Maximum protein content was found in sample T_s .

Figure II Effect of storage on Color of cookies



Figure III Effect of storage on Taste of cookies



Figure IV Effect of storage on Flavor of cookies



Figure V Effect of storage on Overall Acceptability of cookies



As shown in *figure (2), figure (3), figure (4)* and *figure (5)* sample T_4 obtained the maximum score and sample T_7 obtained minimum scores.

Moisture (%) Moisture content of bread packed in LDPE increases considerably with increase in storage period. Increase in moisture content of cookie samples can be attributed to the hygroscopic nature of the flour and relative humidity during the storage period. The overall results clearly revealed that protein content of cookies packed in LDPE decreases considerably with the increase in storage period which can be explained by the action of proteolytic enzymes on protein throughout the period of storage.

Ash Content (%) On the evaluation of results, the maximum ash content was found in sample T_7 as oat is a good source of minerals like manganese, magnesium, phosphorous and copper and minimum ash content was found in sample To. The storage period slightly increased the ash content of bread with increase in storage period, probably because of a decrease in the moisture content of the bread. Similar results were observed by Pasha et al.

CONCLUSION

The sensory attributes such as taste, flavor, color, texture appearance, aroma and overall acceptability of cookies packed in LDPE varied considerably with the variation in content of chick pea flour and it decreased with the increase in the ambient storage period. Moreover the present study suggests that a combination of 20 % chick pea flour and 80% wheat flour can produce superior quality cookies.

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Development and Quality Analysis of Cardmom & Cinnamon Flavoured Oat Fortified Bread

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ABSTRACT

The main aim of the study of this project was optimal incorporation of oat flour in refined wheat flour bread formulation with respect to sensory quality and nutritional density. The flour was obtained from the local market of Allahabad, subsequent to which a mixture design involving incorporation of oat flour into refined wheat flour was used. Experimentation and Sensory evaluation led to a result indicating that a ratio of 80% refined wheat flour & 20% percent oat flour was optimal incorporation. The resultant product had a moisture content of 38.29%, 36.8%, 35.1% and 33.3% on the initial day, 2nd, 4th and 6th day of evaluation respectively. Protein content was found to be 12.57%, 12.51%, 12.49% and 12.47% on the initial day, 2nd, 4th and 6th day of evaluation respectively Study on the shelf life of the product was done in packaging material HDPE. The critical evaluation of results revealed that HDPE is a best barrier of moisture, air and microbes at refrigeration temperature below 7 degree Celsius thereby positively affecting shelf life.

Keywords: oat flour, refined wheat flour, optimal and HDPE, shelf life.

INTRODUCTION

The demand of bakery products is increasing day by day. India is a developing country with large segment of population depending on wheat as staple food and 25% of wheat is used in the preparation of baked foods.

Bread is staple food prepared by baking dough of flour and water. It may be leavened or unleavened. Salt, fat and leavening agents such as yeast and baking soda are common ingredients, though bread may contain a range of other ingredients like milk, egg, sugar, spice, fruit (such as raisins), vegetables (such as onion), nuts (such as walnut) or seeds (such as poppy seeds). It is fast and convenient food based on wheat. There are many varieties of bread depending on the local demand like whole flour bread, brown bread, bread fortified with vitamins and minerals, milk bread and bread for diabetic patients.

Oat Flour is used in baking; it is oftentimes combined with wheat or other gluten containing flours when making leavened bread. In many studies, eating whole grains, such as oats, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. The incorporation of oat flour in the bread increases the fiber content of bread, whose concentration is helpful in easy digestion and high fiber food is good for health of patients of high blood pressure, cholesterol and diabetes. The presence of oat reduces systolic blood pressure and improves lipid profile beyond effects of weight loss in men and women **Jacob and Morris**, (2001). Keeping this in mind, this project "Cardamom and Cinnamon flavored & fortified bread" was undertaken with the following objectives:

- 1.1.1 To prepare Cardamom and Cinnamon flavored & Oat fortified oread.
- 1.1.2 To evaluate the effect of oat flour incorporation on physico-chemical properties of bread.
- 1.1.3 To evaluate sensory characteristics of developed bread.

MATERIALS AND METHODS

The present work of dissertation entitled "Development and Quaity analysis of Cardamom & Cinnamon Flavoured Oat Fortified Bread" was undertaken in the laboratory at Department of Food Process Engineering, Sam Higginbottom Institute of Agriculture, Technology and Sciences.

Procurement of Ingredients: Flours sample and other ingredients were obtained from the local market of Allahabad.

Formulation of fortified bread : The proportion of the ingredients used are mentioned in *Table 1*.

Development of Bread : As shown in Figure /all the ingredients needed for development of bread were taken and Bread was prepared using flour, sugar, salt, water, yeast along with fats and emulsifier were mixed together to form a dough. The dough was kneaded till clean up stage and allowed to ferment for two and a half hours. Then the dough was divided into 100g Dough ball, moulded placed in a pan and kept in a proofer at 30 °C and 85% relative humidity for 60 minutes.

Product	Wheat	Oat	Cardamom	Cinnamon
	Flour	Flour		
А	100%	0%	0.5%	0.5%
В	90%	10%	0.5%	0.5%
С	80%	20%	0.5%	0.5%
D	70%	30%	0.5%	0.5%

Table 1 : Composition of Trial Breads

Analysis of Bread : The bread was analyzed for moisture, protein, fat and ash content according to the method described in AO AC (1990).

Sensory Evaluation : The bread was evaluated by a panel of judges for taste, colour, texture, flavor and overall acceptability at 0, 2, 4, 6 days interval of storage according to the procedure described in **Rangana (1994)**

Statistical Analysis : Data of physico - chemical properties were subjected to analysis of variance and significant difference at 5% level.

Figure - 1 : Flowchart for Preparation of Bread



RESULTS AND DISCUSSION

Sensory evaluation of fortified bread

The sensory evaluation is a very important criterion of the food industry. Bread was prepared from wheat flour incorporated with oat flour in different proportion (i.e. 0%, 10%, 20% and 30%) along with cardamom and cinnamon powder. The sensory evaluation was done for colour, taste, texture and overall acceptability of bread. Treatments had significant effect on taste and overall acceptability of bread.

As shown in *figure (2)*, *figure (3)*, *figure (4)* and *figure* obtained the maximum score and obtained minimum scores.













Figure V Effect of storage on Overall Acceptability



Moisture (%) Moisture content of bread packed in HDPE decreases considerably with increases in storage period which results in hardening of bread eventually with an increase in storage period. The observed loss of moisture during the storage period is due to water vapour losses through the packaging material.

Protein Content (%) On critical evaluation of results it was found that protein content of the bread was considerably increased as the proportion of oat flour is incorporated. Maximum protein content was found as in this sample protein rich oat flour was found in maximum proportion. The overall results clearly revealed that protein content of bread packed in HDPE decreases considerably with the increase in storage period which can be explained by the action of proteolytic enzymes on protein throughout the period of storage.

Ash Content (%) On the evaluation of results, the maximum ash content was found in sample D as oat is a good source of minerals like manganese, magnesium, phosphorous & copper and minimum ash content was found in sample A. The storage period slightly increased the ash content of bread with increase in storage period, probably because of a decrease in the moisture content of the bread. Similar results were observed by **Pasha** *et al.* (2002)

CONCLUSION

Incorporation of cardamom and Cinnamon with oat flour 20% in bread showed better physic-chemical properties as fat content, fiber content and ash content. The breads having oat flour incorporation. The cardamom and cinnamon incorporation in bread is also helpful as it changes the traditional taste of bread with flavor of cardamom & cinnamon.

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Development and Quality evaluation of Pineapple pomace and Wheat bran fortified biscuits

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ABSTRACT

In the present dissertation, experiments were carried out for the preparation of Pineapple pomace wheat bran fortified biscuits. The waste utilization of Pineapple pomace and wheat bran was the most important aspect of this study. Studies were conducted on incorporation of Pineapple pomace powder (*Ananas cosomus*) and wheat bran fortified biscuit and its shell life studies. Pineapple pomace powder and wheat bran was incorporated with wheat flour in different proportions $(T_0, T_1, T_2 \text{ and } T_3)$ Physico- chemical and sensory parameters of control and pineapple pomace fortified biscuit were analyzed after baking. During shelf life study it was observed that moisture content of control and treatment show slight increase or decrease from zero to 10 days but after 20, 30 and 40 days there was a increase in moisture content of control sample. The Protein content in experimental T_3 sample was also found to be maximum 8.38. The Fat content was decreased slightly in 10, 20, 30 and 40 days. Ash content in experimental T_0 was found minimum 1.74 percent in T_3 and maximum 3.60 percent. Fiber content in experimental T_0 was found minimum 1.35 percent, T_3 and maximum 2.69 percent. Among four treatments (T_0, T_1, T_2 and T_3), T_1 and T_2 was found satisfactory to store for a period of up to 30 and 40 days. So, apart from that pineapple pomace can be recommended to the patients those are suffering from heart diseases and other constipation problem.

Key words: Wheat bran, Fortification, Waste utilization, Pineapple pomace, low fat content, Quality evaluation.

INTRODUCTION

Bakery products have become more popular in India since the earlier times. Among the different bakery products, biscuits constitute the most popular group. Biscuits were first invented as a food. They could be kept for a long time because they are a dry food product. Biscuits are chemically leavened bakery products containing high percentage of fat and sugar Nelson's Navy (1980). Bran is one of the richest sources of dietary fiber. It is the outer husk of wheat, rice, and other cereal grains. At one time most bran was thrown out wheat grains were milled. Until the 1960 when scientist published several repos which stated that bran other types of fiber could prevent heart attacks, intestinal disorders, cancer of the breast, colon, prostate and uterus. Wheat bran when used properly in a high-fiber diet can help prevent intestinal disorders, also because it helps to prevent constipation bran may also benefit people suffering from hemorrhoids.

Pineapple (Ananas comosus), fruit is good source of carotene (vit. A) and ascorbic acid (vit. C) And is fairly rich in vitamin B and B12, it is also contain carbohydrate, protein, fat, fiber, calcium and iron. Pomace or marc is solid remains of grapes, olives or other fruit after pressing for juice or oil. It contains the skin pulp, seeds, and stems of the fruit. Pineapple

pomace is a primary by-product of the pineapple juice industry. It has been estimated that about 25 per cent of the fresh fruit is lost as pomace **Wang and Thomas (1989).**

After extraction of juice from pineapple pomace is obtained, this is waste material having good nutritive value. This pineapple pomace rich in dietary fiber it is also contain calcium, phosphorus and iron **Tivari and Pandey** (2007).

MATERIALS AND METHODS

The required materials to prepare the Pineapple pomace powder, low calorie sugar, wheat flour, wheat bran, water, edible oil, baking powder and packaging materials were procured from the local market of Allahabad. Tray dryer were used for drying of pineapple pomace powder. Drying was carried out at 70 to 100 C for 3 hours. To remove moisture from pineapple pomace up to desired moisture content to obtain uniform dry pomace. Sieving process with 40, 60 mesh sizes used to sieve the end product. Baking oven was used for baking the prepared fortified biscuit, baking were carried out at 165 C for 30 minutes. Four different sample ratio (T_0 , T_1 , T_2 and T_3). Pineapple pomace powder and wheat bran fortified biscuits was packed and sealed in Low density polyethylene (LDPE).

Master Student, *Assistant Professor Department of Food Process Engineering, Vaugh School of Agriculture Engineering and Technology, SHIATS, Allahabad - 211007 (U.P.) Preparation of Pineapple pomace powder and wheat bran fortified biscuits:

Biscuit were prepared by the standard method given by Sambhal Metz for the preparation of Biscuit. Pineapple pomace powder and wheat bran percentage were 05, 10 and 15% as given.

Sample used for preparation of Pineapple pomace powder and wheat bran fortified biscuits.

Sample	Wheat	Pineapple	Wheat
	flour %	pomace powder %	bran %
T ₀	100		
T ₁	90	05	05
T ₂	80	10	10
T ₃	70	15	15

 T_0 (100% commercial straight grade flour) acts as control, Biscuits with 0% Pineapple pomace powder and wheat bran.

 T_1 = Biscuits with 05: 05% Pineapple pomace powder and wheat bran.

 T_2 = Biscuits with 10: 10% Pineapple pomace powder and wheat bran.

 T_3 = Biscuits with 15: 15% Pineapple pomace powder and wheat bran.

Analysis of Pineapple pomace powder and wheat bran fortified biscuits.

Physical analysis:

Pineapple pomace powder and wheat bran fortified Biscuits were analyzed for width, thickness, spread factor, volume and density by following the respective procedures **AACC**, (2000)

Diameter (D) : Six biscuits were placed horizontally (edge to edge) and rotated at 90° angle for reading. Measured by vernier caliper.

Thickness (T) : biscuits thickness was measured with a vernier caliper in triplicate. Means were recorded. Six cookies were measured one-by-one.

Spread ratio (SF) : It was calculated according to the following formula.

SF = D / T

Volume (V) : It was calculated according to the following formula.

 $V = D^2 X X T / 4$

Density (**D**) : It was calculated according to the following formula.

D = Mass / Volume

Chemical Analysis:

Moisture: Estimation of moisture hot air oven method at 105^o c for hrs **By AOAC**, (1995).

Ash : By using muffle furnace method up to constant weigh. Ignite in a muffle furnace at 550+/- 25^oc for 4 hrs By Ranganna, (1986).

Fat : Extracting the sample in a Soxhlet apparatus for 6-8 h using petroleum ether. The solvent is evaporated and the residue is weighed **By Ranganna**, (1986).

Protein: The estimation of nitrogen is done by kjeldahl method where in the protein content is obtained by multiplying the nitrogen value with 6.25 **By Ranganna**, (1986).

Fiber: Fiber is loss on ignition of dried residue remaining after sequential digestion of sample with 1.25% H₂SO₄ (0.255 0.005) and 1.25% NaOH (0.313 0.005N) solution specific conditions.

Sensory evaluation: Evaluate the products for acceptability based on its flavour, texture, appearance, amount of bitterness and overall acceptability using nine-point hedonic scale (1 = dislike extremely to 9 = like extremely; **Meilgaard** *et al.*, (1999).

Shelf life analysis: The Pineapple pomace and wheat bran fortified biscuit samples were packed in LDPE packaging material under ambient temperature for 4 months has evaluated.

Statistical analysis: Analyzed by two-way analysis of variance (ANOVA) and analysis is carried using Microsoft Excel.

RESULTS AND DISCUSSION

Development of Pineapple pomace powder and wheat bran fortified biscuits.

 Table 1 - Physical Analysis of Pineapple pomace powder and wheat bran fortified biscuits.

Sample	Diameter	Thickness	Spread ratio	Volume	Density
T ₀	5.8	0.6	9.6	15.84	0.6
Τ ₁	5.9	0.6	9.8	16.39	0.5
T ₂	6	0.6	10	16.95	0.5
T ₃	6.2	0.7	8.8	21.12	0.4



Fig.1: Physical Analysis of Pineapple pomace powder and wheat bran fortified biscuits.

The physical characteristics of biscuits prepared replacing wheat flour with 0 to 15 percent Pineapple pomace and wheat bran are presented in Table 1. The amount of water used for making dough was increased with increasing level of Pineapple pomace powder and wheat bran in the formulation. The Diameter of Pineapple pomace powder and wheat bran fortified biscuits sample T_0 , T_1 , T_2 and T_3 were 5.8, 5.9, 6, and 6.2 respectively Diameter was increased with the level of Pineapple pomace powder and wheat bran fortified biscuit. The Thickness of the biscuits sample T_0 , T_1 , T_2 and T_3 were 0.6, 0.6, 0.6, and 0.7 respectively observed on the thickness of biscuit sample T₃ was lightly change. Thickness was found maximum (0.7) of Pineapple pomace powder and wheat bran fortified biscuit. The spread ratio of the biscuits sample T_o, T_1 , T_2 and T_3 were 9.6, 9.8, 10 and 8.8 respectively T_3 was decreased significantly with increasing level but T₀, T₁ and T₂ sample increased with increasing level of Pineapple pomace powder and wheat bran fortified biscuit. The Volume of Pineapple pomace powder and wheat bran fortified biscuits sample T₀, T₁, T₂ and T₃ were 15.84, 16.39, 16.95, and 21.12 respectively Volume was increased with the level of Pineapple pomace powder and wheat bran fortified biscuit. The Density of Pineapple pomace powder and wheat bran fortified biscuits sample T_0 , T_1 , T_2 and T_3 were 0.6, 0.5, 0.5, and 0.4 respectively Density was decreased significantly with the level of Pineapple pomace powder and wheat bran fortified biscuit as shown in Table 1 Likewise Sudha et al., (2007); also found the same result.

Chemical analysis of Pineapple pomace powder and wheat bran fortified biscuit.

Chemical analysis of Pineapple pomace and wheat bran fortified biscuits was calculated on the basis of moisture, ash, fat, protein and fiber content **Kamaliya** (2001).

Table 2 :	Chemical Analysis of Pineapple pomace powder
	and wheat bran fortified biscuit.

Sample	Protein g/100g	Fat g/100g	Fiber g/100g	Ash g/100g	Moisture g/100g
T ₀	7	16.21	1.35	1.74	1.40
T ₁	7.53	16.74	2.34	2.23	1.56
T ₂	7.96	16.78	2.5	2.76	1.75
T ₃	8.38	16.82	2.69	3.60	1.81

During present investigation it was observed that the present weight of moisture, fat and protein content of different treatments (T_0 , T_1 , T_2 , and T_3) were not increase or decrease than the content of fiber, ash, which were found in different percent weight in different treatment. This is due to present study in the formulation is based on 90:05:05 percent, 80:10:10, and 70:15:15 percent Pineapple Pomace, wheat bran and wheat flour composition of biscuits is presented in *Table.2* baking time 30 min and temperature was 165°C. The moisture content



Fig 2. : Chemical Analysis of Pineapple pomace powder and wheat bran fortified biscuit.

of Pineapple pomace and wheat bran fortified biscuits sample T₀, T₁, T₂ and T₃ were 1.40, 1.56, 1.75, and 1.81 respectively higher than those control biscuits Shadi et al. (2010). Which was due to the addition of Pineapple pomace and wheat bran in 05, 10, and 15 per-cent proportions in sample T₁, T₂, and T3 respectively. The protein content of Pineapple pomace and wheat bran fortified biscuits sample T_0 , T_1 , T_2 and T_3 were 7, 7.53, 7.96 and 8.38 respectively higher than those control biscuits Loponen et al. (2004). Which was due to the addition of Pineapple pomace and wheat bran in 05, 10, and 15 percent proportions in sample T_1 , T_2 , and T_3 respectively. The fat content of Pineapple pomace and wheat bran fortified biscuits sample T₀, T₁, T₂ and T₃ were 16.21, 16.74, 16.78 and 16.82 respectively decreased with increase in the Pineapple pomace and wheat bran fortified biscuits and decrease in the wheat flour. The data presented in Table 2 indicates that the fiber content of control sample, sample T_1 , T_2 , and T_3 was 1.35, 2.34, 2.5, 2.69 respectively hence the sample T₂ and T₂ having maximum amount of fiber which provide the more fiber content as compared to control sample Boskov et al (2002). The ash content of Pineapple pomace and wheat bran fortified biscuits sample T₀, T₁, T₂ and T₃ were 1.74, 2.23, 2.76 and 3.60 respectively more than the control biscuits Clarke et al. (2003) and this was attributed to higher ash content of Pineapple pomace and wheat bran. Pineapple pomace and wheat bran fortified biscuits also contains higher amount of calcium, phosphorus and iron as shown in Table 2 Likewise Sharif et al (1990) also found the same result.

Sensory Analysis of Pineapple pomace and wheat bran fortified biscuits

Physical analysis of Pineapple pomace and wheat bran fortified biscuits was calculated on the basis of colour, flavour, texture, taste and overall acceptability. **Meilgaard** *et al.*, (2007) and **Katina** (2005) Sensory analysis of Pineapple pomace and wheat bran fortified biscuits sample T_1 , T_2 , T_3 , and control was carried out on the basis of Colour, Flavour, Texture, taste and Overall acceptability with the help of sensory evaluator. **Hammes** (1998).



Table 3: Sensory Analysis of Pineapple pomace and wheat bran fortified biscuits

Sensory evaluation of Pineapple pomace and wheat bran fortified biscuits prelist that the score of control biscuits was high i.e. 8, as compared to experimental biscuits shown in *Table 3*. Among the Pineapple pomace and wheat bran fortified biscuits the sample T_2 recorded the highest score in which 8 percent Pineapple pomace and wheat bran was added. The overall acceptability of biscuits, the texture of Pineapple pomace and wheat bran fortified biscuits was significantly affected by increased level of Pineapple pomace and wheat bran **Thiele and Cercha (2002)** and **Hansen (1996)**.

CONCLUSION

Among the studies were conducted for entitled "Development and quality evaluation of pineapple pomace and wheat bran fortified biscuits". For treatment were conducted i.e. the sample 100:10:10% found satisfactory after testing of physico-chemical and depending upon different sensory attributes like color, flavor, taste, texture, at overall acceptability. There was a significant difference in these treatment 10% and 15% of pineapple pomace and wheat bran samples but the 10% sample found more satisfactory as compare to 15% pineapple pomace and wheat bran sample.

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Ergonomic approach to improve work efficiency and work environment in Garment Manufacturing Units

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ABSTRACT

A present study on male and female workers between 30-35 years of age was conducted regarding ergonomic intervention to improve the work environment in garment manufacturing units. One male and female garment industries was selected for the study. The total sample size was 110 which comprised of 55 men and 55 women. The work environment in the garment manufacturing units is unhealthy and unsafe for the workers, resulting in several health problems. Analysis of garment manufacturing units using a combination of techniques revealed that the congested work area, improper ventilation, dust, unergonomic workstations, excessive noise and non-use of personal protective equipment were the major constraints faced by the workers in these units. Based on the study, interventions to improve the work environment, safety aspects and work methods have been suggested which could be adopted on a wider scale.

INTRODUCTION

The work environment in a majority of garment manufacturing units is unsafe and unhealthy. These include poorly designed workstations, unsuitable furniture, lack of ventilation, inappropriate lighting, excessive noise, insufficient protection from dangerous chemicals, insufficient safety measures in fire emergencies and lack of personal protective equipment. People working in such poor or substandard environment are prone to occupational diseases.

Ergonomics is a discipline that involves arranging the environment to fit the person in it. When ergonomics is applied correctly in the work environment, visual, musculoskeletal discomfort and fatigue are reduced significantly. Following ergonomic principles helps reduce stress and eliminate many potential injuries and disorders associated with the overuse of muscles, bad posture, and repeated tasks. This is accomplished by designing tasks, work spaces, controls, displays, tools, lighting, and equipment to fit the employee's physical capabilities and limitations. **Cristiansen (2001)**.

Mismatch between man and machine is one of the major factors contributing to musculoskeletal problems. **Kelly** *et al.* (1996) studied that musculoskeletal discomfort among the sewing operators can be reduced by the contribution of ergonomic interventions including redesign, proper adjustment of workstations and use of ergonomically designed seating. The amount of Fatigue experienced depends largely on the postures of the performance. According to **Bellis** (2007) the goal of ergonomics in the workplace is to prevent injuries and illnesses (work-related musculoskeletal disorders

or WMSDs) by reducing or eliminating worker exposure to occupational hazards. These hazards include awkward postures, repetition, force, mechanical compression, duration, vibration and temperature extremes. David and Vanwely (2007) reported that an adjustable height task chair with a curved seat pan can reduce neck and shoulder pain severity among sewing machine operators. This may be mainly due to the attempts made by the workers to 'fit the man to the job' rather than to 'fit the job to the man'. Guanayan et al. (1995) concluded that sewing machinists suffer from musculoskeletal problems, which have been attributed to poor working postures as well as to the repetitive hand and arm movements. The potential for improvement of industrial sewing machines was investigated in a study of the effects of two design parameters (table inclination and view of the needles). It was shown that both trunk posture and head/ neck flexion could be improved significantly by altering these design parameters. Their posture is constrained by both the visual and the design of the sewing machine and task, design of the sewing machine and table has a considerable influence on the posture adopted. The recent efforts in this area are directed to fitting the job to the man by eliminating mismatch between the man and the machine and redesigning the work environment to the optimum comfort levels of the workers.

Keeping the above facts in mind the present study was conducted with following objective.

 To impart knowledge based on ergonomic approach to improve upon work efficiency and working environment which is the outcome of the in depth analysis of work and work environment.

MATERIALS AND METHODS

The study was conducted in male and female garment manufacturing units located in Ghaziabad. Total of 110 sewing machine operators consisted of 55 men and 55 women of garment manufacturing units aged between 30-55 years were selected. Various methods like interview with the workers; analysis of work environment; hazard identification risk assessment; quantification techniques were used to collect information about the work, work environment and workers' health problems.

RESULT AND DISCUSSION

Table- 1 shows that the high stool (mean height 59.5 cm) in male manufacturing units and (mean height 48.0 cm) in female manufacturing units forced the workers to bend their trunk and head. The gap between two rows of machine was 2-3 feets which was contributing to the generated at the workplace due to improper circulation of air. The mean levels of illumination in the stitching sections of both the units were of 211.1 and 231.1 Lx respectively. Due to improper selection of lighting fixtures and their placements, the efforts made to improve the level of illumination had failed to give the desired results at the point of operation. Lack of task lighting (local lighting) and lack of general safety measures like absence of first aid kits and lack of safety devices like fire extinguishers, alarms and emergency exits were other serious deficiencies at the workplace.

The results of the study revealed that there had been several gaps in work environment, tools and equipment that affect the health and safety of workers at the work site. Table-2 presents the gaps identified in the work environment. The height of the furniture was too high and low which caused postural discomfort like pain in shoulders, neck, beck, thighs and hands. Lack of task lighting (local lighting) was an important deficiency noticed in the sewing machine. 66.3% of the workers complained of headache and occurrence of accidents like needle-piercing because of the visual strain caused by insufficient light at the point of operation while 40% of the workers complained that the level of noise was very high which caused hearing problems.

Table 2. Gaps identified in work environment

Areas	Gaps identified	Supportive findings
		(workers)
Furniture • Cutting table • Sorting table • Inspection table • Ironing table • Sewing operators	Work height too low Work height too high Work height too high Too low Too high and low	79% workers Complained of postural discomfort and pain in shoulder, neck, beck, thighs and hand.
stool Work Environment • Inadequate lighting	Low level of lighting	66.3% workers Complained of visual strain and blurred vision.
• Noise	High level of noise	40.0% Workers complained the hearing problems.

Table 3 summarizes the gaps in the design and usage of tools and equipment and also in safety aspects at work site. 62.7% workers complained that the continuous use of cutting shears has led to swelling of fingers and cornifications of the skin of the fingers. Many of the workers in the cutting section used to wrap the handles of the shears with a piece of cloth/ cotton to reduce the friction of the metallic handle on the muscles and the resultant pain. 91.8% workers reported that Lack of general safety measures like absence of first aid kits and lack of safety deices like fire extinguishers, alarms and emergency exits were other serious deficiencies in the workers

S.No	Existing Environment	Recommended	Garment Manufacturing Units	
	at the workstation	Standards**		
			Men	Women
1	No. of lighting Fixtures	-	30	25
2	Gap between the two rows	4-5 feet	2-3 feet	2-2.5 feet
3	Circulation Space	5 feet	3 feet	2.5 feet
4	Ventilation (No. of windows)	-	6	4
5	Height of the stool	41.5 cm (women) &	59.5 cm	48.0 cm
		43 cm (men)		
6	First aid facility	-	No facility	No facility
7	Level of noise	80 dB	93.8 dB	87.01 dB
8	Intensity of light	400 Lx	211.1 Lx	231.1 dB

Table 1: Comparison of existing workstation environment of garment manufacturing units with recommended standards.

Table 3:	Gaps	identified	in equip	oment and	tools
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Areas	Gaps identified	Supported findings
		(workers)
Equipments and tools		
• Shears used for cutting fabric.	Handles heavy and strenuous to use for long	62.7% workers Swollen fingers and cornifications
 Safety at work site General safety measures. Personal protective equipments. 	Absence of general safety measures. Absence of personal protective equipments	 91.8% observed gaps. 93% reported incidents. Suggestions to improve work environment

getting trapped inside the units under emergency situations. 93% of the cutting machine operators reported that the workers were not using any personal protective equipment like metallic gloves for safeguarding the hands from possible mechanical injuries.

The suggestions that have emerged from the present study have been formulated as guidelines. These guidelines **Parimalan** *et.al* (2006) would not only be of use for improving the work environment in existing units from the health and safety point of view but would also be invaluable for entrepreneurs starting new units.

DIMENTIONS: The recommended dimensions of the sewing machine operator's work seat height should be 41.5 cm for women and 43 cm for men to attain 105° trunk-thigh angle while operating the sewing pedal. The seat should be padded or wire-netted to provide comfort to the worker. The wooden platform will also be help in preventing electrical shocks while operating electrical instrument.

LIGHTING- A minimum lighting level of 400 lx is recommended for all the three sections of the readymade garment manufacturing units. For sewing operations, additional task lighting is to be provided in the machine in such a way that the visibility of the needle points will be optimum. Lighting in the sewing section is to be planned functionally and the lights fixed at appropriate points to ensure optimum lighting at the work site.

NOISE - Some unions have set a noise level of 80 db as safe standard to work. Work in noise twice that level 83 dB should not go on for more than four hours. Noise control at the source can be ensured by regular maintenance, lubrication and replacement of parts that produce noise in the sewing machines. Use of earplugs/ earmuffs by workers in the sewing section can be made obligatory. Workers exposed to high

noise levels should be provided with ear protection or heir working periods rotated so that they remain within the permissible limit of 4 hours exposure to 95.0 dB. **National Standard for Occupational Noise (1998)**.

VENTILATION - Provision of local exhaust ventilation that uses suction, based on the principle of a vacuum cleaner, is to be encouraged in the cutting and stitching sections to remove dust from the air. The dust particles can be sucked through the ventilation duct provided in all the garment units. Workers in the cutting and stitching sections should be encouraged to use dust protectors in the form of fine-mesh cloth material worn over the face and the nose.

ORIENTATION SPACE - A gap of 4-5 feet between rows of machines will minimize the workers' exposure to heat from the sewing machine motor.

FIRST AID FACILITY - Every unit should have at least the minimum first aid facilities and access to trained personnel to provide emergency medical care. First aid facilities and trained personnel are important components of health and safety arrangement. Safety measures should be checked periodically for ensuring their utility during emergency situations. Use of personal protective equipment (PPE) like earplugs, earmuffs and dust masks should be made mandatory wherever threat to workers' health and safety is anticipated. All workers using PPE should be trained in their use and maintenance. While purchasing PPE, items that have been designed in accordance with recognized standards set by relevant institutions should be bought - ISI approved.

REST PERIOD - In order, to decrease fatigue it is advisable to provide a frequent short pause of 10 min. followed by every 50 min. of work. The rest period should not be spent while sitting in the place of work.

ADJUSTABLE FURNITURE- seats with adjustable back rest supporting the lumber region are recommended to reduce postural strain and low back pain, which is likely to result in the long run without any back support.

CONCLUSION

By the combination of these techniques, several gaps were identified in the work environment and facilities provided to the workers. Based on the study, ergonomic interventions have been suggested which will eventually help to improve the work environment and also to overcome the health problem. These interventions made in the units would help to improve the work environment of the garment manufacturing units and in addition would also be of use to units seeking certification under international standards. These guidelines will help in reducing body strain, occupational hazards and musculoskeletal disorders.

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Study on Landscaping and Interiorscaping of hotels in Delhi and NCR

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ABSTRACT

In the hospitality business, providing a soothing atmosphere is critical for ensuring high rates of occupancy. Whether they are staying for business or for pleasure, guests want to be able to unwind with a minimum of distractions. Landscaping and interiorscaping have a lot of benefits and what they can do to boost the economy and occupancy rate of the hotel industry is tremendous. The study was conducted on five star hotels of Delhi and National Capital Region (NCR). It focused on the features and practices of landscaping; the reasons for investing in and benefits gained through landscaping & interiorscaping and the awareness & perception of the occupants of the hotels regarding the landscaping. It was found that the main reasons for investing in landscaping and interiorscaping were to improve the image of the hotels, to reduce noise, for air purification, to attract more customers and to act as stress busters to occupants. The major landscape features installed in the hotels were plants, flowers, water elements, stones and rocks, sculptures, pavements, arches and pergolas, lights and turf grass. Most of the occupants were aware about the features and practices and perceived that the landscaping and interiorscaping acted as a stress buster for them, increased the aesthetic beauty of the hotel, helped in wayfinding and signposting, concealed less attractive features, purified air and reduced noise in the surrounding areas. Landscaping and interiorscaping benefited the hotels by adding monetary gains through attracting more customers, extra premium for guests rooms with better interiorscape features and better views, banqueting on terrace gardens and use of recycled water for irrigating the plants.

INTRODUCTION

Landscaping also known as 'landscape gardening' is the business of arranging trees, shrubs, climbers and various other groups of plants, together with buildings, walks, drives, gardens and natural features for the use of humanity (Bhattacharjee, 2004). Interiorscaping or interior landscaping is the art of landscaping the interiors of the house. Landscaping and interiorscaping offers a lot of benefits like increasing labor productivity, promoting innovation and ideas, acting as stress buster and contributing to the well being of people, air purification, noise reduction, lowering operations and maintenance cost, aiding in privacy and property protection, acting as a flexible design element, making the building more attractive and welcoming. The major aim of this study was to know are the hotels in the country have such benefits through landscaping and interiorscaping.

MATERIAL AND METHODS

The study was conducted in three Five-star hotels of Delhi and NCR namely The Lalit, The Radisson and The Claridges. The total sample size comprised of 60 occupants (employees and guests) of the hotel to know their perception regarding landscaping and interiorscaping of the hotels. The technical personnel from each hotel were interviewed to gather the technical information about landscaping and interiorscaping. Questionnaire cum interview schedule was used to gather information from the sample. Observation and photography was used to supplement the information gathered through the interviews. Data collected was analyzed through frequencies and percentages.

RESULTS AND DISCUSSIONS

Features and Practices of Landscaping and Interiorscaping of the Hotels

The total area of outdoor landscaping of the studied hotels ranged from $1752.83m^2$ to $4046.85m^2$. The budget for the maintenance of the landscaping and interiorscaping ranged from Rs.11,00,000 to Rs.20,00,000. The landscape service of The Lalit hotel was insourced and that of Radisson hotel and The Claridges hotel was outsourced. The hotels had 10 - 15 employees for the upkeep of the landscaping and interiorscaping. The Claridges hotel won the award for India's Leading Green Hotel at the World Travel Awards 2009 held at London.

The main reasons of the hotels going into landscaping and interioscaping were to improve the image of the hotel, to reduce noise, for air purification, to attract more customers and to act as stress busters. The landscape features installed in the hotels were plants, flowers, water elements, stones and rocks, sculptures, pavements, arches and pergolas, lights

and turf grass. The hotels had different plant species ranging from 30-65 species. All the hotels had terrace gardens and also had some parts of the walls covered with plants. About 20% - 100% of the guest rooms had views of the landscape. All the guest rooms at The Claridges hotel had balconies where interiorscaping had been done and the special suites had better views of the landscape. The guest rooms with views of the landscape were more expensive at Radisson and The Claridges. The guest rooms with views of the landscape were preferred by the guests and were frequented by regular guests. Interiorscape features were installed in areas like the entrance, lobby, restaurants and bars, reception area, offices, guest rooms, pool, spa, gym and parlor. The common interiorscape features in the guest rooms were live foliage plants, live flowering plants and cut flower arrangements. The Radisson hotel was satisfied with its landscaping and interiorscaping while Lalit and The Claridges were highly satisfied with their landscaping and interiorscaping.

Perception of the Occupants of the Hotels (Table 1)

As depicted in *Table 1*, majority (95%) of the occupants were aware about the terms landscaping and interiorscaping. The occupants expressed that landscaping and interiorscaping meant the practice of designing, arranging and caring for plants, beautifying the surrounding area to make it more pleasing, enhancing the aesthetics and improving the image of the surrounding by plantation.

Awareness about the presence of landscape features (*Table 2*)

All the occupants were aware about the presence of plants in the hotel. Majority of the occupants were aware about the presence of landscape features like flowers (96.67%), water elements (93.33%), lights (91.67%), stones/rocks (75.00%), sculptures (63.33%) and turf grass (60.00%). A minority of the occupants were also aware about the presence of pavements (43.33%) and arches and pergolas (21.67%) (*Table 2*).

Interiorscape features at work place/room (Table 3)

The study revealed that majority (70%) of the occupants had fresh cut flower arrangements and live foliage plants (58.33%) installed at their work place/room. Some of the occupants also had live flowering plants (38.33%) and artificial plants and flowers (13.33%). Some occupants (15%) did not have any interiorscape features installed at their work place/room (*Table 3*).

Landscaping and interiorscaping as stress buster (Table 4)

With today's lifestyle and style of working, the stress level has increased manifolds. In a study conducted by Dr. Loh, the participants were 12% less stressed in an environment with plants (*Gilhooley*, 2002). So it was a good idea to know whether the landscaping and interiorscaping have played any role in decreasing the stress of the occupants. *Table 4* showed that landscaping and interiorscaping acted as stress buster for majority (95%) of the occupants.

Perception about	Hot	Hotel 1		Hotel 2		Hotel 3		al
the terms landscaping and interiorscaping	n=20	%	n=20	%	n=20	%	n=60	%
Yes	19	95.00	18	90.00	20	100.00	57	95.00
No	1	5.00	2	10.00	0	0.00	3	5.00

 Table 1.Perception about the terms- landscaping and interiorscaping

Table 2. Awareness about the presence of landscape features

Landscape features	Hot	Hotel 1		Hotel 2		el 3	Tot	al
	n=20	%	n=20	%	n=20	%	n=60	%
Plants	20	100.00	20	100.00	20	100.00	60	100.00
Flowers	19	95.00	19	95.00	20	100.00	58	96.67
Water elements	18	90.00	19	95.00	19	95.00	56	93.33
Stones/rocks	14	70.00	18	90.00	13	65.00	45	75.00
Sculptures	15	75.00	13	65.00	10	50.00	38	63.33
Pavements	13	65.00	3	15.00	10	50.00	26	43.33
Arches and pergolas	8	40.00	2	10.00	3	15.00	13	21.67
Lights	20	100.00	16	80.00	19	95.00	55	91.67
Turf grass	17	85.00	5	25.00	14	70.00	36	60.00

Interiorscape features at	Hot	el 1	Hot	el 2	Hote	el 3	Tot	al
work place/room	n=20	%	n=20	%	n=20	%	n=60	%
Life foliage plants	9	45.00	12	60.00	14	70.00	35	58.33
Live flowering plants	9	45.00	2	10.00	12	60.00	23	38.33
Fresh cut flower arrangements	11	55.00	16	80.00	15	75.00	42	70.00
Artificial plants and flowers	6	30.00	2	10.00	0	0.00	8	13.33
Aquariums	0	0.00	0	0.00	0	0.00	0	0.00
Terrariums	0	0.00	0	0.00	0	0.00	0	0.00
Not applicable	5	25.00	3	15.00	1	5.00	9	15.00

Table 3. Interiorscape features at work place/room

Increasing aesthetic beauty of the hotel (Table 5)

The main reason of the hotels investing in landscaping and interiorscaping was to increase the image of the hotel. As shown in *Table 5*, majority (98.33%) of the occupants perceived that landscaping and interiorscaping increased the aesthetic beauty of the hotel. A similar finding was found in a post graduate study carried out in a London hospital in 1995 (**Stiles, 1995**) where the participants found the building with plants 17% more ornate, 17% more interesting, 17% more cheerful and 16% more welcoming.

Help in way finding and signposting (Table 6)

Landscape features can act as landmarks and signage, signify a specific area and help in easy recall of a specific area. Because of this importance, the occupants were asked if the landscaping and interiorscaping help them in wayfinding and signposting. *Table 6* shows that the landscape and interiorscape features helped in wayfinding for majority of the respondents (58.33%).

Landscaping and interiorscaping a reason of working/stay in hotel (*Table 7*)

The Opryland Hotel case study (**Gilhooley**, **2002**) revealed that the hotel was able to enjoy 85% occupancy rates, well above the national average of 68% because of its landscape gardening. It was interesting to know if the landscaping and interiorscaping had such benefits for the hotels in the country. *Table 7* showed that landscaping and interiorscaping attracted 35% of the occupants to the hotel but did not attract 65% of the occupants.

Benefits of Landscaping and Interiorscaping

The landscaping and interiorscaping of the hotels benefited the hotels by attracting more customers, reducing noise, acting as stress buster, helping in wayfinding and signposting, increasing aesthetic beauty of the hotels and monetary gains through increase in sale by attracting more customers, banqueting in outdoor gardens and using recycled water for irrigation of plants.

Landscaping and	Hot	el 1	Hot	el 2	Hot	el 3	Tot	al
interiorscaping as								
stress buster	n=20	%	n=20	%	n=20	%	n=60	%
Yes	17	85.00	20	100.00	20	100.00	57	95.00
No	3	15.00	0	0.00	0	0.00	3	5.00

Table 4. Landscaping and interiorscaping as stress buster

1ubie S. Increasing aesinetic beauty of the hotel

Increasing aesthetic	Hot	el 1	Hot	el 2	Hot	el 3	Tot	al
beauty of the hotel	n=20	%	n=20	%	n=20	%	n=60	%
Yes	19	95.00	20	100.00	20	100.00	59	98.33
No	1	5.00	0	0.00	0	0.00	1	1.67

Table 6. Help in way finding and signposting

Help in wayfinding	Hotel 1		Hotel 2		Hotel 3		Total	
and signposting	n=20	%	n=20	%	n=20	%	n=60	%
Yes	12	60.00	6	30.00	17	85.00	35	58.33
No	8	40.00	14	70.00	3	15.00	25	41.67

Landscaping and	Hotel 1		Hotel 2		Hotel 3		Total	
interiorscaping a reason								
of working/stay in hotel	n=20	%	n=20	%	n=20	%	n=60	%
Yes	8	40.00	3	15.00	10	50.00	21	35.00
No	12	60.00	17	85.00	10	50.00	39	65.00

Table 7. Landscaping and interiorscaping a reason of working/stay in hotel

The extent of landscaping and interiorscaping in the hotels were not very large to help make a marked contribution to the monetary gains. The hotels could not give the revenue of the monetary contribution made by the landscape and interiorscape. The landscaping and interiorscaping did not contribute in lowering the operations and maintenance cost.

CONCLUSION

It is a known fact that landscaping and interiorscaping adds to the aesthetics of the building and its interiors. Moreover, landscaping has other important advantages such as - increasing labour productivity and creativity, helping patients recover faster, air purification, noise reduction, energy savings, wayfinding, providing privacy and property security, and increasing the property value. With the rapid growth, very good future prospect for growth of the hospitality industry and the many benefits that landscaping and interiorscaping can have on this industry, it becomes imperative to look into how this industry is faring in landscape gardening. The research revealed that the hospitality industry in Delhi and NCR had a lot of benefits through landscaping and interiorscaping but the hospitality industry did not make any marked monetary contribution through its landscaping and interiorscaping. The occupants of the hotels were well aware of the practices and features of landscaping and interiorscaping in their respective hotels.

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Dietary pattern of obese young women in semi urban area of Allahabad District

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ABSTRACT

The present study pertaining to the "Dietary pattern of obese young women in semi urban area of Allahabad district" was conducted in Allahabad District. This was a cross-sectional study were 150 semi urban young women aged between 20-40 years were selected randomly from Gangotri Nagar and Friends Colony Naini, Allahabad. For the data collection, a structured interview schedule was developed and data was collected by face to face interview. The anthropometric measurements (Height in cm. and weight in kg) of the respondents were recorded. The nutrient intake of the subjects was calculated on the basis of 24 hours dietary recall method. Results of the study indicated that, out of 150 respondents the majority of women (87 per cent) of semi urban area of Allahabad District, were in Grade II obesity and remaining respondents were in grade I (35 per cent) and grade III (28 per cent) obesity. The mean nutrient intake of the respondents regarding Energy, Protein, Fat, Calcium, Iron, Vitamin C and β -carotene were more than the RDA, except for Iron intake among women between 30-35 and 35-40 years, Calcium in women aged 30-35 years and Vitamin C in women between 25-30 years which were lesser than RDA. The dietary pattern, such as type of cooking oil, type of milk used, consumption of fast/ junk food, methods of cooking, also contributed to obesity in women.

INTRODUCTION

The word "Obesity" comes from a Latin word "Obesus" which originally means "eaten more" or hungry. Obesity, a worldwide problem associated with a reduced life span and has been extensively documented in the western countries. According to an estimate, around 17 to 38 per cent of the Indian populations are obese (Ghai & Gupta, 1999). Objective of this study are, to assess the anthropometric measurements and determine the Body Mass Index of the selected respondents and to find out the nutrient intake and dietary pattern of the obese semi urban women.

A high prevalence has been reported in the female sex, with some evidence of an association with parity **Calandra** *et al.* (1981). Over weight is a condition where the body weight is 10-20 per cent greater than the mean standard weight for age, height and sex. Excess body weight is a hindrance, leading to breathlessness on moderate exertion and predisposes a person to disease like atherosclerosis, high blood pressure, stroke, diabetes, gall bladder diseases and osteoarthritis of weight bearing joints, varicose veins. Obesity is a chronic disease. Usually obesity is due to positive energy balance. That is, the intake of calories is more than the expenditure of calories. (Srilakshmi, 2005).

MATERIALS AND METHODS

Selection of sample: Three stage of sampling was adopted for the present study-

Selection of city- Allahabad city of Uttar Pradesh was selected purposively for the investigation because it was convenient and accessible for the researcher.

Selection of area- Semi urban area of Allahabad district, Gangotri Nagar and Friends Colony Naini, Allahabad were selected purposively because of easy accessibility and convenience for authentic collection of data.

Selection of respondents- Total 150 women were selected between the age of 20-40 years. Stratified random sampling techniques were used for the selection of respondents. 75 respondents from Gangotri Nagar and 75 respondents were selected from Friends Colony. With prior permission of the owner of the house the women of the respective age group were asked to give the survey schedule accordingly.

Collection of data- Survey method was adopted to collect the data from the selected respondents with the help of pretested schedule. The young women were personally interviewed during the period of study for the collection of required information.

Assessment of nutrient intake- 24 hour dietary recall method was adopted and nutrients intake per day was calculated (Swaminathan, 2004). Calculation of nutrients intake was done with the help of Nutritive Value of Indian foods and compared with RDA Given by ICMR (Gopalan *et.al.* 2004).

Statistical analysis- Appropriate statistical tools viz. Standard Deviation and t- test were used for statistical analysis.

RESULTS AND DISCUSSION-

From the study it was reported that maximum 35.5 per cent were in age group of 35 - 40 years, followed by 23.3 per

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cent, who were in 30 - 35 years age group, 20.6 per cent were in age group of 25 - 30 years and 20.6 per cent respondents were in the age group of 20 - 25 years. Maximum 60 per cent belonged to Hindu religion followed by 28.6 per cent who were Muslims and 11.4 per cent believed to the Christian community. 60 per cent were married, followed by 23.4 per cent who were unmarried and 16.6 percent women were widows. It was found that 8.6 per cent were illiterate, 30 per cent had studied till High School, 26.7 per cent were educated till Intermediate, 22.7 per cent were Graduates and 12 per cent were Post graduates. Maximum, 64.7 per cent and 35.3 per cent of them belonged to joint family. Nuclear family was more common than joint families. Similar were the findings were also reported by Verma (2004) in some part of Allahabad District of Uttar Pradesh. 56.6 per cent had less than 6 family members, 43.4 per cent had found more than 6 family members. 56.6 per cent were found to be housewives followed by 28.6 per cent who were in service, 7.3 per cent in business, 6 per cent were have Agriculture and 3.5 per cent were found to have other occupations. 28 per cent had 1-2

children, 57.4 per cent had 3-4 children and 14.6 per cent of women had 5-6 children. 28 per cent were in Low income group (Rs 0 - 5000), 57.4 per cent were found in Middle income group (Rs 5000 - 10,000), and 14.6 per cent of women found in High income group (Rs above 10,000) as per income range of the selected area.

According to the *Table* most of the mean average daily intake of all the nutrients with reference to energy, protein, fat, calcium, iron, ascorbic acid and β - carotene was compared to ICMR (RDA). The average intake of young women of age 20-25 years shows the average nutrient intake of energy (2662 kcal/day), protein (63.8 g/day), fat (32.9 g/day), iron (39.9 mg/ day), calcium (507.2 mg/day), vitamin C (49.6 mg/day) and β carotene (2350 µg/day) were more than the RDA. Among the respondents in 25-30 years age group, the average nutrient intake of energy (2695 kcal/day), protein (66.8 g/day), fat (32.3 g/day), iron (40.5 mg/day), were more than the RDA, while in same age group, intake of remaining nutrients such as calcium (339 mg/day), vitamin C (38 mg/day) and β - carotene (2278 µg/day) were less than the RDA. The average intake of young

Subjects	Particulars	Energy	Protein	Fat	Iron	Calcium	Vit C	β -carotene
		(k cal)	(g)	(g)	(mg)	(mg)	(mg)	(µg)
	RDA	2225	50	20	30	400	40	2400
Young women	Intake	2662	63.8	32.9	39.9	507.2	49.6	2350
	Difference	-437	-13.8	-12.9	-9.9	-107.2	-9.6	50
	S.E	±0.74	±1.63	±1.2	±5.7	±1.2	±1.1	±0.95
(20 - 20 years)	Cal [t]	61.4	33.5	2.40	64.6	30.0	1.0	53.2
	Result	S	S	S	S	S	S	S
	RDA	2225	50	20	30	400	40	2400
Young	Intake	2695	66.8	32.3	40.5	339	38	2278
women	Difference	-470	-16.8	-12.3	-10.5	61	2	122
(25 - 30 years)	S.E	±2.59	±1.86	±0.3	±1.05	±1.8	±1.0	±1.0
	Cal [t]	73.4	28	2.69	1.76	33.8	1.35	44.3
	Result	S	S	S	S	S	NS	S
	RDA	2225	50	20	30	400	40	2400
Young	Intake	2329	65.8	35.5	29.8	421.8	37.5	2309
women	Difference	-104	-15.8	-15.5	0.2	21.8	2.5	91
(30 - 35 years)	S.E	± 1.8	± 0.8	±2.3	±0.4	±0.3	± 1.0	±2.4
	Cal [t]	65.2	34.6	4.6	2.7	1.0	0.4	0.7
	Result	S	S	S	NS	NS	S	S
	RDA	2225	50	20	30	400	40	2400
Young	Intake	2636	63.6	35	39.9	395.2	30.7	2398
women	Difference	-411	-13.6	-15	-9.9	4.8	9.3	2
(35 - 40 years)	S.E	±1.0	±2.6	±0.3	±0.8	±1.6	±2.6	±0.9
	Cal [t]	85.3	23	4.3	0.9	2.3	2.7	1.4
	Result	S	S	S	NS	S	S	S

Table : 1 -Average daily nutrient intake of the women-

women of age 30-35 years shows the average nutrient intake of energy (2329 kcal/day), protein (65.8 gm/day), fat (35.5 gm/ day), calcium (421.8 mg/day) were more than the RDA, while in same age group, nutrient intake of iron (29.8 mg/day), vitamin C (37.5 mg/day) and β - carotene (2309 µg/day) were less than the RDA. Among those in 35-40 years age group, the average nutrient intake of energy (2636 kcal/day), protein (63.6 gm/day), fat (35.0 gm/day), iron (39.9 mg/day), were more than the RDA, while in same age group nutrient intake of calcium (395.2 mg/day), vitamin C (30.7 mg/day) and β carotene (2398 µg/day) were less than the RDA. It is clear from this study that some nutrients were in excess amount and some other nutrients were found to be less than RDA in young women. Intake of some important nutrients according to RDA, which required for proper growth, development and to support their brain development.

CONCLUSION

It is concluded that, out of 150 respondents the majority of women (87 per cent) of semi urban area of Allahabad District, were in Grade II obesity and remaining respondents were in grade I (35 per cent) and grade III (28 per cent) obesity. The mean nutrient intake of the respondents regarding Energy, Protein, Fat, Calcium, Iron, Vitamin C and β -carotene were more than the RDA, except for Iron intake among women between 30-35 and 35-40 years, Calcium in women aged 30-35 years and Vitamin C in women between 25-30 years which were lesser than RDA. The dietary pattern, such as type of cooking oil, type of milk used, consumption of fast/ junk food, methods of cooking, also contributed to obesity in women.

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Sensory evaluation of the products incorporated with Oyster mushroom (Pleurotus ostreatus) flower

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ABSTRACT

Mushrooms are gaining popularity in the world today as one of the most important vegetable of the twentieth century. They are consumed as a delicacy and appreciated for their good taste, ample nutrition and enticing flavour. They are considered to be healthy food that can reduce malnutrition and help the country deliver the global commitment of achieving the Millennium Development Goals on health, poverty and hunger (United Nations, 2000). Pleurotus species (Pleurotus ostreatus) commercialized in India were evaluated for consumer acceptability. Basic sensory methods for food evaluation and hedonic tests to measure degree of likeness were adopted for this research. Three products were prepared viz. Pakora, Mushroom Potato vegetable and Mathri at 10-80 percent level. Sensory evaluation revealed highest score for Overall acceptability of Pakora in treatment T, (8.49 ± 0.63) followed by Mathri in treatment T₁ (8.38 ± 0.62) and lowest for Mushroom Potato vegetable (7.84 ± 0.60) . It can be concluded that Oyster mushroom based products being good sources of minerals and energy may be incorporated in daily diets. If mushroom consumption is popularised, the support for food nutrition security is substantial.

Key words: Pleurotus ostreatus, sensory evaluation, Product development

INTRODUCTION

Wide spread malnutrition with ever increasing protein gap in our country has necessitated the search for alternative source of protein because the production of pulses has not kept pace with our requirement due to high population growth. Animal protein is beyond the reach of the most people in this country because most of the people (over 86%) live beyond poverty level. Edible mushrooms are recommended by the FAO as food, contributing to the protein nutrition of developing countries dependent largely on cereals. Cultivation of Mushroom is eco-friendly and profitable agribusiness but labour-intensive. Mushroom cultivation represents the only current economically viable biotechnology process for the conversion of waste plant residues from forests and agriculture. The different species of pleurotus grow within a temperature range from 15-25°C and it can be grown on various agricultural waste materials as substrate. Compost of wheat and paddy straw, banana leaves, sugarcane bagasses and leaves, wheat barn, rich husk, sawdust etc. can be used as substrate for growing mushroom. Pleurotus ostreatus produce in large quantities in a short time and provides more protein per unit area than any other crop (Hasan et al. 2010).

Since paddy straw is easily available and cheap, it is widely used. They are consumed for their nutritive as well as medicinal value. Oyster mushrooms contain ergothioneine, a unique antioxidant exclusively produced by fungi and high in nutrients. Oyster mushrooms contain significant levels of protein, zinc, iron, potassium, calcium, phosphorus, vitamin C, folic acid, niacin, and vitamins B complex (Tara Carson,

2011). Edible pieces of oyster mushroom are delicious and nutritious. The texture of oyster mushroom is wonderful, velvety and the flavor is mild in nature. Oyster mushroom contains most of the mineral salts that is required by the human body. Calcium, phosphorous and iron content in oyster mushrooms is double the amount available in beef, pork and chicken meat. Vitamin B3 in oyster mushrooms is 5-10 times higher as compared to any other vegetable.

Keeping this in view, the present investigation was undertaken to sensory evaluation of the value added traditional products incorporated with oyster mushroom flower.

MATERIALAND METHODS

The present investigation was conducted in the Department of Foods and Nutrition, Halina School of Home Science, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad.

Development of value added products and their sensory evolution.

Fresh Oyster mushroom flowers were purchased from the Non -Formal of SHIATS. These flowers were washed and cleaned properly. Chopped Oyster mushroom flowers were tray dried at controlled temperature and time 50°C to 60°C for 4-5 hours in the Cabinet drier.

Three products namely Pakora, Mushroom Potato vegetable, Mathri were developed by incorporating oyster mushroom flowers at 10-80 percent level.

Pakora and Mushroom *Potato vegetable* were developed by incorporated fresh mushroom flower at 60-80 percent level where as Mathri was developed by dehydrated oyster mushroom flower at 10-20 percent level. The treatment was replication of the products are shown in *table 1* given below:

Sensory evaluation of the products

The evaluation of the products was done on the basis of colour, texture, taste, flavour and overall acceptability. The developed products namely Pakora, Mushroom Potato vegetable and Mathri respectively were evaluated, using the 9 point Hedonic scale given by **Amerine** *et al.* (1965). The evaluation was done by trained panel of ten members from the Halina School of Home Science. Each treatment was replicated thrice.

Statistical analysis

Data obtained were tested for significance using ANOVA. Mean standard deviations were used to interpret mean sensory scores of the products incorporated with mushroom.

RESULTS AND DISCUSSION

Products developed from Oyster mushroom flower Oyster mushroom "Mathri"

Table 2 shows that effect of adding different levels of dehydrated oyster mushroom colour on the Mathri. Treatment T_2 , gave the highest score for colour and appearance as compared to the other treatments T_1 and T_3 . From the table it can be concluded that there is non-significant difference between treatments regarding the colour of the products.

The highest average score for texture of Mathri as T_2 followed by the T_1 and T_3 . It can be concluded that there is

Table-1. Treatment and product developed byincorporating oyster mushroom flowers-

Treatments	Products and in	Products and incorporation level of mushroom flower by substituting main ingredients							
	Pakora		Mushroom Potat	o vegetable	Mathri				
	Fresh	Besan	Fresh	vegetables	(Dehydrated	Refined			
	Mushroom		Mushroom		Mushroom	wheat flour			
T ₁	60%	40%	60%	40%	10%	90%			
T ₂	70%	30%	70%	30%	15%	85%			
T ₃	80%	20%	80%	20%	20%	80%			

Table 2: Effect of incorporation of Oyster Mushroom on organoleptic characteristics of food products.

Sensory	Scores on 9 poin	Scores on 9 point hedonic scale								
characteristics	Colour	Texture	e	Flavour	& Taste	Overall				
/Treatments						acceptability				
1. Oyster Mushroom	n 'Mathri'									
T ₁	8.43±0.61	8.12 ± 0	.61	$7.81\pm$	0.60	7.38 ± 0.62				
T ₂	7.93±0.61	8.18 ± 0	.61	$7.81\pm$	0.60	8.95 ± 0.61				
T ₃	7.75 ±0.61	$7.8 \pm 0.$.60	$8.31\pm$	0.62	8.35±0.62				
F value	1.25 (NS)	0.35 (N	S)	3.32 (NS)	5.81 (S)				
CD value	1.10	1.16		-		1.2				
2. Oyster Mushroon	n ' Pokora'									
T ₁	8.43 ± 0.62		8.78 ± 0.64		5.87 ± 0.52	8.09±0.61				
T ₂	8.56 ± 0.63		8.62 ± 0.63		6.31 ± 0.54	8.49 ± 0.63				
T ₃	8.59 ± 0.63		8.38 ± 0.62		5.43 ± 0.52	8.26±0.62				
F value	5.09 (S)		6.66 (S)	16.12(S)	12.72(S)				
CD value	0.55		0.94		0.24	0.26				
3. Oyster Mushroom	n 'Mushroom Potat	to vegetable'								
T ₁	7.8 ± 0.60		7.56±	0.59	8 ± 0.61	7.90 ± 0.61				
T ₂	7.93 ± 0.60		8.81±	0.61	8.25 ± 0.62	7.95 ± 0.61				
T ₃	8.06 ± 0.61		7.43±	0.58	8.06 ± 0.61	7.84 ± 0.60				
F value	7.85 (S)		6.66 (S)	10.54 (S)	0.06 (NS)				
CD value	1.19		0.94		1.06	0.75				

NS = Non significant. S = significant $., \pm$ = Standard deviation

non-significant difference between treatments regarding the texture of the products.

The mean score of Mathri related to taste and flavour was obtained by T_1 , T_2 and T_3 respectively indicating that treatment T_2 and T_3 gave the best taste and flavour to Mathri. This indicated that treatments had non-significant effect on the taste and flyour of Mathri.

The mean score of Mathri regarding its overall acceptability, shows the maximum score of T_1 followed by T_3 and T_2 . Significant difference was found between the three treatments regarding the overall acceptability of Mathri.

Oyster mushroom "Pakora"

The data illustrated in the *table 2* pertaining to the effect of addition of fresh Oyster mushroom on the colour and appearance of Pakora clearly indicates that the treatment T_3 got the highest score for the colour of Pakora followed by T_2 and T_1 . It is concluded that the fresh oyster mushroom influences the appearance of products. There is significant difference between treatment regarding the colour and appearance of Pakora.

The mean scores pertaining to the effect of addition of fresh oyster mushroom texture of Pakora shows that the treatment T_1 scored the maximum marks followed by T_2 and T_3 respectively. It can be concluded there is significant difference between treatments regarding the texture of Pakora.

The *table 2* shows, that the mean scores of Pakora in relation to taste and flavour indicates that T_2 had the highest score followed by T_1 and T_3 respectively. The taste of mushrooms is influenced by the presence of three types of compounds as described by **Chen (1986)**. They include sweet components (alarnine, glycine and threonine), monosodium glutamate- like compounds with high levels of aspartic and glutamic acids and bitter compounds high in phenolic compounds. There is significant difference between treatment regarding the taste and flavour of Pakora. The *table 2* shows, that the mean scores of Pakora in relation to overall acceptability which indicates that T_2 had the highest score followed by T_3 and T_1 respectively. It can be concluded that there is significant difference between treatments regarding the overall acceptability of Pakora.

Mushroom Potato vegetable

Table 2 shows that the treatment T_3 had the highest score for colour and appearance followed by T_2 , and T_3 respectively. Therefore it is concluded that all the treatment were acceptable by the panel of judges. There is significant difference between the colour and appearance of mushroom potato vegetable in different treatment.

The *table 2* shows that treatment T_2 held the maximum score (8.81) regarding the texture of mushroom potato vegetable followed by T_1 and T_3 . It is quite clear from the

score that all the treatments in comparison to the T_1 and T_3 were moderately liked by the panel judges. However, the T_3 was preferably better regarding the texture of the products. There was non-significant difference between the three treatments of mushroom potato vegetable.

The mean scores of Mushroom Potato Vegetable on the taste and flavour. It can be seen by the table that the treatments T_2 (8.25) held the top score followed by T_1 and T_3 respectively indicating that the treatments were liked moderately. *Table 2* shows that there was significant difference between the taste and flavour of Mushroom Potato Vegetable in different treatments.

The treatment T_2 was ranked at the top by the panel of judges followed by T_1 and T_3 respectively. Scoring indicates that treatments were moderately liked by the panel judges. There was non-significant difference between the of overall acceptability mushroom potato vegetable in different treatments.

CONCLUSION

From the result it may be concluded that Mathri made from 10 percent oyster mushroom flower were considered as most acceptable organoleptically followed by Pakora. The development of such functional foods not only improves the nutritional status of the general population but also helps those suffering from degenerative diseases associated with today's changing life styles and environment.

The present study therefore recommends the prospects of more aggressive commercialization of this species, for increased utilization, income generation and poverty alleviation. However, recommendation should also take into account economics of the oyster mushroom as well as the Nutriceuticals, which should be addressed in future studies.

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The impact of various coagulation temperatures and levels of salt on lactose and energy content of chhana spread

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ABSTRACT

Among milk products Chhana is gaining momentum in its production and consumption. Chhana is heated and acid coagulated indigenous milk product which forms the base of several popular Indian sweets like Rasogulla, Sandesh, Rasamalai and Chumchum etc Chhana or paneer, means the product obtained from cow or buffalo milk or a combination of them by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70% of the moisture, and the milk fat not be less than 50% of the dry matter (PFA, 1976). The present study was undertaken with the objectives, to optimize processing parameters for the manufacturing of chhana spread, to evaluate the sensory, physico-chemical and microbiological qualities of chhana spread, to determine the shelf life of chhana spread at different storage periods, to find out the consumer acceptability of chhana spread, to find out the cost of manufacturing chhana spread. Three different type of milk Cow ,Buffalo, Admixture milk as $M_1 M_2 M_3$ were used for making chhana spread and three different coagulant temperature 60°C, 65°C, 70°C as T_1 , T_1 , T_3 and three salt levels 1%, 1.5%, 2% as S_1 , S_2 , S_3 were used for making chhana spread and 27 treatment combinations used in the study .The different treatment combinations were compared with each other The experiment treatment combinations $(M_1T_1S_3)$ The highest percentage of lactose (3.08). The highest energy value of (303.71) was found in the treatment combinations

Key words: Chhana Spread, Coagulation Temperature, Salt Levels, Storage Periods

INTRODUCTION

Today the average per capita availability of milk in India has reached 246 gm per day, when the world milk production in 2008 is around 700 million tonnes, out of which India has produced 106 million tonnes. The goals of the 11th five year plan for the live stock sector are expected to achieve an overall growth between 6% to 7% per annum for the sector as a whole and the production growth is estimated to 5% per annum from 100 million tonnes from 2008 to 126.46 million tonnes by 2011-12 (Indian dairyman, 2009). Recent advances in the food and nutrition sciences accentuate the substantial role of diet in modulation of various physiological functions and thus the health status of the human body. As a result, new nutritional concepts in therapeutic nutrition in the form of dietetic foods have evolved, which focus on the diets specially designed to satisfy the specific nutritional requirements of different consumer groups. Various epidemiological and clinical studies provide a strong and consistent evidence for relationship among saturated fat, intake high blood cholesterol and increased risk for coronary heart diseases. According to a recently conducted survey by BM Birla Heart Research Institute (Chakarvarti, 2005). Nutritive value of Chhana is fairly high as it contains almost all the protein present in milk besides quantity of minerals

and vitamins. It possesses a nutty flavour with slightly sour and sweet taste which makes it palatable to Indian palate. It is an ideal food for expectant and nurshing mothers, infants, growing childerns, adolescents and adults. Being rich source of animal protein, it is a good source of all the essential amino acids to the vegetarians. Its fat content renders the fat soluble vitamin A and D, essential fatty acid (linoleic, linolenic and arachedonic acid) and energy. With its high protein and low sugar content, it is highly recommended to the diabetic patients. It has also particular food value for those who possess the problem of milk intolerance. Chhana retains about 90% of fat and protein, 50% ash and 10% lactose of the original milk. The energy value of cow chhana ranges from 2886 to 3748 calories per kg and chhana also retains appreciable proportion of fat soluble vitamins A and D (Ray and De 1953).

MATERIALS AND METHOD

The present investigation was conducted in the Student's Training Dairy and Research Laboratory of Warner School of Food and Dairy Technology and Nutrition Research Laboratory of Ethelind school of Home science, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed - to - be - University), Allahabad, U.P.

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PREPARATION OF CHHANA SPREAD

Chhana was prepared from cow milk standardized to 3.5 % fat & 8.5% SNF as per method suggested by Ray and De (1953). Cow milk was heated at 90oC for 15 minutes and cooled down to 60°C and therefore, added warm coagulant solution (1%) at 60°C to effect proper coagulation. Traditional method was used to drain the free whey from the coagulated mass. The curd along with whey was transferred on a muslin cloth and whey was allowed to drain by hanging technique till trickling of free whey was stopped. The curd sample obtained by this method was subjected for chhana spread making. The curd from traditional method was converted into chhana spread by using method suggested by Tiwari and Sachdeva (1991). In this case chhana was broken into pieces and blended in domestic blender along with 10 percent whey and specified salt level

TREATMENT COMBINATIONS

Three different type of milk Cow, Buffalo, Admixture milk as $M_1 M_2 M_3$ were used for making chhana spread and three different coagulant temperature 60°C, 65°C, 70°C as T_1 , T_1 , T_3 and three salt levels 1%, 1.5%, 2% as S_1 , S_2 , S_3 were used for making chhana spread work. 27 treatment combinations used in study namely ($M_1T_1S_1$, $M_1T_1S_2$, $M_1T_1S_3$, $M_1T_2S_1$, $M_1T_2S_2$, $M_1T_2S_3$, $M_1T_3S_1$, $M_1T_3S_2$, $M_1T_3S_3$, $M_2T_1S_1$, $M_2T_1S_2$, $M_2T_1S_3$, $M_2T_2S_1$, $M_2T_2S_2$, $M_2T_2S_3$, $M_2T_3S_1$, $M_2T_3S_2$, $M_3T_3S_3$, $M_3T_1S_1$, $M_3T_3S_2$, $M_3T_3S_3$, $M_3T_2S_1$, $M_3T_2S_2$, $M_3T_2S_3$, $M_3T_3S_1$, $M_3T_3S_2$, $M_3T_3S_3$)

CHEMICAL TESTING OF CHHANA SPREAD

The procedure given in Manual in Dairy Chemistry, **ICAR**(1972), for sampling was followed.

ANALYTICAL TECHNIQUE

Chhana spread will be analyzed for moisture content using **AOAC (1980)** method. Total nitrogen will be determined by micro-kjedahl method. For fat content in milk, Gerber's method of **BIS(1981)** will be used. The fat, ash and content was determined using **AOAC (1980)** procedures. Lactose, calcium content was estimated by **AOAC (1980)**

DETERMINATION OF TOTAL ENERGY

Kcal/100gm = (4 X protein %) + (4 X CHO %) + (9 X fat %)

STATISTICALANALYSIS

The order to study the effects of milk, various temperature, levels of salts and preservatives of chhana spread, a laboratory experiment was conducted and required data were collected. Analysis of variance of these data was worked out on the basis of factorial completely randomized design (Federer, 1963).

RESULTS AND DISCUSSION

The data collected on different aspects as per the methodology have been tabulated and analyzed statistically The results obtained from the analysis are presented and discussed.

Table:1.1	Average lactose content of chhana spread in
	percent on account of various type of milk and
	coagulation temperatures

Types of milk	Coagulation Temperatures(T)				Mean	
		T ₁ (60°C	9	T ₂ (65°C)	T ₃ (70°C)	
Cow milk (M ₁)		3.05		3.17	2.74	2.99
Buffalo milk (N	1 ₂)	3.03		3.04	2.39	2.82
Admixture milk	(M ₃)	2.93		3.06	2.37	2.79
Mean		3.00		3.09	2.51	
Factors	М	Т		М	хT	
SE(m) +	0.00	5 0	.00	05 0.	009	
C.D. at 5%	0.01	5 0	.01	15 0.	026	

Table1.1 displayed that the average lactose content of chhana spread, due to various coagulation temperatures, irrespective of various milk was found 3.00, 3.09 and 2.51 percent at 60°C, 65°C and 70°C, respectively. The maximum chhana spread lactose content was recorded to be 3.17 percent in cow milk at 65°C and minimum was 2.37 in admixture milk at 70°C. On an average lactose content of chhana spread was recorded maximum as 2.99 percent in buffalo milk and minimum 2.79 percent in admixture milk. There was significant differences for lactose content with respect of milk categories and the range of coagulation temperatures. The interaction effect between types of milk and coagulation temperatures (MxT) was found significant.

Table:1.2 Average lactose content of chhana spread in percent on account of various type of milk and different levels of salt

Types of milk	Different	levels of Sa	lt (S)	Mean	
	S ₁ (1%)	S ₂ (1.5%)	S ₃ (2%)		
$\operatorname{Cow milk}(M_1)$	3.00	2.99	2.97	2.99	
Buffalo milk (M_2)	2.84	2.82	2.81	2.82	
Admixture milk (M_3)	2.80	2.79	2.78	2.79	
Mean	2.88	2.87	2.85		
Factors	М	S	MxS		
SE(m)+	0.005	0.005	0.009		
C.D. at 5%	0.015	0.015	N.S		

The effect of various salt levels on lactose content of chhana spread is presented in *Table 1.2* there was significant differences in respected of the lactose content due to different levels of salt and types of milk. The lactose content of chhana spread due to different salt levels, irrespective of various

milk were recorded to be 2.88, 2.87 and 2.85 percent at 1%, 1.5% and 2%, respectively. Comparatively highest lactose was recorded by 3.00 percent in cow milk spread at 1% salt concentration, while it was minimum as 2.78 percent in admixture milk chhana spread at 2% salt level. When compared with C.D at 5 per cent probability level, it was noticed that the lactose content of chhana spread varied significantly from types milk and levels of salt to. The interaction effect between levels of salt and types of milk (MxS) was found not significant.

Average lactose content of various samples of chhana spread has been given in Tables 1.3 which shows the effect

In admixture milk on an average lactose content with respect of variations in coagulation temperatures were recorded as 2.93, 3.06 and 2.39 percent at 60°C, 65°C and 70°C, respectively. The salt level 1% was recorded maximum content of lactose as 2.80 percent and minimum as 2.78 percent at 2% level of salt, while the content of lactose percentage of all level of salt was significantly at par value. The effect between types of milk, coagulation temperatures and levels of salts was found dependent as interaction (MxTxS) was recorded significant.

Types of milk	Coagulation Temperatu	res		Diff	erent levels	of Salt	(S)	Mean
			S ₁ (1%))	S ₂ (1.5%))	$S_{3}(2\%)$	
Cow milk (M ₁)							-	
	$T_{1}(60^{\circ}C)$		3.07		3.05		3.04	3.05
	T ₂ (65 ^o C)		3.19		3.18		3.16	3.17
	T ₃ (70°C)		3.08		2.74		2.73	2.88
	Mean		3.11		2.99		2.97	3.02
Buffalo milk (M ₂)								
	$T_{1}(60^{\circ}C)$		3.05		3.04		3.02	3.03
	$T_{2}(65^{\circ}C)$		3.02		3.06		3.04	3.04
	$T_{3}(70^{\circ}C)$		2.41		2.40		2.38	2.39
	Mean		2.82		2.83		2.81	2.82
Admixture milk (M ³)								
	$T_{1}(60^{\circ}C)$		2.93		2.94		2.92	2.93
	T ₂ (65 ^o C)		3.08		3.06		3.05	3.06
	T ₃ (70°C)		2.41		2.40		2.38	2.39
	Mean		2.80		2.81		2.78	2.79
	Overall Mean		2.88		2.87		2.85	2.86
Factors	M	Т		S		MxTxS	5	
SE(m)+	0.005	0.005		0.005		0.016		

0.015

Table:1.3 Average lactose content of chhana spread in percent on account of various type of milk, coagulation temperatures and different levels of salt

of different types of milk, coagulation temperatures and salt levels on lactose contents of chhana spread. In cow milk on an average lactose content of chhana spread with respect of different coagulation temperatures were recorded 3.05, 3.17 and 2.88 per cent at 60°C, 65°C and 70°C. Likewise in salt level 1% showed the minimum lactose content was 2. 97 percent and maximum was noticed 3.11 percent at 2% salt level.

0.015

C.D. at 5%

In case of buffalo milk the maximum lactose content was recorded 3.03 at 60°C and minimum as 2.39 percent at 70°C. Similarly in levels of salt on an average lactose contents were recorded 2.82, 2.83 and 2.81 percent at 1%, 1.5% and 2% levels of salt, respectively.

Table:1.4 Average energy content of chhana spread in percent on account of various type of milk and coagulation temperatures

0.045

0.015

Types of milk		Coagulat	Mean		
		$T_1(60^0C)$	T ₂ (65°C)	T ₃ (70°C)	
Cow milk (M ₁)		202.96	214.61	252.13	223.23
Buffalo milk (M ₂)	298.00	302.28	301.26	300.51
Admixture milk ((M ₃)	228.98	245.22	245.05	239.75
Mean		243.31	254.04	266.15	
Factors	М	Т	Ma	кT	
SE(m) +	0.07	/2 0.0	072 0.1	24	
CD at 5%	0.20	0.1 0.1	204 0.3	54	

Table 1.4 shows that the effect of chhana spread on energy content, irrespective of various kinds of milk and coagulation temperatures. The maximum energy content was recorded by 302.28 in buffalo milk at 65°C and minimum was 202.96 in cow milk at 60°C of chhana spread. The energy content of chhana spread due to different coagulation temperatures, irrespective of various milk was recorded as 243.31, 254.04 and 266.15 at 60°C, 65°C and 70°C, respectively. Maximum scores was registered at 70°C followed by 65°C and 60°C these were registered minimum. The interaction effect between types of milk and coagulation temperatures (MxT) was found significant.

Table:1.5 Average energy content of chhana spread inpercent on account of various type of milk anddifferent levels of salt

Types of mill	Different levels of Salt (S)				Mean	
		S ₁ (1%)	S2(1.5	5%)	S ₃ (2%)	
Cow milk (M	1)	224.14	223.4	4	222.13	223.23
Buffalo milk ((M ₂)	301.79	300.5	5	299.21	300.51
Admixture mi	lk (M ₃)	240.91	239.8	0	238.54	239.75
Mean		255.61	254.5	9	253.29	
Factors	М	S		M	κS	
SE(m) +	0.07	72 0.	072	0.1	24	
CD at 5%	0.20	04 0.	204	N.:	S	

The effect of various salt levels on energy content of chhana spread is presented in *Table 1.5* The average energy content of chhana spread due to different salt levels, irrespective of various milk were recorded by 255.61, 254.59 and 253.29 at 1%, 1.5% and 2%, respectively. The highest energy content was recorded 301.79 in buffalo milk at 1% salt concentration, while it minimum by 222.13 in cow milk chhana spread at 2% salt level.

Table 1.6 shows the effect of different types of milk, coagulation temperatures and salt levels on energy content of chhana spread. In cow milk the maximum content of energy was noticed as 252.13 at 70°C. Coagulation temperature 60°C and 65°C recorded low values i.e. as 202.96 and 214.61, respectively. Likewise in salt level 1.5% showed the maximum energy content i.e. 224.14 and minimum as 222.13 at 2% salt level.

In case of buffalo milk on an average, energy contents of chhana spread with respect of different coagulation temperatures were recorded 298.00, 302.28 and 301.26 at 60°C, 65°C and 70°C. Similarly considering levels of salt, the maximum energy content was recorded 301.79 at 1% and minimum was recorded 299.21 at 2% salt level.

In admixture milk on an average energy content with respect of variation in coagulation temperatures was recorded 228.98, 245.22 and 245.05 at 60°C, 65°C and 70°C, respectively.

Table:1.6 Average energy content of chhana spread in percent on account of various type of milk, coagulation temperatures and different levels of salt

Types of milk	Coagulation Temperatu	ires	Di	fferent levels	of Salt (S)	Mean
		F	S ₁ (1%)	S ₂ (1.5%)) S ₃ (2%)	
Cow milk (M ₁)						
	$T_1(60^{\circ}C)$		203.56	203.63	201.70	202.96
	T ₂ (65°C)		215.60	214.60	213.65	214.61
	T ₃ (70°C)		253.26	252.09	251.05	252.13
	Mean		224.14	223.44	222.13	223.23
Buffalomilk (M ₂)						
	$T_{1}(60^{\circ}C)$		299.34	298.03	296.63	298.00
	T ₂ (65°C)		303.41	302.36	301.09	302.28
	T ₃ (70°C)		302.62	301.26	299.91	301.26
	Mean		301.79	300.55	299.21	300.51
Admixturemilk (M ₃)						
	$T_{1}(60^{\circ}C)$		230.02	228.93	228.00	228.98
	T ₂ (65°C)		246.34	245.21	244.12	245.22
	T ₃ (70°C)		246.37	245.28	243.51	245.05
	Mean		240.91	239.80	238.54	239.75
	Overall Mean		255.61	254.59	253.29	253.02
Factors	М	Т	S	-	MxTxS	
SE(m)+	0.0721	0.0721	0.07	21	0.2164	
CD at 5%	0.2045	0.2045	0.20	45	0.6136	

The salt level 1% recorded maximum content of energy, 240.91 and minimum 238.54 at 2% level of salt. The effect between types of milk, coagulation temperatures and levels of salts was found dependent as interaction (MxTxS) was recorded significant.

CONCLUSION

It was concluded that chhana spread can be successfully prepared by different kinds of milk i.e. cow milk, buffalo milk and their admixture milk. The recipe is standardized for chhana spread. Chhana spread prepared from cow, buffalo and admixture milk having 3.5%, 6% and 4.5% fat and 8.5%, 9% 8.7% SNF, respectively. The experimental treatments M_1T_1S (3.07), $M_1T_2S_1$ (3.19), $M_1T_3S_1$ (2.75) $M_2T_1S_1$ (3.05) $M_2T_2S_1$ (3.06) $M_2T_3S_1$ (2.41) $M_3T_1S_3$ (2.94) $M_3T_2S_3$ (3.08) $M_3T_3S_1$ (2.42) were found to be superior to other 18 treatments with regard lactose. The experimental treatments $M_1T_1S_1$ (203.56), $M_1T_2S_1$ (215.60), $M_1T_3S_1$ (253.26) $M_2T_1S_1$ (299.34), $M_2T_2S_1$ (303.71), $M_2T_3S_1$ (303.62) $M_3T_1S_1$ (229.92), $M_3T_2S_1$ (246.34), $M_3T_3S_1$ (246.89) were found to be superior to other 18 treatments 18 treatments with regard energy

RECOMMENDATION

With its high protein and low sugar content, it is highly recommended to the diabetic patients. It has also particular food value for those who possess the problem of milk intolerance. Chhana spread is a product which may be utilized as it is nutritionally rich. By incorporating different proportions of fat and SNF of milk, and by adding different herbal extracts like as mint, ginger, basil and fenugreek leaves (methi) etc. May be prepared various herbal spread. It have higher protein and low sugar content it also recommended for inclusion in diets to benefit children and adults as well as patients cardiovascular disorders, obesity and malnutrition syndromes.

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A study on adoption of hybrid rice production practices among the rice growers in Rampur Karkhana Block of Deoria District (U.P.)

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ABSTRACT

The study was conducted in purposively selected Rampur Karkhana block in Deoria district of Uttar Pradesh. Ten villages were selected purposively and 12 hybrid rice growers were selected from each selected village by using random sampling technique, thus a total sample size constituting 120 respondents. Data were collected through personal interview method with the help of interview schedule. The collected data were tabulated, analyzed and interpreted with the help of appropriate statistical tools. The study inferred that, most of respondents were found to have had higher level of adoption of hybrid rice production practices. Characteristics namely education (0.268**), socio-economic status (0.641**), economic motivation (0.465**), innovativeness (0.293**) and level of knowledge (0.534**) were found to be positively and significantly related to adoption behavior of the respondents respectively at 0.01 per cent level of probability. On the other hand, characteristics namely information seeking behavior (0.226*) was found to be positively and significantly related at 0.05 per cent level of probability with adoption behavior of the respondents respectively.

Key word: Knowledge; Adoption; Hybrid rice

INTRODUCTION

Rice is the most important and extensively grown food crop in India and it is the staple food for more than half of the world population. Rice is more than simply a food composed of carbohydrates, protein, fat and micronutrients.

Uttar Pradesh divided in to nine agro-ecological zones and rice is cultivated in all the zones. The hybrid rice is being popularized in all the up land and semi up land rice growing areas of U.P. As a result of organized effort made in promotion of hybrid rice in U.P. more than 90% of the acreage under hybrid rice in U.P. is restricted in central and eastern U.P. During Kharif season, rice is grown in most parts of Deoria district in Uttar Pradesh because of favorable agro-climatic factors. The scope for expanding hybrid rice production lies in enhancing productivity in this season.

In spite of efforts made by extension agencies and having great potential to increase the production and productivity of hybrid rice in Deoria district in U.P.

Yet, hybrid rice technology has not been adopted on a large scale as it was expected. As a result, there exists a gap in achieved yield and achievable yield due to ecological factors, availability of varieties in time and other critical factors and socio-economic factors besides constraints faced by growers in adoption of entire package of practices.

Several studies have indicated that the adoption of recommended hybrid rice practices gives high yields and income to the farmers. The yield levels of hybrid rice which are comparatively low at farmers field need to be increased substantially. Higher production can be achieved by adoption of all the recommended improved practices by large number of farmers. In general, recommended practices are not accepted by all the farmers at a time and also to full extent. It may be due to individual variability.

Keeping the above facts in view, a study entitled "A study on Adoption of Hybrid Rice Production practices among the hybrid rice growers in Rampur Karkhana Block of Deoria District" was under taken with the following specific objectives:

Objectives:

- 1. To ascertain the socio-economic and psychological attributes of the hybrid rice growers.
- 2. To determine the extent of adoption of the recommended hybrid rice production practices among the hybrid rice growers.
- 3. To findout the relationship between attributes of the hybrid rice growers and their extent of adoption of hybrid rice production practices.

METHODOLOGY

The present study was purposively undertaken in the Rampur Karkhana block in Deoria district of Uttar Pradesh state. Ten villages were also purposively selected from the selected block on the basis of higher number of hybrid rice growers available there in. From each selected village, 12 farmers were selected randomly constituting a sample of 120 as respondents.

The descriptive research design was followed in this study. The independent variables were measured by using suitable scale and procedure adopted by various researchers in past with some modifications. The dependent variable taken in this study was adoption behavior towards hybrid rice production practices which was measured by developed structured schedule.

An interview schedule was developed according to objectives set forth and the data were collected by arranging personal interview with 120 respondents. The collected data were classified, tabulated and analyzed in order to make the findings meaningful. The statistical tools were used to analyze the data as per requirement.

RESULTS AND DISCUSSION

SOCIO-ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE RESPONDENTS: The socioeconomic and psychological characteristics of the respondents were studied and the data have been given in *Table-1*.

 Table1. Distribution of respondents according to their socio-economic & psychological characteristics:

 (n=120)

S.N.	Category	Frequency	Percentage
1.	Age		
	Young (18-30 years)	37	30.83
	Middle (31-55 years)	40	33.33
	Old (above 55 years)	43	35.84
2.	Education	Frequency	Percentage
	Illiterate	28	23.33
	Up to middle	30	25.00
	Secondary education	40	33.33
	Graduate and above	22	18.34
3.	Hybrid rice cultivation experient	ce	
	Low (1-3 years)	34	28.33
	Medium (4-7 years)	41	34.17
	High (above 7 years)	45	37.50
4.	Socio-economic status		
	Low (6-10)	34	28.33
	Medium (11-14)	46	38.33
	High (15-18)	40	33.34
5.	Economic motivation		
	Low (5-12)	34	28.33
	Medium (13-19)	45	37.50
	High (20-25)	41	34.17

6.	Innovativeness		
	Low (9-15)	35	29.17
	Medium (16-21)	53	44.17
	High (22-27)	32	26.66
7.	Information seeking behavior		
	Low (12-20)	33	27.50
	Medium (21-28)	38	31.67
	High (29-36)	49	40.83
8.	Mass media exposure		
	Low (8-13)	34	28.33
	Medium (14-18)	49	40.83
	High (19-24)	37	30.84
9.	Extension participation		
	Low (6-10)	36	30.00
	Medium (11-14)	47	39.17
	High (15-18)	37	30.83
<i>10</i> .	Level of knowledge		
	Low (9-15)	31	25.83
	Medium (16-21)	47	39.17
	High (22-27)	42	35.00

1. Age : Age as personal profile of an individual helps in constructing the mind set towards acceptance of agricultural innovation.

As it is evident from the *table 1* that a bit higher percentage of the respondents (35.84%) belonged to old age group followed by 33.33 per cent in 'middle' and 30.83 per cent young age group respectively. Thus, it was concluded that majority of the respondents were old and middle age group and together accounted for 69.17 per cent of the respondents.

2. Education : Education plays an important role in individual's behavior. It provides knowledge and skill to participate in socio-economic life. the table 1 depicts that 33.33per cent respondents had studied secondary education level followed by up to middle level (25%), illiterate (23.33%) and 18.34 per cent of the respondents were educated up to graduate and above education level respectively.

3. Cultivation experience : Experience of cultivation provides the basic knowledge and skills. Besides, it also develops the confidence in farming and exposure to number of agricultural innovations. Table 1 depicts that 37.50 per cent of the respondents had hybrid rice cultivation experience above 7 years followed by 4-7 years of experience (34.17%) and 1-3 years experience (28.33%) cultivation experience of hybrid rice.

4. Socio-economic status : It refers to the positions, an individual or a family occupies in the society consisting of a number of higher and lower position. socio- economic status

provides risk bearing capacity to an individual and also helps against any stress and threat. A person is known by his status in the society. As it is evident from the *table 1* that most of the respondents (38.33%) had medium level of socioeconomic status followed by higher level (33.34%) and low level (28.33%) of socio-economic status. This reflects that more than one third respondents have had medium level of socio-economic status.

5. Economic motivation : It refers the values or attitude of an individual which give greater importance to profit maximization as the ends and means. In this study result indicates that majority of the respondents (37.50%) were found to have medium economic motivation followed by high (34.17%) and low (28.33%) economic motivation respectively.

6. Innovativeness : It is conceptualized as the degree to which an individual adopts new ideas relatively earlier than other in his serial system. It is also stated that innovativeness is one of the most important indicators of farming excellences. In this investigation, majority of the respondents (44.17%) were found to have had medium level of innovativeness character followed by low (29.17%) and high (26.66%) level of innovativeness respectively.

7. Information seeking behavior : Information seeking behavior means all activities performed by an individual to get scientific and technical information about farm technology useful in enhancing level of knowledge and productivity of enterprises taken on the farm. In this case, hybrid rice growers used different information sources to get hybrid rice production technology knowledge.

It is evident from the *table 1* that most of the respondents (40.83%) belonged to high level of information seeking behavior followed by medium (31.67%) and low (27.50%) level of information seeking behavior. It may be concluded that the respondents were used to utilize the available sources of information.

8. Mass media exposure : It is the degree to which an individual is exposed to mass media of communication. Multiple media exposure increases media influence in producing effects in the audience for each mass media tends to reinforce the others.

The *table 1* shows that majority of the respondents (40.83%) had medium level of mass media exposure followed by high (30.84%) and low (28.33%) respectively.

9. Extension participation : It refers the degree to which a farmer involves in extension educational activities organized by various development agencies with a view to interact and gain desired information related to the enterprises. In this study, it is evident from the *table 1* that most of the respondents (39.17%) belonged to medium level of extension participation followed by high (30.83%) and low (30.00%)

level of extension participation. It indicates that extension activities are not proved to be effective.

10. Level of knowledge : Knowledge is one of the important components of human behavior and plays a major role in the covert and overt behavior of the human beings. Once knowledge is acquired, it produces changes in the thinking process of an individual, which would lead to further changes in the mental aptitude.

In this investigation, it was found that the majority of the respondents (39.17%) have had medium level of knowledge followed by high (35.00%) and low (25.83%) level of knowledge about improved practices of hybrid rice cultivation. There is considerable scope for increasing the level of knowledge through intensive extension efforts.

EXTENT OF ADOPTION OF RECOMMENDED HYBRID RICE PRODUCTION PRACTICES:

Table2. Distribution of the respondent according to their adoption of hybrid rice production practices

			(n=120)
11.	Level of adoption	Frequency	Percentage
	Low (9-15)	21	17.50
	Medium (16-21)	44	36.42
	High (21-27)	55	46.08

Adoption is the decision to make full use of an innovation and it further implies that the adopter is satisfied with the innovation before he adopts it.

Table 2 depicts that the most of the respondents (46.08%) have had higher adoption level followed by medium (36.42%) and low (17.50%) adoption behavior about recommended hybrid rice production practices respectively. We may conclude that about half of the respondents had high level of adoption of improved production practices of hybrid rice cultivation.

RELATIONSHIP BETWEEN SOCIO-ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS WITH ADOPTION OF IMPROVED HYBRID RICE PRODUCTION PRACTICES:

Table 3: Relationship between socio-economic and psychological characteristics with adoption of improved hybrid rice production practices.

(N - 120)

		(11 - 120)
Sr. No.	Characteristics	'r' value
1.	Age	0.166 N.S.
2.	Education	0.268**
3.	Cultivation experience of hybrid rice	0.063 N.S.
4.	Socio-economic status	0.641**
5.	Economic motivation	0.465**
6.	Innovativeness	0.293**

7.	Information seeking behavior	0.226*
8.	Mass media exposure	0.128 N.S.
9.	Extension participation	0.023 N.S.
10.	Level of knowledge	0.534**

* = Significant at p=0.05

**= Significant at p=0.01

NS=Non-Significant

The result of correlation analysis in table 3 revealed that characteristics namely education (0.268^{**}) , socio-economic status (0.641^{**}) , economic motivation (0.465^{**}) , innovativeness (0.293^{**}) and level of knowledge (0.534^{**}) were positively and significantly at 0.01 per cent level related to adoption behavior of the respondents respectively. On the other hand, characteristics namely information seeking behavior (0.226^{*}) was positively and significantly related at 0.05 per cent level to adoption behavior of the respondents.

Thus, it can be concluded that all the above characteristics of the respondents were found to be positively and significantly correlated with adoption of improved hybrid rice production practices, indicating that higher in frequency of socio-economic and psychological characteristics of the respondents results greater the adoption of hybrid rice production practices.

The socio-economic and psychological characteristics namely age (0.166 N.S.), cultivation experience of hybrid rice (0.063 N.S.), mass media exposure (0.128 N.S.) and extension participation (0.023 N.S.) were found to positively but non significantly related to adoption behavior of the respondents respectively.

Thus, it can be concluded that all the above characteristics of the respondents were found to be positively and significantly correlated with adoption behavior, indicating that higher in frequency of socio-economic and psychological characteristics of respondents results higher the adoption behaviour of the respondents. However, age, cultivation experience of hybrid rice, mass media exposure and extension participation had insignificant influence on adoption behavior of hybrid rice growers.

CONCLUSIONS

Most of the respondents were of old aged, educated up to secondary education, sufficient level of hybrid rice cultivation experience, medium socio-economic status, economic motivation, innovativeness, knowledge and extension participation. However, they were found to have had high level of information seeking behavior consequently they were found to be in higher level of adoption of improved practices of hybrid rice production meaning thereby that as these variables increase the adoption level would also be increased.

IMPLICATION

Since the respondents in study area adopted higher level of simple agronomical practices and low cost inputs but the adoption of complex practices and high cost input were found to be medium or low level. Hence, emphasis should be given on the various aspects of practices whose adoption were low and medium. Attention should be paid by the extension functionaries to increase the adoption rate which in turn will increase the production of the hybrid rice. The attention should also be paid on the socio-psychological factors while making the extension strategies for transfer of technology.

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Knowledge and Attitude of the Paddy growers towards system of Rice intensification in Meja Block of Allahabad District of U.P.

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ABSTRACT

The study was conducted in purposively selected Meja block in Allahabad district of Uttar Pradesh. Ten villages were selected purposively and from each selected village 12 farmers were selected randomly thus 120 respondents constituting the sample size for the present study. Data were collected by using personal interview method. The collected data were tabulated, analyzed and interpreted with the help of appropriate statistical tools. Majority of farmers were found having medium level of knowledge and attitude towards system of rice intensification. Education and annual income were found positive and significant correlation with their knowledge of SRI whereas education had positive and significant association with their attitude towards System of rice intensification.

Key word: Knowledge; Attitude; System of rice intensification.

INTRODUCTION

The cultivation of earth is the most important labour of man. When tillage begins other arts follow. The farmers are therefore the founder of civilization. Rice (Oryza sativa) is world's second most important crop after wheat which remains a lifeline for world in general and Asia in particular where rice is the staple food and maximum human population of the world is concentrated. Humanity faces the biggest problem of adequate food and nutrition from originally huge but now continuously shrinking base of resources.

The SRI was conceptualized by Henri de Laulanie, a French missionary priest, in Madagascar during the early 1980s as a complimentary suite or rice management techniques. The main components of SRI include careful transplanting of single young seedlings at wider spacing, water management that keeps the soil moist but not continuously flooded, early and frequent (3 to 4 times) mechanical /manual weeding before canopy closure, and ensuring adequate nutrient supplies. The main purpose of this study was to get a clear-cut picture of the present situation of the knowledge and attitude towards System of rice intensification in Uttar Pradesh especially in Allahabad district where problems of scarcity as well as abundance of water were there.

Therefore, the present study "Knowledge and attitude of the respondents towards System of rice intensification in Meja block of Allahabad district of Uttar Pradesh" was planned with the following specific objectives.

- 1. To assess the socio-economic profile of the respondents.
- To determine the level of knowledge of the respondents about adoption of SRI technique of paddy crop.

- 3. To determine the attitude of the respondents towards SRI technique.
- 4. To find out the relationship between knowledge and attitude towards SRI technique of paddy crop and socio-economic characteristics of the respondents.
- 5. To find out the constraints and seek their suggestions to overcome the constraints and to suggest for better adoption of SRI technique.

METHODOLOGY

The present study was purposively undertaken in the Meja block in Allahabad district of Uttar Pradesh state. Ten villages were purposively selected from the selected block on the basis of higher number of farmers growing rice crop . From each selected village, 12 farmers were selected randomly by making a sample of 120 respondents. Pretested interview schedule were used for collection of data. The collected data were classified, tabulated and analyzed in order to make the findings meaningful. A simple ranking technique applied to measure the problems and suggestions to overcome problems of adoption of System of rice intensification. The statistical tools used to analyze the data were percentage, mean and standard deviation.

The present study was confined to ex-post-facto research design. The independent variables were measured by using suitable scale and procedure adopted by various researchers in past with due modification. The dependent variable taken in this study was knowledge and attitude towards System of rice intensification which measured by developed structured schedule on the basis of the attitude scale developed by Likert's (1932).

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RESULTS AND DISCUSSION

Socio-economical characteristics of the respondents:

The socio-economical, characteristics of the respondents were studied and the data have been given below.

Table 1. Distribution of respondents by the socio-economic status (n=120)

Age					
Category	Frequency	Percentage			
Young (21to 32 years)	21	17.50			
Middle (33 to 44 years)	59	49.16			
Old (45 to 56 years)	40	33.34			
Education					
Illiterate	29	24.17			
Primary (1 to 5th standard)	37	30.83			
Middle (6 to 8th standard)	23	19.17			
High School	17	14.17			
Intermediate	10	8.33			
Graduate and above	04	3.34			
Land Holding					
Marginal (up to 3 ha)	32	26.67			
Small (4.1 to 6.0 ha)	47	39.17			
Medium (7 to 9.0 ha)	29	24.16			
Big land(above 9.0ha)	12	10.00			
Annual Income					
Low (up to 1,50,000/-)	38	31.67			
Medium (1,50,000 to 2,50,000/-)	51	42.50			
High (above 2,50,000/-)	31	25.83			
Extension Contact		-			
Low (13 to 19 score)	25	20.83			
Medium (between 20 to 25 score)	65	54.17			
High (above 26 score)	30	25.00			
Mass media exposure					
Low (up to 11 score)	25	20.83			
Medium (between 18 to 21 score)	68	56.67			
High (above 21 score)	27	22.50			
Overall socio-economic status					
Low (up to 16 score)	36	30.00			
Medium (17 to 21 score)	61	50.83			
High (above 22 score)	23	19.17			

Socio-economical characteristics of the respondents:

The majority (42.50 %) of the respondents had medium level of overall socio-economic status, followed by 31.67 per cent and 25.83 per cent of respondents with low and high level of socio-economic status, respectively. The finding are supported by the finding of **Sain (2008)**

Knowledge and attitude of the respondents towards system of rice intensification:

Table 2.Distribution of the respondent according to their
knowledge and attitude towards system of rice
intensification(n=120)

Knowledge Level				
Category	Knowledge Score	Frequency	Percentage	
Low	Up to 10	36	30.00	
Medium	11-14	61	50.83	
High	Above to 14	23	19.17	
Mean = 12.1083		SD=1.1053		

Attitude Level				
Category	Attitude Score	Frequency	Percentage	
Low	Up to 36	29	24.17	
Medium	37-48	65	54.17	
High	Above to 48	26	21.66	
Mean = 42.908		SD=3.916		

Knowledge Level



Attitude Level

Knowledge and attitude of the respondents towards system of rice intensification: Table 2 Indicates that the majority (50.83 %) of the respondents possessed medium level of knowledge, followed by 30.00 per cent and 19.17 per cent of respondents possessed low and high level of knowledge about SRI of paddy crop, respectively. The majority (54.16%) of respondents had medium level of attitude towards system of rice intensification. While, 24.17 and 21.67 per cent respondents had low and high level of attitude towards system of rice intensification, respectively. The similar results were observed by of **Patel**, **A. C. 2006b** and **Thore**, **V.V. (2008)**

Relationship between the selected socio-economic characteristics and knowledge and attitude towards system of rice intensification:

Table 3: Relationship between the selected socio-
economic characteristics and knowledge and
attitude towards system of rice intensification

Knowledge level				
S.No.	Variables	Correlation coefficient ('r' value)		
1.	Age	-0.125NS		
2.	Education	0.256**		
3.	Land holding	-0.196*		
4.	Annual income	0.125 NS		
Attitude level				
1.	Age	-0.05708NS		
2.	Education	0.1990**		
3.	Land holding	0.17486**		
4.	Annual income	-0.18162*		
.1.	<u> </u>	071 1 0 1 1		

(n = 120)

* = Significant at 0.05 level of probability.

** = Significant at 0.01 level of probability.

NS = Non Significant.

Table 3 Out of four independent variables of the respondents, variable viz., education was found to have positive and significant correlation and land holding was found negatively significant with their knowledge of system of rice intensification. The one variables annual income of the farmers were non significantly associated with their knowledge of respondents towards system of rice intensification. Remaining age had negative and non-significant association observed with their knowledge of system of the rice intensification. The similar findings also reported by **Randriamibarisoa, R. and Uphoff, (2002).**

Out of four independent variables of the respondents, one variables education had positive and significant association observed with their attitude towards system of rice intensification. The variables viz. annual incomes of the respondents were negatively but significantly associated with their attitude towards system of rice intensification. Remaining variable viz., age was found to have negative and non-significant correlation with their attitude towards system of rice intensification. The finding is in support of **Patel, D. F.** (2006a) and **Patel, M. C., Chauhan, N. B. and Korat, D. M.** (2007).

CONCLUSIONS

Majority of the farmers belonged to middle age group having primary education and illiterate. These farmers had medium size of land holding. These farmers had medium level of extension contact, mass media exposure. These farmers possessed medium level of knowledge about system of rice intensification. Majority of the farmers were found to have medium level of attitude of system of rice intensification.

The variables, education of the farmers were positive and significantly associated with their knowledge of system of rice intensification. The variables viz. educations of the farmers were positive and significantly associated with their attitude towards system of rice intensification. Regarding problems of system of rice intensification, majority of the farmers facing the problems like cono-weeder not easily available and high price, high cost in nursery preparation, lack of timely technical guidance in time. These problems can be solved by certain extension strategies like organization of training programme, training on SRI technique should be conducted at village level establishment of co-ordination and availability of day to day farm services to the door of farmers.

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Assessment of nutrients intake of School Going Children (7-9 years) of Faizabad District

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ABSTRACT

School children may be at increased risk of nutrients deficiencies owing to increase energy expenditure combined with decreased meal frequency, reduced maternal attention and parasitic infections. Under nutrition reduces immunity and infections, reduce appetite, impair absorption and lead to catabolic losses of precious nutrients.

The aim of research is to study the "assessment of nutrients intake of school going children". Four hundred samples were selected from different schools. Dietary survey was done by questionnaire-cum-interview method. Finding revels that the most of the respondents were 7 year of age group. Most of respondents were from hindu religion. The nutrients consumption of respondents were lower than the Recommended Dietary Allowances (RDA). Nutrient intake of children was inadequate and anthropometric measurement (mean height and mean weight) were significantly (P<0.05) lower than the reference value.

Key words: Nutrients intake, Dietary Survey, Recommended dietary allowances

INTRODUCTION

Historically, the science of nutrition developed in part from the study of disease entities brought about by inadequate diet. Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilization in the body (**Vandana, 2012**). Nutrition plays a vital role, as inadequate nutrition during childhood may lead to malnutrition, growth retardation, reduced work capacity and poor mental and social development (**Awasthi, 2000**).

School children from the important vulnerable segment of population and constitute about 20 percent of total population of India. School age is the dynamic period of growth and development as children undergo physical, mental, emotional and social change during this stage. Once a child crosses the age of five, they are considered more or less safe from nutritional disorders. But little attention is paid to the quality of life.

Malnutrition refers to the situation where there is an unbalanced diet in which some nutrients are in excess, lacking or wrong proportion. Deficiency in nutrition inflict long-term damage to both individuals and society. Compared with their better-fed peers, nutrition-deficient individuals are more likely to have infectious diseases such as pneumonia and tuberculosis, which lead to a higher mortality rate. Nutritiondeficient individuals are less productivity at work (**WHO**, **2000**).

Objective :- To assess the nutrient intake of school going children (7-9 years).

MATERIALS AND METHODS

Research methodology is the plan, structure and strategy of investigation, so as to obtain answer to research question and control variance plan in the overall scheme.

Location of study :- The study was conducted in primary schools of Mawai Block of Faizabad District.

Sample Selection :- 400 school going children were selected for the study which was selected from different primary schools through purposively sampling. The nutrient intake information of the subject was collected with the help of questionnaire.

Collection of Data :- The primary tool used in the study was a detailed Performa. The information was obtained from the respondents by questionnaire cum interview method. Each subject was contacted individually and was persuaded to answer all the questions in the questionnaire and their responses were recorded.

Dietary Assessment :- Methods used for measuring food consumption of individual can be classified into two major groups (**Gopalan, 2007**). The first group known as quantitative daily consumption method consists of recall or records and the second group include the dietary history and food frequency questionnaire (**Gibson,1990**).

Statistical Tools :- The Collected data were classified in the light of the objective of study. The classified data were, tabulated and analyzed statistically with the help of approved statistical techniques.

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Percentage

The percentage values are calculated to make simple comparison.

Percentage= $\frac{f}{N} X100$ Where, f = Number of respondents in the event.

N = Total Number of respondents

Deficient Percent

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Deficient Percent = Standard (RDA) - Average intake
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RESULTS AND DISCISSION

Table 1:	Thiamin consumption	of	respondents	as
	compared to RDA			

Age	RDA	Girls		Bo	oys
group		Average intake	% Deficient	Average intake	% Deficient
7	1.0	0.61	0.39	0.57	0.43
8	1.0	0.59	0.41	0.58	0.42
9	1.0	0.56	0.44	0.63	0.37

Table 1 shows the thiamin consumption of respondents as compared to RDA. Maximum 0.44 percent deficiency of thiamin was found in the 9 year of age in girls respondents, whereas in boys respondents maximum 0.43 percent deficiency of thiamin was found in 7 year of age in comparison to RDA.

Minimum 0.39 percent deficiency of thiamin was found in 7 year of age in girls respondents, whereas in boys respondents minimum 0.37 percent deficiency of thiamin was found in the 9 year of age.

 Table 2: Riboflavin consumption of respondents as compared to RDA

Age	RDA	Girls		Bo	oys
group		Average %		Average	%
		intake	Deficient	intake	Deficient
7	1.2	0.67	0.53	0.84	0.36
8	1.2	0.86	0.34	0.70	0.50
9	1.2	0.72	0.48	0.73	0.47

Table 2 shows the riboflavin consumption of respondents as compared to RDA. Maximum 0.53 percent deficiency of riboflavin was found in the 7 year of age in girls respondents, whereas in boys respondents maximum 0.50 percent deficiency found in 8 year of age in comparison to RDA.

Minimum 0.34 percent deficiency of riboflavin was found in 8 year of age in girls respondents, whereas in boys respondents minimum 0.36 percent deficiency was found in the 7 year of age.

 Table 3: Nicotinic acid consumption of respondents as compared to RDA

Age	RDA	Girls		Bo	oys
group		Average intake	% Deficient	Average	% Deficient
		maxe	Dencient	maxe	Dencient
7	13	5.61	7.39	5.98	7.02
8	13	5.88	7.12	6.00	7.00
9	13	6.71	6.29	7.02	5.98

Table 3 shows maximum 7.39 percent and 7.02 percent deficiency of nicotinic acid was found in both girls and boys respondents, respectively. Minimum 6.29 percent and 5.98 percent deficiency of nicotinic acid was found in both girls and boys respondents, respectively as compared to RDA.

CONCLUSION

On the basis of summarized result it may be concluded that the nutrient intake of school going children was inadequate in their diet. The mean thiamin consumption was not good. The riboflavin and nicotinic acid was also lower than RDA.

RECOMMENDATION

There is an urgent need to educate mothers of school going children about the importance of balanced diet and promote the consumption of healthy food in children's diet to improve their nutritional status.

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Dietary pattern, food frequency and complications developed in menopausal women suffering from osteoporosis

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ABSTRACT

Osteoporosis is a disease of the skeleton in which the bone loses calcium and its density. After age 80, up to 70% of women develop osteoporosis. Health status of the respondents is measured by comparing weight for height of the respondents, of which maximum (40%) respondents were overweight whereas minimum (3.33%) respondents were severely obese. Osteoporosis is asymptomatic disease but as disease becomes severe, maximum patients complain various problems like loss of mobility, pain in climbing stairs; some had severe backache & some of them complained of pain during bed time & were unable to do heavy work. Most of the respondents consumed 2 cups of tea/ coffee daily. Daily intake of milk was maximum (12) among elderly women. Consumption of green leafy vegetables was highest. There was daily consumption of pulses by the respondents as most of them were vegetarian. It is concluded that dietary pattern of menopausal women suffering from osteoporosis, indicates that about 70% of the respondents are vegetarian, 20% non-vegetarian & about 10% ovetarian, which was comparable to standard values. Calcium intake was low and below ICMR recommended dietary allowances. Disease and its complication lead to loss of appetite and poor health status. Excessive intake of tea/ coffee and table salt by females led to more complications. Milk and milk products consumption was also very less by the females.

INTRODUCTION

Menopause is the permanent end of menstruation and fertility. With declining oestrogen levels, midlife women are at increased risk of developing osteoporosis, which are greatly affected by diet. The reduction in bone mass eventually leads to deterioration of micro-architecture of bone tissue and thus to reduce bone quality (Matos et.al; 2005; Ramachandran et.al., 2003). Recommended dietary calcium in the average diet ranges from 400-800 mg/day, depending on the type of diet consumed and cultural factors. Therefore, supplementation of 400 mg/day is sufficient except for pregnancy and after menopause, where 800 mg/day is appropriate (Cellotti and Bignamini 2000). Urinary calcium loss increases at the menopause and an extra 200 mg over the premenopausal recommended dietary intake of 800 mg/day is estimated to be needed to maintain calcium balance (Truswell et. al., 2000). The hip fracture patients had lower intake of energy, fat, carbohydrate, calcium, potassium, magnesium and iron (Dhar et. al., 2001). Various problems are associated with menopause so there is a need to study the problem related to menopause.

The present study was conducted with an objective to observe the dietary pattern and complications of menopausal disorders among the elderly women.

MATERIALS AND METHODOLOGY

The following methodology was adopted for the study. **Selection of sample:-** three stages of sampling were adopted for the present study.

- 1. Allahabad city is selected for the study.
- 2. Different government & semi government hospital from different areas of Allahabad were selected in order to cover most of the patients of Allahabad city.
- 3. Menopausal women are selected and grouped according to the income levels of their families.
- 4. 30 respondents were taken for the study.

Method of enquiry & collection of data: -

Dietary survey method was adopted to collect the data from selected respondents who were interviewed personally with the help of questionnaire and tabular method was adopted for the analysis & interpretation of results. (Gopalan, *et. al.*, 2004)

RESULTS AND DISCUSSION

Table 1: Average distribution of respondent on the basis of their BMI

BMI (kg/m ²)	Total %
Very severely underweight (Less than 15)	-
Severely underweight (From 15-16)	-
Underweight (16-18.5)	6.67
Normal (healthy weight) (18.6-25)	36.67
Overweight (25-30)	40
Obese Class I (Moderately obese) (30-35)	13.33
Obese Class II (Severely obese) (35-40)	3.33
Obese Class III (Very severely obese) (Above 40)	-

Average distribution of the respondents is measured by comparing weight for height of the respondents, of which maximum (40%) were overweight whereas minimum (3.33%) were severely obese. 36.67% of respondents were normal i.e. of healthy weight while none of them were neither very severely underweight, severely underweight, or very severely obese. 6.67% of the respondents were underweight and 13.33% of them were moderately obese. **Langsetmo** *et.al.*, (2011) studied the relation between dietary patterns and incident fracture and possible mediation of this relation by body mass index, bone mineral density, or falls. The associations were independent of body mass index, bone mineral density, falls, and demographic variables. A diet high in vegetables, fruit, and whole grains may reduce the risk of low-trauma fracture, particularly in older women.

 Table 2 Average percentage complications observed in menopausal women suffering with osteoporosis

COMPLICATIONS	Total %
Loss of mobility	63.33
Pain in climbing stairs	53.33
Backache	33.33
Can't do heavy work	26.67
Pain during bed time	13.33
Fracture	26.67
No major changes	20

Most of the respondents suffered from multiple complications of which maximum (63.33%) were suffering from loss of mobility whereas minimum (13.33%) were suffering from pain during bed time. 20% of them had none of the above complications. 26.67% of the elderly women had fracture and can't do heavy work. 53.33% of the respondents suffered from pain in climbing stairs whereas 33.33% of them had backache.

 Table 3 Distribution of the respondents based on dietary pattern, food frequency and keeping fast

TYPE OF FOOD ITEMS	AVERAGE
	(%)
Vegetarian	70
Non-vegetarian	20
Ovetarian	10
FOOD HABITS	AVERAGE
	(%)
Breakfast + Dinner	6.67
Breakfast + Lunch + Dinner	10
Breakfast + Mid-morning + Lunch + Dinner	33.33
Breakfast + Lunch + Evening tea + Dinner	50
FREQUENCY OF KEEPING FAST IN A	AVERAGE
WEEK	(%)
Once	53.34
Twice	3.33
Monthly	23.33
Never	20
FREQUENCY OF INTAKE OF	AVERAGE
TEA/COFFEE PER DAY	(%)
1 cup	3.33
2 cups	46.66
3 cups	20
4 cups	16.66
Never	6.66

The average percentage of different food items indicates that maximum (i.e. 70%) were vegetarian, whereas minimum (i.e. 10%) were ovetarian. Only 20% of the total respondents were non-vegetarian. The average percentage of food habits indicates that the maximum (50%), followed dietary pattern which is Breakfast + Lunch + Evening tea + Dinner while minimum (6.67%) followed dietary pattern which is Breakfast + Dinner. 33.33% followed dietary pattern which is Breakfast + Mid-morning + Lunch + Dinner and 10% followed dietary pattern which is Breakfast + Lunch + Dinner. Helen et.al., (2004) conducted a study to ascertain the dietary factors influence perimenopausal skeletal loss. Fruit and vegetable intake may protect against premenopausal bone loss. The above table shows that, maximum respondents (53.34%) kept fast once in a week while minimum (3.33%) kept fast twice in a week. 23.33% of them kept fast once in a month whereas 20% of them never kept fast. Maximum respondents (46.66%) consumed 2 cups of tea/coffee per day while minimum (3.33%) consumed 1 cup of tea/coffee per day. 6.66% of respondents never consumed tea/coffee, 20% of them consumed 3 cups of tea/coffee per day while 16.66% consumed 4 cups of tea/ coffee per day.

Food items	Daily	Occasionally	Never
Milk	12	10	8
Cheese	1	18	11
GLV	17	13	-
Pulses	25	5	-
Egg	-	3	22
Meat/Fish	-	7	20

Table 4 Average intake of different food items by the respondents

Among vegetarian respondents, 12 of them daily consumed milk, 10 of them occasionally and 8 never consumed milk; only 1 respondent consumed cheese daily, 18 of them occasionally while 11 never consumed cheese; almost all the respondents had included green leafy vegetables daily in their diet i.e. 17 respondents whereas 13 occasionally; most of them (25) consumed pulses daily and the least (5) occasionally. 7 respondents were non-vegetarian while 3 were ovitarian. The consumption of cheese was minimum (1) while consumption of pulses was maximum (25). Langsetmo et.al., (2011) studied the relation between dietary patterns and incident fracture and possible mediation of this relation by body mass index, bone mineral density, or falls. He identified 2 dietary patterns by using factor analysis. The first factor (nutrient dense) was strongly associated with intake of fruit, vegetables, and whole grains. The second factor (energy dense) was strongly associated with intake of soft drinks, potato chips, French fries, meats, and desserts. The nutrientdense factor was associated with a reduced risk of fracture. The energy-dense pattern was not related to fracture. A diet high in vegetables, fruit, and whole grains may reduce the risk of low-trauma fracture, particularly in older women.

Table 5 Average daily dietary nutrient intake of menopausal women

NUTRIENT	RDA	OBSERVED	DIFFERENCE
		AVERAGE VALUE	
Energy	1875 kcal	1628.24 kcal	246.76
Carbohydrate	468.75 gm	428 gm	40.75
Protein	50 gm	57.2 gm	-7.2
Fat	20 gm	23 gm	-3
Calcium	400 mg	254 mg	146
Vitamin D	1000 IU	568 IU	432

Energy, carbohydrate, protein, fat and calcium were calculated by 24 hr dietary recall. (**Gopalan**, *et. al.*, **2004**). The observed average calcium value was 254 mg which is below the RDA value i.e. 400mg and the observed average vitamin D value was 568 IU which is below the RDA value i.e. 1000 IU. The average older man and woman will need intakes of at least 20 to 25 mcg (800 to 1,000 IU) per day of vitamin D (3) to reach a serum 25(OH) D level of 75 nmol/l. Based on the available evidence, if older men and women maintain serum levels of 25 (OH) D that are higher than the consensus median threshold of 75 nmol/l, they will be at lower risk of fracture. **Dawson et.al., (2005). Cellotti and Bignamini (2000)** recommended dietary calcium in the average diet ranges from 400-800 mg/day depending on the type of diet consumed and cultural factors. Therefore, supplementation of 400 mg/ day is sufficient except for pregnancy and after menopause, where 800 mg/day is appropriate.

CONCLUSION

Average distribution of the respondents, on the basis of their BMI, is measured by comparing weight for height of the respondents, of which maximum were overweight whereas minimum were severely obese. In case of multiple complications, maximum numbers of respondents were suffering from loss of mobility while minimum was suffering from pain during bed time. Largely the intake of 2 cups of tea/ coffee per day was observed. The average percentage of different types of food items indicates that maximum numbers of respondents were vegetarian and among them, almost all the respondents had included the green leafy vegetables daily in their diet. The consumption of cheese was minimum (1) while consumption of pulses was maximum (25) among all the food products. The observed average calcium value was 254 mg which is below the RDA value i.e. 400mg and the observed average vitamin D value was 568 IU which is below the RDA value i.e. 1000 IU. Poster and charts have been used to educate the menopausal women belonging to the three groups.

RECOMMENDATION

Risk of occurrence of osteoporosis in females is due to decrease in oestrogen level after menopause, low bone density, less consumption of calcium rich products. Females having Calcium deficiency at adolescent age and during pregnancy are more prone to osteoporosis at menopause. Thus females should give more attention to their dietary calcium intake during early stages of life, childhood, adolescence and reproductive age group. They should include calcium rich foods like milk and milk products, green leafy vegetables, egg etc. Intake of tea/coffee should be reduced. Foods rich in isoflavons and phytoestrogen should also be included in the diet as they mimic the function of oestrogen. Oestrogen plays a protective effect on bones as they influence calcium absorption from the gut & reduce bone loss.

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Preparation of value added food products by incorporation of carrot flour in wheat flour

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ABSTRACT

Wheat belongs to the genus- Triticum and there are 30,020 species. The kernel of wheat is usually 1/8 - ¹/₄ inches long. Wheat is consumed mostly in the form of flour obtained by milling the grain. Wheat flour is an excellent source of complex carbohydrates. In addition, wheat flour contains B-vitamins, calcium, iron, magnesium, phosphorus, potassium, zinc, minimal amounts of sodium and other trace elements. https://en.wikipedia.org/wiki/wheat. Carrot is the richest source of beta-carotene among all the root vegetables; therefore it holds an important position among vegetables. Its common Hindi name is Gajar. Carrot can also promote colon health as it is rich in fiber. Vitamin A deficiency remains widespread in many countries in South Asia and contributes to a significant proportion of preventable blindness (Bloe, 1997) Vitamin A.

The objectives of present research were to evaluate the sensory attributes of prepared products and to assess the nutritional quality of the prepared products. Carrot flour were incorporated in wheat flour recipes viz- Ladoo and Cookies with one control (T_0) and four treatments for each products T_1 , T_2 , T_3 and T_4 at different percentage incorporation levels with Carrot flour for all two products using their standard ingredients and method of preparation. Sensory evaluation of the prepared products was done by 9 point hedonic scale. The nutritive value of prepared food products was calculated by using the food composition table (Gopalan, 2007).

Result showed that based on the expert panel evaluation of two products, showd that the highest overall acceptability was found in T_3 (30%) in case of Ladoo and T_2 (20%) in cookies. All the experimental prepared products were fond to be acceptable. Significant Difference (P<0.05) in flavour and taste, body and texture and colour and appearance between various treatment combinations was found. The prepared products were found to be low in calories and carbohydrate but high in fibre, calcium, iron, phosphorus, sodium potassium and carotene content. It was concluded from the results that the products formulated by incorporation of Carrot flour in wheat flour at different level can improve the nutritional quality of products as well as variety in the diet.

Key words: Carrot, Wheat Flour.

INTRODUCTION

Wheat grains are ovoid in shape, rounded on both the ends. Along one side of the grain there is a crease, a folding of the aleorone and all the covering layers. Wheat proteins are rich in glutamic acid and low in Tryptophan. Glutamic acid and aspartic acid are present in amide form as glutamine and aspargine. **Carrot** (*Daucus carota*) is a root vegetable, usually orange or red- white blend in color with crisp texture when fresh. Carrot gets its characteristic and bright orange color from β - carotene, which is metabolized into vitamin A in human when bile salts are present in the intestines. Carrots are also rich in dietary fiber, and antioxidants. Carrot can also promote colon health as it is rich in fiber. India is a second largest vegetable producer in the world after china. Vegetable are grown in an area of about 6.09 million hectares in India. At

present the total vegetable production in India has gone up from 63.8 to 113.00 million tones about a period of a decade recording increase of 33 percent (**Singh 2008**)

MATERIALS AND METHODS

The present study entitled "Preparation of value added food products by incorporation of carrot flour in wheat flour" was conducted in the Nutrition Research Laboratory of Foods and Nutrition Department, Ethelind School of Home Science, Sam Higginbottom Institute of Agriculture Technology and Sciences, (Deemed-to-be-University), Allahabad.

Procurement of Raw Materials: The required materials i.e. fresh Carrot flour and other row materials were collected from local market of Allahabad city.

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Method and Preparation of Flour:

Flow chart for the preparation of Carrot Flour

Fresh Carrot ↓

Washing

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Trimming

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Slicing (Blanching for 3 minute in water containing 2% salt and 0.1% citric acid)

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Sun drying

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Draining

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Spreading in trays

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Mechanical drying up to 5-10% moisture content (60±2°C for 8 hours)

ſ

Grinding

↓

Carrot Flour

Source- Shrivastava. (2007). A Text book on Principal of Food Preservation

Detail of control and treatments:

Table of treatments and replication of Carrot Ladoo and Cookies.

Treatments						
Products	T0	T1	Т2	Т3	T4	Replications
Whole Wheat						
Flour	Control	90%	80%	70%	60%	5
Carrot Flour	-	10%	20%	30%	40%	5

- **a.** Control (\mathbf{T}_0) : Control T0 was prepared without incorporating Carrot Flour.
- **h Treatment T₁:** In This treatment 10 percent Carrot Flour was incorporated in 90 percent Whole Wheat Flour.
- c. Treatment T_2 : In This treatment 20 percent Carrot Flour was incorporated in 80 percent Whole Wheat Flour.
- **d** Treatment T₃: In This treatment 30 percent Carrot Flour was incorporated in 70 percent Whole Wheat Flour.
- e. Treatment T_4 : In This treatment 40 percent Carrot Flour was incorporated in 60 percent Whole Wheat Flour.

Organoleptic Evaluation of the Prepared Products:

Freshly Prepared Products Carrot flour Ladoo and Carrot flour Cookies were served to taste panel members consisting of 5 experienced persens. The 9 point hedonic scale Performa as suggested by **American** *et al.* (1965).

Calculation of Nutritive Value of Prepared Products:

The nutrient compositions as available in **Gopalan's** (2007) publication were used for calculating nutritive value of the products. Protein, Fat, Carbohydrate, Energy, fiber, iron, calcium, Phosphorus, Sodium Potassium and Carotene of the control and enriched products were thus assessed by Calculation.

Formula:

Nutrient /100g of product = Ingredient used (g)×Nutritive value of Ingredient / 100

Statistical Analysis of the Products:

After tabulating the data obtained from sensory evaluation was statically analysed by using two way Analysis of Variance techniques. Significant difference between the treatments was determined by using CD (critical difference) test.

RESULT AND DISCUSSION

The entire experiment was undertaken to prepare enriched products i.e. healthy and nutritious products - Carrot flour Ladoo and Carrot flour Cookies using different Flours combinations. Results related to formulation and standardization of healthy and nutritious products i.e sensory evaluation and nutritional composition have been presented and discussed in this chapter.

Sensory	Scores on 9 point hedonic scale								
characteristics/ treatment	Colour and Apprearence	Body and Texture	Taste and Flavour	Overall Acceptability					
	Mean±S.E	Mean±S.E	Mean±S.E	Mean±S.E					
T ₀ (Control)	7 ± 1.87	6.92±0.291	6.56 ± 0.221	6.83 ± 0.148					
T ₁ (10%)	7.76 ± 0.153	6.88 ± 0.145	7.08 ± 0.133	7.18 ± 0.167					
T ₂ (20%)	7.58 ± 0.114	7.6 ± 0.178	7.44 ± 0.118	7.54 ± 0.136					
T ₃ (30%)	8.84 ± 0.066	8.84 ± 0.087	8.884 ± 0.066	8.88 ± 0.171					
$T_4(40\%)$	7.96 ± 0.143	8 ± 0.056	8.08 ± 0.061	8.03 ± 0.036					
F Value	15.26S	4.487S	44.590S	69.78S					
CD Value	0.513	0.627	0.432	0.286					

Organoleptic Evaluation of the Prepared Products:

Table 1. Average sensory scores of different parameters in control and treated sample of Carrot Ladoo.

table shows significant result, it is desirable to compare all possible combinations of two treatments at a time for which CD test has been applied. Difference between two treatments mean have been compared against the CD value.

Carrot Ladoo, the sensory score of T3 (30 percent) was best regarding the overall acceptability followed by T4 (40 percent), the treatment T2 (20 percent) was found to be more acceptable than T1 (10 percent) and T0 (control).

Table 2. Average sensory scores of different parameters in control and treated sample of Carrot Cookies.

Sensory		Scores on 9 point hedonic scale								
characteristics/	Colour and	Body and	Taste and	Overall						
treatment	Apprearence	Texture	Flavour	Acceptability						
	Mean±S.E	Mean±S.E	Mean±S.E	Mean±S.E						
T ₀ (Control)	6.56 ± 0.191	6.56 ± 0.191	6.8 ± 0.178	6.63 ± 0.193						
$T_1(10\%)$	7.68 ± 0.155	7.56 ± 0.143	7.48 ± 0.145	7.56±0.173						
T ₂ (20%)	8.6±0.126	8.48±0.133	8.6±0.160	8.58±0.133						
T ₃ (30%)	7.64 ± 0.182	7.52 ± 0.107	7.76 ± 0.143	7.60 ± 0.182						
$T_4(40\%)$	6.92±0.216	6.76±0.131	6.18±0.113	6.83±0.163						
F Value	41.33S	34.81S	38.10S	147S						
CD Value	0.366	0.386	0.36	0.803						

table shows significant result, it is desirable to compare all possible combinations of two treatments at a time for which CD test has been applied. Difference between two treatments mean have been compared against the CD value.

In **Carrot Cookies**, the sensory score of T2 (20 percent) was best regarding the overall acceptability followed by T3 (30 percent), the treatment T1 (10 percent) was found to be more acceptable than T4 (40 percent) and T0 (control).

Calculation of Nutritive Value of Prepared Products:

Table 3. Nutrient Composition (per 100g.) in control and treated sample of Carrot Ladoo.

Nutrients	Protein	Fat	Fiber	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Carotene	Sodium	Potassium
Treatments	(g)	(g)	(g)	(g)	(Kcal)	(mg)	(mg)	m(g)	(µg)	(mg)	(mg)
T ₀	9.57	11.94	1.9	62.47	395.51	162.32	279.94	3.04	80.54	10.81	170.27
T ₁	9.35	11.93	2.11	62.83	395.24	160.59	279.51	2.94	176.27	11.65	159.08
T ₂	9.13	11.92	3.2	63.19	394.97	158.86	279.24	2.85	272	12.49	147.89
T ₃	8.90	11.91	4.28	64.62	394.37	157.13	278.64	2.75	367.72	13.34	136.70
T_4	8.68	11.90	5.37	63.90	394.43	155.40	278.21	2.65	463.45	14.18	125.51

Table 3. shows the nutrient content of the prepared product Carrot Ladoo with or without incorporation of Carrot Flour (Carrot Flour and Whole Wheat Flour).

Nutrient Estimation showed that T_4 (40 percent) has the maximum Fat, Fibre, Carbohydrate, Phosphorus, Carotene and Sodium content and T_0 (Control) has the minimum Fat, Fibre,

Carbohydrate, Phosphorus, Carotene and Sodium content in Carrot Ladoo.

The Protein, Energy and Potassium estimation for Carrot Ladoo shows that T_0 (control) has the maximum Protein, Energy and Potassium content for each product respectively.

Nutrients	Protein	Fat	Fiber	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Carotene	Sodium	Potassium
Treatments	(g)	(g)	(g)	(g)	(Kcal)	(mg)	(mg)	m(g)	(µg)	(mg)	(mg)
T ₀	8.06	21.00	0.17	188.63	458.74	17.07	145.74	1.23	34.27	3.64	50.98
T ₁	7.94	21.03	0.96	188.71	458.23	16.80	140.92	1.25	103.88	4.67	50.11
T ₂	7.82	21.05	1.81	188.79	457.80	16.52	163.58	1.26	149.01	5.70	49.25
T ₃	7.71	21.08	2.67	188.87	457.05	16.25	181.19	1.28	243.09	6.74	48.39
T ₄	7.59	21.10	3.52	188.96	456.86	15.90	172.33	1.29	312.70	7.77	47.52

Nutrient Composition (per 100g.) in control and treated sample of Carrot Cookies.

Table 3. shows the nutrient content of the prepared product Carrot Cookies with or without incorporation of Carrot Flour (Carrot Flour and Whole Wheat Flour).

The Nutrient Estimation showed that T_4 (40 percent) has the maximum Fat, Fibre, Carbohydrate, Phosphorus, Carotene and Sodium content and T_0 (Control) has the minimum Fat, Fibre, Carbohydrate, Phosphorus, Carotene and Sodium content in Carrot Cookies.

The Protein, Energy and Potassium estimation for Carrot Cookies shows that T_0 (control) has the maximum Protein, Energy and Potassium content for each product respectively.

CONCLUSION

From the findings of the study undertaken, it was concluded that Carrot, Flours can be successfully incorporated with Wheat Flour to enhance the sensory and nutritional properties of the products were made there after. Regarding the sensory scores of the prepared products with different flours were highly acceptable in terms of taste and flavour, body and texture, colour and appearance and overall acceptability when compared with control. Nutrients Composition of prepared products showed that low carbohydrate contents as compared to control. The amount of the energy, protein, fat, fiber, calcium, iron, sodium, potassium and carotene content were increase as the incorporation level increased.

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Preparation of spirulina based nutritious namakpara flavoured with thyme and oregano

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ABSTRACT

With the current trend in nutritional and health awareness, the consumers demand for high protein, high fiber and calcium products with acceptable sensory characteristics. The present study was carried out with different levels (5%, 10% and 15%) of spirulina, (90%, 85% and 75%) whole wheat flour and (5%) each of thyme and oregano, to assess the organoleptic and nutritive value of the prepared products namely "Namakpara" and which were served as treatments T_1 , T_2 and T_3 respectively, without incorporation of "Spirulina, Thyme and Oregano" (T_0) served as control. They were replicated five times for all 2 products and organoleptic evaluation was carried out using the nine point hedonic scale. Nutritional composition was calculated using the food composition table, data obtained during investigation were statiscally analyzed by using analysis of variance (ANOVA) and critical difference (CD) techniques. On the basis of findings, it was concluded that in case of Namakpara 15 percent incorporation level treatment (T_3) was the best with regard to colour, treatment (T_1) and (T_2) was best scored with regard to body and texture, treatment (T_1) for taste and flavour and treatment (T_2) for overall acceptability.

Key words: Spirulina, Thyme, Oregano.

INTRODUCTION

Spirulina is a type of blue-green algae that thrives in warm, alkaline fresh-water bodies. Spirulina is being developed as the "foods of the future" because of its amazing ability to synthesize high-quality of protein and concentred food more efficiently than any other algae. Spirulina contains unusually high amounts of protein, between 55 percent and 77 percent by dry weight, depending upon the source. It is a complete protein, containing all essential amino acids, though with reduced amounts of methionine, cysteine and lysine when compare to the proteins of meat, egg and milk. It is however, superior to typical plants proteins, such as that from legumes. Spirulina is rich in vitamins, minerals, and carotenoids, antioxidants. It contains nutrients, including B complex vitamins, beta-carotene, vitamin E, manganese, zinc, copper, iron, selenium, and gamma linolenic acid (Caire et al. 2000). Spirulina increases production of antibodies, infection-fighting proteins, and other cells that improve immunity and help ward off infection and chronic illnesses such as cancer. (Puvfoulhoux et al. 2001). Spirulina protect against allergic reactions by stopping the release of histamines. Spirulina boosted the growth of L. acidophilus and other probiotics. (Blinkova et al 2001). United Nations recommends that "Spirulina is the most ideal food for mankind." US Department of Agriculture in October 1988 published "Spirulina: Food for the Future." Spirulina is the only plant that has GLA. (Akalin et al. 2009).

Nowadays, Spirulina has been marketed and consumed as a human food and has been approved as a food for human consumption by many governments, health agencies and associations of these countries (Vonshak, 2002; Koru, 2009, Henrikson, 2010).

Thyme and oregano commonly called as "banajwain" and "Sathra or Miranjosh". Both are widely used herb in Europe, Asia, Western Mediterranean region and south-east Italy. In India, Thymus serpyllum is distributed from Kashmir to Kumaon Himalaya and oregano is found in temperate Himalayas from Kashmir to Sikkim (Azizi 2010, Spices board India). Both the herbs are endowed with several medicinal properties; antimicrobial agents, antioxidants. They are used in the treatment of bronchitis, whooping cough, catarrh. Thyme and thyme oil have been used as antiseptics, disinfectants and mouth washes. Thyme is prescribed with other herbs for asthma, hayfever. Oregano can be used in number of recipes like pizza, pasta, syrups, salad, dressings and different Italian sauces. Fresh and dried oregano leaves have volatile oils possesses carminative, stomachic, diuretic, diaphoretic, antibacterial, antioxidant and anti-microbial properties, and are shown to inhibits stubborn bacteria like pseudomonas aeruginosa and staphylococcus aureus. The phytonutrients, thymol, carvacrol and rosmarinic acid, present in oregano leaves acts as strong antioxidants that can fight against the free radicals in the body. (Lambert et al. 2001).

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MATERIALS AND METHOD

Procurement of raw materials:

Spirulina was purchased from Medizen labs, Bangalore-18.

Thyme and oregano were purchased from the Big Bazaar, civil lines, Allahabad.

Other Ingredients- other ingredients like whole wheat flour, salt, ajwain, oil were purchased from local market of Allahabad.

Table 1: Details of control and treatments of products:

Experiment site:

The present investigation was carried out in the Foods and Nutrition laboratory, Department of Ethelind School of Home Science (AAI-DU), Sam Higginbottom Institute of Agriculture, Technology and sciences, Deemed-to-be University, Allahabad.

Formulation and preparation of food products

Products /	TO	T1	T2	T3		
Treatment	Whole wheat flour	(whole wheat	(whole wheat	(whole wheat flour		
		flour+spirulina+thyme)	flour+spirulina+oregano)	+spirulina+thyme +oregano)		
Namakpara	100g	90% : 5% : 5%	85% : 10% : 5%	75% : 15% : 5% : 5%		

No. of replication: the control and each treatment is replicated five times.

Spirulina based food products were made flavorued with thyme and oregano at different ratios and evaluated by sensory evaluation method to obtain the best ratios. The three combinations respectively were then be used as treatments (T_1, T_2, T_3) for the development of one products i.e Namakpara.

Organoleptic Analysis

Sensory evaluation of the prepared products were done by a trained panel of 10 judges selected from among the faculty members of the Ethelind School of Home Science for the sensory attributes i.e. colour and appearance,

Sensory characteristic of the products

consistency, tastes and flavours and all acceptability of the prepared products by using nine points Hedonic rating (9like extremely and 1-dislike extremely) (Srilakshmi, 2008). The samples were placed before the judge with sample code, T_1 , T_2 and T_3 . The panel of judges graded the coded samples of the product.

Statistical analysis

Analysis of variance technique (ANOVA), CD, and other appropriate statistical tests was used to analyze the data. The data obtained from sensory evaluation were statistically analyzed by using analysis of variance technique (one way classification). Significant difference between the treatments was determined by using CD (critical difference) test.

Treatments	Colour	Texture	Taste & flavour	Overall acceptability
T ₀	7.96±0.11	8.24±0.20	8.16±0.9	8.09±0.18
T ₁	8.4±0.04	8.48±0.06 8.48±0.06		8.42±0.12
T ₂	8.44±0.02	8.48±0.06	8.6±0.06	8.49±0.16
T ₃	8.52±0.20	8.2±0.17	8.28±0.10	8.28±0.20
F-test	S	NS	S	S
CD	0.06	0.13	0.12	0.12

Table 1. Average sensory scores of different parameters in control and treated samples of Namakpara.

The data illustrated in the above pertaining to the average sensory scores of different parameters in control and treated sample of Namakpara, clearly indicates that treatments T₃ (8.52) had the highest score followed by (8.44) in T₂, (8.4) in T_1 and (7.96) in T_0 making it quite obvious that the addition of spirulina to the treatments have significant influence on the colour and appearance of Namakpara. While an increase in the amount of spirulina increased the colour acceptability of Namakpara. The mean scores of Namakpara in relation to texture, which indicates that the highest score obtained for texture of Namakpara from spirulina flavoured with thyme and oregano treatments T_1 (8.48) and T_2 (8.48) has the highest

score followed by (8.24) in T₀, (8.2) in T₃ making it quite obvious that the addition of spirulina flavoured with thyme and oregano effect the texture of Namakpara. While an increase in the amount of spirulina increases the texture acceptability of Namakpara. The mean scores of Namakpara in relation to Flavour and Taste, which indicates that treatment the highest score obtained for taste and flavour of Namakpara from spirulina flavoured with thyme and oregano was recorded (8.6) in T₂ followed by (8.48) in T₁, (8.28) in T₂, (8.16) in T₀ making it quite obvious that the addition of spirulina effects the Flavour and Taste of Namakpara. The above table shows the mean scores of Namakpara in relation to overall acceptability which indicates that the treatment T_2 (8.49) has the highest score followed by (8.42) in T_1 , (8.28) in T_3 , (8.09) in T_0 respectively. So it can be concluded that the addition of spirulina improved overall acceptability of Namakpara.

Nutritive value of standard recipes and treatments (nutrient/ 100g)

Table .2: Average percentages of nutrients in control and treated sample of "Namakpara"

Treatment Nutrient	T ₀	T ₁	T ₂	T ₃
Energy (Kcal)	791	766.44	784.15	769.5
Protein (g)	12.1	14.04	16.58	18.52
Carbohydrate (g)	69.4	64.87	64.59	60.07
Fat (g)	51.7	51.99	52.7	53.01
Iron (mg)	4.9	6.7	9.2	11.03
Calcium (mg)	48	69.45	131.6	153.05

The *Table No.2*. Presented above shows the nutrient contents of Namakpara with or without incorporation of spirulina, thyme and oregano at three different level- T_1 (90% Whole wheat flour, 5% spirulina and 5% thyme), T_2 (85% whole wheat flour, 10% spirulina and 5% oregano) and T_3 (75% whole wheat flour, 15% spirulina and 5% each of thyme and oregano). respectively. It shows the average nutritional composition of Namakpara with the incorporation of spirulina flavoured with thyme and oregano reveal that the nutrients content i.e protein, fat, carbohydrates and energy and minerals iron and calcium increased with the increased addition of spirulina flavoured thyme and oregano. The energy content of Namakpara ranged from 791Kcal/100g to 769.5 Kcal/100g. Treatment T_0 has the highest content of Energy followed by T_1 , T_2 and T_3 respectively.

The calcium, protein and iron content of Namakpara were found to range between 48mg per 100g to 153mg per 100g, 12.1g per 100g to 18.52g per 100g and 4.9mg per 100g to 11.01mg per 100g respectively.

Cost of the prepared food products (Rs/kg)

Cost is very important factor, which affects the marketability of the products and needs to be considered while manufacturing of the food products. It is the basis for price fixation and determining the profit on the cost of production. The cost has been calculated on the basis of prevailing price of raw materials. The cost of the developed product is increases due to incorporation of spirulina flavoured with thyme and oregano at different levels.

CONCLUSION

From the result it is being concluded that the spirulina incorporated in Namakpara of the products was well acceptable on the basis of sensory evaluation. In Namakpara T_3 (75:15:5) was best as compared to other treatments, T_1

(90:5:5) was best. Namakpara was rich in calcium, iron and protein content i.e. (153.05mg/100g), (11.03g/100g), (18.52mg/100g). Addition of spirulina increased nutrient density of all food prepared.

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Development of Value added food products by Incorporation of the Coarse Grain and Whey

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ABSTRACT

Coarse grains are the name referred to the millets along with maize and sorghum, which constitute the food of the economically weaker sections of the population of India. The present study was undertaken with the objectives to determine the nutritive value of different food products by the utilization of coarse grains and whey at different levels, to assess the organoleptic evaluation of the prepared food product. Products like "Sev", and "Cheela", Incorporated with whey at the level of 10 percent, 15 percent and 20 percent and served as treatments T_1 , T_2 and T_3 respectively. Treatment T_0 , without incorporation of whey served as control. The replicated three times for all two food products and data obtained from investigation were statistically analyzed by using analysis of variance (ANOVA) and critical difference (CD) techniques. Sensory evaluation was carried out by using nine point Hedonic scale., it was observed that in case of "Sev" (T_3) coded the best regard to colour, Body and texture, and overall acceptability, (T_2) Coded the best regarded to taste and flavour. In case of "Cheela", (T_3) coded the best colour, body and texture, and overall acceptability and (T_2) was best in taste and flavour. "Cheela" rich in nutrients. On the basis of finding we concluded that coarse grain and whey can be incorporated in the preparation of different food increased their nutrient content. Cost of the prepared product on the basis of raw material was decreased with incorporation of coarse grain and whey.

Keywords - Coarse grain and whey, Sensory evaluation, Nutrient content

INTRODUCTION

Coarse cereals are staple diets of millions of people living in the dryland regions of the country. Predominantly grown in the fragile ecosystems, these crops include jowar, bajra, ragi and other small millets. The Indian Council of Medical Research has worked out the nutritional superiority of millets. Compared to rice (on a 100 gram weight basis), Fox tail millet has 81 per cent more protein, Little millet has 840 per cent higher fat, 350 per cent higher fiber and 1229 per cent higher quantity of iron **(Sharma, 2009)**.

Millet protein contains amino acids in balanced proportions and is rich in methionine, cystiene and lysine. These are especially beneficial to vegetarians who depend on plant food for their protein nourishment. It is reported that cardiovascular diseases, duodenal ulcers and hyperglycemia occurs rarely in regular millet eaters. Since millets which are rich in fibre are used less as staple though available in plenty, it world while considering a supplementation study with selected millet. (**Menon**, **2004**).

Among millets, pearl millet ("bajra") is the predominant crop of India which is a staple food of rural people of dry land regions of India. In India, pearl millet is the 4th most important staple food crop after rice wheat and sorghum in India, about 9.97 million tonnes of "Bajra" are produced during 2007-2008, which is generally utilized in the form of roti or snacks (Puffed grain) and for animal feed. Pearl millet is comparable and even superior in some of the nutritional characteristics to major cereals with respect to its energy value, protein, fat and minerals. The amino acid profile of pearl millet is better than that of sorghum and maize and is comparable to wheat, barley and rice. The consumption of pearl millet is very poor in spite of being nutritionally superior to other crops. The majority of people in India are economically poor and thus, food choices for a balanced diet are further restricted by poverty and insufficient supply of nutritious food. Therefore, it becomes important to focus on promoting maximal use of locally available inexpensive food rich in protein calcium, iron, fibre etc. (Anu et al., 2007).

Sorghum is a genus with many species and subspecies, and there are several types of sorghum, including grain sorghums, grass sorghums (for pasture and hay), sweet sorghums (for syrups), and Broomcorn. The focus of this species page is on Sorghum bicolor ssp. bicolor, or grain sorghum. Grain sorghum and maize (corn) are comparable in costs of production and in nutrition; therefore the growing environment is the largest determining factor for choosing which to grow. Sorghum is used for human nutrition all over the world globally, over half of all sorghum is used for human consumption It is a major crop for many poor farmers, especially in Africa, Central America, and South Asia. Grain sorghum is used for flours, porridges and side dishes, malted and distilled beverages, and specialty foods such as popped grain (**Grains Council US 2006**).

■Student, *Assistant Professor, □Dean
Whey protein has potential as a functional food component to contribute to the regulation of body weight by providing satiety signals that affect both short-term and longterm food intake regulation. Because whey is an inexpensive source of high nutritional quality protein, the utilization of whey as a physiologically functional food ingredient for weight management is of current interest (**Luhovyy** *et.al.*, 2007)

MATERIALS AND METHODS

Procurement of raw materials

Coarse grain and whey collected from the local market of Allahabad district of Uttar Pradesh (India).

Preparation Value Added products

The basic recipes were standardized and serve as control (T_0) . Three treatments i.e. incorporation of coarse grain and whey on different level was referred as T_1 , T_2 and T_3 respectively for each of two products.

Name of	Main	Formulation	Mixing Ratio
products	Ingredient	Name	
Sev	Besan, Jowar,	T ₀	40g. Besan, 20g. Jowar,
	Bajra, Maize,		20g. bajra, 20g. Maize
	Whey	T ₁	30g.Besan, 20g.Jowar,
			20g. Bajra, 20g. Maize,
			10g.Whey
		Τ2	25g.Besan, 20g. Jowar,
			20g.Bajra, 20g. Maize,
			15g. Whey
		T ₃	20g.Besan, 20g. Jowar,
			20g. Bajra, 20g. Maize,
			20g. Whey
Cheela	Jowar, Bajra,	T ₀	25g. Jowar, 25g. Bajra,
	Maize, Besan,		20 g. Maize, 30g.Besan
	Whey,	T ₁	20g.Jowar, 20g. Bajra,
			20g. Maize, 30g. Besan,
			10g.Whey
		T ₂	20g.Jowar, 20g.Bajra,
			15g.Maize, 30g. Besan,
			15g. Whey
		T ₃	20g.Jowar, 15g.Bajra,
			15g.Maize, 30g. Besan,
			20g. Whey

Table-1: Details of Control and Treatments of sev and Cheela

Sensory evaluation :-

The Organoleptic evaluation of prepared products was done by a panel of 5 judges to assess the acceptability of the products based on the various sensory attributes like color, appearance, texture, flavour and taste. The evaluation was done on the 9 point Hedonic scale based score card (Srilakhmi, 2010).

Nutritive value of Developed food product:-

Nutritive value of the prepared products was calculated by using the values of raw ingredients given in food composition table by (**Gopalan** *et.al*, **2004**).

Statistical analysis :

Data is ascertained from the experiment was statistical analyzed using analysis of variance technique (one way classification). Significant difference between the treatments was determined by using CD (critical difference) test.

RESULTS AND DISCUSSION

The results obtained from the present investigation have been discussed in the fallowing sub units:-

Sensory Evaluation of the value added Food Products:

Table-2 Shows the sensory evaluation of prepared products was done by using nine point hedonic scale score card. Sensory evaluation of the "Sev" prepared from incorporation of coarse grain and whey showed that significant influence on color and appearance was highest in treatment T_3 (8.53) and non significant for Body and Texture was highest in treatment T_3 (7.06), Taste and Flavour was highest in treatment T_1 (8.53) and Overall acceptability was T_3 (7.8).

"Cheela" had significant influence on Color and Appearance was highest in T_3 (8.4). Body and Texture was highest in T_3 (6.6). Taste and Flavor was highest in treatment T_2 (8.4). Overall acceptability was highest in T_3 (7.72).

The mean sensory score for prepared sample products with varying proportion of coarse grain and whey are shown in table 1 significant difference (p<0.05). Significant difference (p<0.05) in color for both and overall acceptability for both Cheela and Sev. This result may be attributed partly to the varying proportions of coarse grain in the place of other vegetables used in the preparation. This result of consumer oriented test was acceptable for Cheela discovered on significant difference (p<0.05) in color, taste and flavour, body and texture and overall acceptability of tested varying proportions, rather, the result agreed with **Gupta (2012)** who reported that addition of dehydrated herbs in rice flakes can improve the both sensory and nutritional quality of prepared products.

Nutritional Composition of Prepared Food Products:

Table-3 shows that the coarse grain and whey are incorporated in sev and cheela. Coarse grain and Whey incorporated cheela was rich in energy (357.5kcal), calcium (39mg), iron (5.07mg), and sev was rich in protein (14.94g.). The mean nutrient composition for prepared sample products with varying proportions of coarse grain and whey are shown in table 3. In case of energy the result proposed with **Gokoglu** *et.al.* (2004) was obtained the similar study, they studied the

fat content was high because of the different methods (deep frying) of cooking. Similar study was found by Martin et al. (2010) they found in their study the iron content was high because of replacement of other ingredients with rice products and green vegetables. Related result was found by Oboh and Akindahunsi (2002) they suggested in their study the protein content was increased due to the replacement of other ingredients with coarse grain.

8.2

7.35

7.17

7.57

Τ.

7.8

7.72

Parameters	rs Color & Appearance				Body & Texture			Taste & Flavor				Overall Acceptability				
	T ₀	T ₁	T ₂	T ₃	T ₀	T ₁	T ₂	T ₃	T ₀	T ₁	T ₂	T ₃	T ₀	T ₁	T ₂	Т
Sev	7.26	7.26	773	8 53	626	613	646	7.06	793	8 53	85	82	7.09	7 28	7 52	7

8.4

8.4

Table-2 Average Sensory Score of Different Parameters in Control and Treated Sample

Table-3 Nutr	itive Co	mnosit	tion ne	r 100o	in Co	ntrol (and Tr	eated S	amnle
Cheela	7.6	7.13	7.86	8.4	6.1	6.1	6.6	.66	7.9

Products and	Carbohydrate	Protein	Fat	Energy	Calcium	Iron	Phosphorus	Fiber
treatments	(g)	(g)	(g)	(Kcal)	(mg)	(mg)	(mg)	(g)
Sev					_			
T ₀	65.18	14.94	4.34	355.2	37.8	5	305.6	1.58
T ₁	59.71	12.94	3.81	324.7	36.9	4.47	272.5	1.46
T ₂	56.98	11.94	3.55	307.45	36.45	4.2	255.93	1.4
T ₃	54.24	10.94	3.29	290.2	36	3.94	239.4	1.34
Cheela								
T ₀	66.2	13.96	4.12	357.5	35.55	5.07	298.4	1.6
T ₁	59.71	12.94	3.18	324.7	36.9	4.47	272.5	1.46
T ₂	56.66	12.42	3.65	308.95	38.75	4.35	255.1	1.32
T ₃	53.53	11.88	3.42	292.25	39	3.95	240.3	1.26

CONCLUSION

From the result it is concluded that the incorporation of coarse grain and whey in Sev and Cheela can improve the nutritional quality of the products. Partial replacing of other ingredients with coarse grain and whey had good impact on the nutritive value by increasing the protein, energy, calcium, and iron content in the Sev and Cheela. The prepared food product was found to be acceptable in both sensory and nutritional quality. Thus addition of value added coarse grain and whey in food products will improve the well being the citizen in the country and prevent micronutrient malnutrition.

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Sensory Evaluation and Nutritional compositioin of utilization of Multi-Flour mix in the preparation of Gluten free Snacks

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ABSTRACT

Gluten is a special type of protein that is commonly found in rye, wheat, and barley. Gluten provides many additional important qualities; it keeps the gases that are released during dough fermentation. By employing the multi-flour mix, four products were developed namely Laddoo, Cheelay, Namakpara and Chappaties. The four treatments were made of all the products with the different percent of incorporation of different flours. In the T_1 treatment 70% Bengal gram flour was incorporated with 10% Soya bean flour, 10% Buckwheat flour and 10% Flaxseeds flour for making the products i.e: Laddoo, Cheelay, Namakpara and Chappaties respectively. In T_2 treatment 55% of Bengal gram flour was incorporated with 15% of soya bean flour, 15% of Buckwheat, 15% Flaxseeds flour for making the products. In T_3 treatment 40% of Bengal gram flour was incorporated with 20% of soya bean flour, 20% of Buckwheat flour, and 20% of Flaxseeds for making the products. In the T_4 treatment 25% of Bengal gram, was incorporated with 25% of soya bean flour, 25% of Buckwheat and 25% of Flaxseeds flour for making the products. Organoleptic qualities of the products were judged by the five panels of members by 9 point hedonic scale. All the products were acceptable with the different treatments. In laddoo T_2 treatment was the best (8.7±0.44), T_1 treatment was best in the chappaties (8.5±0.34). T_2 was the best treatment in cheela (8.4±0.27) following with the other treatments. In the fourth product, namakpara T_1 treatment has the highest score (8.9±0.45).

Keywords: Sensory evaluation, Product development, Multi-flour mix, Gluten free snacks.

INTRODUCTION

Gluten is derived from the Latin word "glue" it is the composite of a prolamin and a glutelin. These exist, conjoined with starch, in the endosperm of some grass-related grains, notably wheat, rye, and barley. Gliadin and glutenin (the prolamin and glutelin from wheat) comprise about 80 percent of the protein contained in wheat seed.Gluten free flours is the type of flours which does not contain even a small amount of wheat protein or gluten protein. For e.g: soybean flour, it is a gluten free flour obtained from soybean grains. Examples of grains that do not have gluten include wild rice, buckwheat, millet,oats, soyabean, and sunflower seeds Wheat consist of an outer husk or bran that enclose the wheat kernel. The kernel contains the wheat germ the endosperm, which is full of starch and protein. It is these protein that form gluten when flour is mixed with water. When dough is kneaded, gluten stretches like elastic to trap the bubbles of carbon dioxide, the gas released by the yeast, and the dough rises. (Edward et al. 2005). Calcium salt present in the hard water tend to increase the elasticity of gluten Sodium chloride (NaCl) likewise effects gluten. Acids also alter gluten strength, over kneading declines the elasticity of the gluten and the dough becomes sticky and the volume of the loaf poor. In making chapattis', too little or too much gluten results in poor quality (Srilakshmi, 2008).

A Gluten-free diet is a diet completely free of ingredients derived from gluten-containing grains: wheat, barley, rye, malts and triticale etc. The gluten is used as food additive in the form of flavoring, stabilizing, or thickening agent. Several grains and starch sources are considered acceptable for gluten free diet. Gluten free diets is to swear off all wheat, rye, and Barley grains free from gluten. Gluten Free flours need to be used in combination with one another. There is no one Gluten free flour that you can substitute 1:1 successfully for the wheat flour.

After being opened, gluten free flours should be stored in the refrigerator or freezer since they don't have a very long shelf life. The gluten free product tends to be much more expensive than their regular counterparts. Along with the increasing number of products labeled gluten free, have allowed many are wondering whether the gluten free diet isof benefit for those who are suffering with celiac disease. Under the Food Allergen and consumer Protection Act, the Food and Drug Administration issued a rule for voluntarily labeling of food as Gluten free. A gluten free diet should be continued for at least five years and subsequently small amounts of gluten may be introduced. In adults with celiac disease, the prognosis is not as in children. (Khanna, 2008).

Gallaher (2000), Conducted a gluten free research in Ireland and found that gluten free products can be regarded

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as 'double' functional foods as they are excellent carrier of healthy ingredient such as dietary fiber, prebiotics, available calcium and other constituents.

The inflammatory reactions in the mucosa of the small intestine produce are profuse secretion of mucous which interferes in the absorption of all nutrients and especially of fat. Celiac disease occurs both in children and adult. The subjects lost appetite and become weak due to under nutrition. (Swaminathan, 2008).

The present investigation was undertaken to explore the possibilities of using multi-flour mix to prepare the various kinds of gluten free recipes, to enrich the food items and to evaluate the colour, texture, taste and flavor, and overall acceptability of the different prepared products.

MATERIALS AND METHODS

Procurement of Raw materials

The different grains required for the experiment were purchased from the local market of Allahabad the grains that were used for the experiment i.e. i.buckwheat ii. Bengal gram iii.Soy bean iv. Flaxseeds. These ingredients were washed, dried and its flours were made.

Development of Food Product

Four food products namely Laddoo, Cheelay, Namakpara and Chappaties were developed by incorporating the flours at different levels. The products were prepared by using standard recipes.

Treatments and Replications of the Products

The basic recipe was standardized and served as control (T_0) . Four treatments i.e. Incorporation of the flours at different levels T_1 , T_2 , T_3 and T_4 were referred respectively were given for each of the four products made. The formulated products were replicated for three times.

Details of Treatments:

 T_0 (control): In this the products were prepared with only standard ingredient without any incorporation of the gluten-free flours.

 T_1 : In this treatment 70% Bengal gram flour was incorporated with 10% Soya bean flour, 10% Buckwheat flour and 10% Flaxseeds flour for making the products i.e: Laddoo, Cheelay, Namakpara and Chappaties respectively.

 T_2 : 55% of Bengal gram flour was incorporated with 15% of soya bean flour, 15% of Buckwheat, 15% Flaxseeds flour for making the products i.e: Laddoo, Cheelay, Namakpara, and Chappaties respectively.

 T_3 : In this treatment 40% of Bengal gram flour was incorporated with 20% of soya bean flour, 20% of Buckwheat flour, and 20% of Flaxseeds for making the products i.e.: Laddoo, Cheelay, Namakpara and Chappaties respectively.

 T_4 : In this treatment 25% of Bengal gram, was incorporated with 25% of soya bean flour, 25% of Buckwheat and 25% of Flaxseeds flour for making the products i.e: Laddoo, Cheelay, Namakparaand Chappaties respectively.

Sensory Evaluation

The evaluation of the products was done on the basis of Colour, Texture, Taste, Flavor and Overall acceptability. The developed products namely Laddoo, Cheelay, Namakpara and Chappaties respectively were evaluated, using the 9 point Hedonic Scale by five panel members from the Halina School of Home Science. The best treatment on the basis of sensory evaluation were identified and their nutritive value was calculated using food composition tables (**Gopalan** *et al* **2007**) **Statistical Analysis**

The data obtained from sensory evaluation were statistically analyzed by using analysis of variance technique (one way classification). Significant difference between the treatments was determined by using CD (critical difference) test.

RESULTS AND DISCUSSION

Product Development and Sensory Evaluation

(Laddoo)

Table1 shows the mean scores of Laddoo in relation to colour which indicates that T_2 had the highest score followed by T_0 , T_1 , T_3 and T_4 respectively. Scoring shows that the

Table.1.The	Average sensory	scores of different para	umeters in control and	treated sample of 'Laddoo'.

Treatments	Colour and	Texture	Taste and flavor	Overall
	Appearance			acceptability
T ₀ (control)	8.7+0.22	7+0.17	8.2+0.21	8.3+0.22
T ₁	8.3+0.46	8.2+0.31	8.2+0.17	8.5+0.72
T ₂	8.8+0	8+0	8.7+0.34	8.7+0.44
T ₃	7.6+0.14	8.7+0.27	7.7+0.45	7.7+0.30
T ₄	6.9+0.22	7+0.14	7.3+0.43	7.4+0.64
F %	Significant	Significant	Non-significant	Significant
C.D	0.4	0.5	-	0.5

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Treatments	Colour and	Texture	Taste and flavour	Overall
	Appearance			acceptability
T ₀ (control)	7.9±0.36	7.8±0.24	7.7±0.34	8.1±0.32
T ₁	8.3+0.22	8.1+0.26	8.2+0.5	8.5+0.34
T ₂	7.6+0.36	7.3+0.48	7.7+0.24	7.5+0.32
T ₃	7.2+0.14	7.1+0.57	7.1+0.43	7.1+0.15
T ₄	6.8+0.34	6.9+0.22	6.5+0.18	6.6+0.24
F%	Significant	Non-Significant	Significant	Significant
C.D	0.5	-	1.5	0.8

Table.2 Average sensory scores of different parameter in control and treated sample of Chappaties.

treatment T_2 was liked very much while control and T_1 , T_3 , T_4 were moderately liked by the panel of judges. The texture of laddoo clearly indicates that the treatment T_3 had the highest score for the texture of Laddoo followed by T_0 , T_1 , T_2 , and T_4 respectively. The effect of multi-mix gluten free flour on the taste and flavor of laddoo indicates that treatment T_2 held the maximum scores as compared to (control) T_0 , T_1 , T_3 , and T_4 . *Table 1* shows non-significant difference in all the treatments, the mean scores of laddoo in relation to overall acceptability indicate that the treatment T_2 scored maximum followed by treatment T_0 , T_1 , T_3 and T_4 respectively. (Chappaties)

Table 2 shows the effect of adding different levels of multimix gluten free flour on the colour of Chappaties which clearly indicates that treatment T_1 (8.5), gave the highest score for colour of Chappaties as compared to the other treatments T_0 , T_2 , T_3 and T_4 . It is evident from the above table that the highest average score for texture of Chappaties was T_1 , followed by the T_0 , T_2 , T_3 , and T_4 . It can be concluded that there is a significant difference between treatments regarding the texture of the products. The mean score of Chappaties in relation to taste and flavour was obtained by T_0 , and T_1 , T_2 , T_3 and T_4 respectively indicating that T_1 and T_2 gave the best taste and flavour to, Chappaties.The scores showed in the

Table.3 Average sensory scores of different parameters in control and treated Cheelay.

Treatments	Colour and	Texture	Taste and flavour`	Overall
	appearance			acceptability
T ₀ (control)	8+0	8.1+0.22	8.1+0.53	7.8±0.1
T ₁	7.8+0.14	8.3+0.26	7.9+0.51	8+0.17
T ₂	8.7+0.33	7.7+0.22	8.4±0.38	8.4+0.27
T ₃	7.3+0.5	7.3+0.54	7.7+0.45	7.4+0.19
T ₄	6.8+0	6.8+0.60	7.2+0.26	7+0.30
F%	Significant	Significant	Non-significant	Significant
C.D	0.22	3	-	1.4

above table signify the mean scores of Chappaties regarding its overall acceptability. It is seen here treatment that control (T_1) at 8.5 shows the maximum score followed by T_0 (8.1), T_2 (7.5), T_3 (7.1), and T_4 (6.6). It is quite clear from the above result that the use multi-mix gluten free flours in the Chappaties gives acceptable Chappaties.

(Cheelay)

The data presented in *table 3*, pertaining to the effect of addition of multi-mix gluten free flours on the colour and appearance of cheelay clearly indicates that the treatment T_2 got the highest score for the colour of cheelay followed by T_0 , T_1 , T_3 and T_4 . It is concluded that the concentration of multi-mix gluten free grains influences the appearance of products. The mean scores pertaining to the effect of addition of multi-mix gluten free flours in the texture of cheelay shows

that the treatment T_1 scored the maximum marks of 8.3 followed by T_0 , T_2 , T_3 and T_4 respectively. Therefore it is concluded that the treatments were liked moderately while T_2 , was liked very much by the panel of judges. The above *table 3*, shows, that the mean scores of Cheelay in relation to taste and flavor indicates that T_2 had the highest score followed by T_0 , T_1 , T_3 , and T_4 respectively. The mean scores of Cheelay in relation to overall acceptability which indicates that T_2 had the maximum score followed by T_0 , T_1 , T_3 , and T_4 respectively. (*Namakpara*)

From *table 4*, it is found that treatments T_1 of the fourth product i.e. namakpara had the highest score for colour and appearance followed by T_0 , T_2 , T_3 and T_4 respectively. Therefore it is concluded from the above mean scores that all the treatments were acceptable to the panel of judges. It is

Products	Colour and	Texture	Taste and flavour	Overall
	appearance		acceptability	
Treatments				
T ₀ (control)	8.3+0.36	8.2+0.26	8.1+0.47	8.3+0.20
T ₁	8.4+0.42	7.5+0.14	7.5+0.29	8.9+0.45
T ₂	6.8+0.17	8.4+0.62	7+0	7.6+0.11
T ₃	6.5+0.12	6.7+0.30	6.5+0.2	7.3+0.14
T ₄	6.1+0.17	6.4+0.1	6.4+0.25	6.5+0.32
F%	Non-Significant	Non-Significant	Significant	Non-Significant
C.D			0.5	

Table.4 Average sensory scores of different parameters in control and treated sample of Namakpara.

quite clear from the score that all the treatments in comparison to the control were moderately liked by the panel judges. However, the T_3 was preferably better regarding the texture of the products. The table 4, shows illustrates that the mean scores of namakpara on the taste and flavor. It is seen that the treatments T_0 at 8.1 held the top score followed by T_1 , T_2 ,

NUTRITIONAL COMPOSITION OF THE DEVELOPED PRODUCT

Nutrient content of laddoo

Table 5, shows the comparative nutritive value of control (T_0) only Bengal gram was used, as moisture content 13.3g, Protein content 11.1g, Carbohydrate content 173.3 g, Energy

Products	Treatment	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	(control)		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
		Bengal -gram	100g	13.3	11	73.9	348	0.9	2	23
Standard	T ₀	Sugar	50g	-	0.1	99.4	398	-	0.8	12
Recipe		Ghee	50g	-	-	-	400	50	-	-
		TOTAL		13.3	11.1	173.3	1146	50.9g	2.8	35
Products	Best	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	Treatment		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
		Bengal- gram	55g	5.5	3.03	9.04	200.2	0.8	28	1.17
		Buckwheat	15g	1.47	1.8	10.3	55.7	0.7	2.01	25.3
Laddoo	Τ ₂	Soyabean	15g	1.36	7.02	3.06	66.2	3.06	1.74	27.5
		Flaxseeds	15g	0.8	3.37	4.3	82.3	5.9	0.6	37.5
		Ghee	50g	-	-	-	450	50	-	82.3
		Sugar	50g	-	0.2	49.7	199	-	10	6
		TOTAL		9.13	15.4	76.4	1053	60.4	42.3	179.7

Table 5. Nutrient content of Laddoo.

 T_3 and T_4 respectively indicating that the treatments were liked moderately. Therefore it can be concluded that the addition of multi-mix gluten free flours contributed to the taste and flavor of the namakpara. It is evident from the data above that treatment T_1 was ranked at the top by the panel of judges followed by T_0 , T_2 , T_3 , and T_4 respectively. Scoring indicates that treatments were moderately liked by the panel judges. From here we come to know that the addition of multimix gluten free flours in the namakpara improve the overall acceptability of namakpara. content 1146 kcal, Fats content 50.9g, Iron content 2.8mg and calcium content 35mg. On comparison with the best treatment on the basis of sensory evaluation, T_2 where gluten free mixture of flours were used in proportion Bengal gram 55g, Buckwheat 15g, Soyabean 15g, and Flaxseeds 15g there is an increase in Protein content 15.4g, Energy content 1053kcal, Fats content 60.4 g, Moisture content 9.13g, Iron content 42.3mg, and Calcium content 179.7mg/100g. All the products are gluten free.

Products	Treatment	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	(control)		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
Standard	T ₀	Wheat flour	100g	13.3	11	73.9	348	0.9	2	23
Recipe		TOTAL		13.3	11	73.9	348	0.9	2	23
Products	Best	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	treatment		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
		Bengal- gram	55g	5.5	3.03	9.04	200.2	0.8	28	1.17
Chappatties	T ₂	Buckwheat	15g	1.47	1.8	10.3	55.7	0.7	2.01	25.3
		Soyabean	15g	1.36	7.02	3.06	66.2	3.06	1.74	27.5
		Flaxseeds	15g	0.8	3.37	4.3	82.3	5.9	0.6	37.5
		TOTAL		9.13	15.2	26.7	404.4	10.1	32.3	91.4

Table 6. Nutrient content of Chappaties.

Nutrient content of Chappaties

Table 6, shows the comparative nutritive value of control (T_0) where only wheat flour was used, the moisture content was 13.3g, Protein 11g, Carbohydrate 73.9 g, Energy 348 kcal, Fats 0.9 g, Iron 2mg and calcium content was 23mg. On comparison with the best treatment on the basis of sensory

evaluation, T_2 where gluten free mixture of flours was used in the proportion, Bengal gram 55g, Buckwheat 15g, Soyabean 15g, and Flaxseeds 15g there is an increase in Protein content 15.2g, Energy content 404.4kcal, Fats content 10.1 g, Moisture content 9.13g, Iron content 32.3mg, and Calcium content 91.4mg. Above all the product is gluten free.

Products	Treatment	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	(control)		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
		Bengal Gram	50g	13.3	11	73.9	348	0.9	2	23
Standard	T ₀	Moong dal	50g	-	0.1	99.4	398	-	0.8	12
Recipe		Oil	10ml	-	-	-	90	50	-	-
		TOTAL		13.3	11.1	173.3	791	59	2.8	45
Products	Best	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	treatment		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
		Bengal- gram	70g	7.4	2.02	42.2	254.8	3.5	3.5	1.47
Cheelay	T ₁	Buckwheat	10g	0.97	1.2	6.9	37.1	0.5	1.3	16.3
		Soyabean	10g	0.91	4.02	2.06	44.2	2.6	1.6	25
		Flaxseeds	10g	0.57	2.29	2.3	54.3	3.9	0.4	54.5
		TOTAL		9.8	9.53	53.4	390.4	10.5	6.8	97.2

Table 7. Nutrient content of cheelay.

Products	Treatment	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	(control)		(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)
Standard	T ₀	Wheat flour	100g	13.3	11	73.9	348	0.9	2	23
Recipe		Oil	25ml	-	-	-	344	50	-	-
		TOTAL		13.3	11	73.9	748	50.9	2	23
Products	Best	Ingredients	Amount	Moisture	Protein	Carbohydrate	Energy	Fats	Iron	Calcium
	treatment	(g)	(g)	(g)	(g)	(kcal)	(g)	(mg)	(mg)	
		Bengal- gram	70g	7.4	2.02	42.2	254.8	3.5	3.5	1.47
Namakpara	T ₁	Buckwheat	10g	0.97	1.2	6.9	37.1	0.5	1.3	16.3
		Soyabean	10g	0.91	4.02	2.06	44.2	2.6	1.6	25
		Flaxseeds	10g	0.57	2.29	2.3	54.3	3.9	0.4	54.5
		Oil	25ml	-	-	-	344	25	-	-
		TOTAL		9.85	9.53	53.4	725.4	35.5	6.8	96.7

Nutrient content of Cheelay

Table 7, shows comparative nutritive value of control (T_0) only Bengal gram and moong dal was used, the moisture content was 13.3g, Protein 11.1g, Carbohydrate 173.3 g, Energy 791 kcal, Fats 59 g, Iron 2.8mg and calcium content was 45mg. On comparison with the best treatment on the basis of sensory evaluation, T_1 where gluten free mixture of flours was used in the proportion, Bengal gram 70g, Buckwheat 10g, Soyabean 10g, and Flaxseeds 10g there is an increase in Protein content 9.8g, Energy content 390.4kcal, Fats content 10.5 g, Moisture content 9.8g, Iron content 6.8mg, and Calcium content 97.2mg. Above all the product is gluten free.

Nutrient content of namakpara

Table 8, shows comparative nutritive value of control (T_0) only wheat flour was used, the moisture content was 13.3gm, Protein 11gm, Carbohydrate 73.9 gm, Energy 748 kcal, Fats 50.9 gm, Iron 2mg and calcium content was 23mg. On comparison with the best treatment on the basis of sensory evaluation, T_1 where gluten free mixture of flours was used in the proportion, Bengal gram 70gm, Buckwheat 10gm, Soybean 10gm, and Flaxseeds 10gm there is an increase in Energy content 725.4kcal, Fats content 35.5 gm, protein content 9.85gm, carbohydrate content 53.4gm, Iron content 6.8mg, and Calcium content 96.7mg.

CONCLUSIONS

From the findings of the study undertaken, it is concluded that the products like laddoo, namakpara, chappaties, and cheelay can be successfully made with gluten free flours like Bengal gram flour, buckwheat flour, soybean flour and flaxseeds flour. On comparing the organoleptic attributes of the products prepared, T_2 treatment which consist of 55% of Bengal gram flour, 15% of buckwheat, 15% of soybean and 15% of flaxseeds flour, combination gave the best products for all four products prepared. The nutrient content of the admixture of flours comparatively better than wheat flours only in terms protein, carbohydrate, energy and crude fiber content.

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Preparation and Storage quality of low cost weaning food

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ABSTRACT

The present study was carried out with the objective to prepare the weaning food by using different flours and evaluate the organoleptic properties of the reconstituted prepared weaning food, to calculate the nutritive value as well as to study the storage quality and to calculate the cost of prepared weaning food. Three treatment combinations T₁ (wheat flour 35g,lentil flour 25g, potato flour 20g, carrot flour 15g and sesame seeds flour 5g), T, (wheat flour 35g, lentil flour 20g, potato flour 15g, carrot flour 25g and sesame seeds flour 5g) and T₃(wheat flour 35g, lentil flour 15g, potato flour 25g, carrot flour 20g and sesame seeds flour 5g) were prepared and reconstituted with milk and water. Sensory evaluation of the weaning food reconstituted with water and milk was carried out by using the 9 point hedonic scale. The nutritive value was calculated by using the food composition tables. Microbial analysis and peroxide value was determined with the help of standard procedure. The cost of the product was also calculated. The experiment was replicated four times and the data obtained during the investigation were statistically analyzed by using analysis of variance (ANOVA) and critical difference techniques. Sensory score of reconstituted weaning food with water and milk scored highest in T₁ (wheat flour 35g, lentil flour 25g, potato flour 20g, carrot flour 15g, sesame seeds flour 5g and jaggery 35g) in relation to colour, taste and flavour and overall acceptability. The prepared weaning food are rich in carotene, calcium, phosphorus, energy, fat and iron thus the prepared weaning food are nutritious and useful for infants health. No microbial growth (yeast-mold count) was found till 14 days. In prepared weaning food T_3 (wheat flour 35g, lentil flour 15g, potato flour 25g, carrot flour 20g, sesame seeds flour 5g and jaggery 35g) was found cheaper (26.20Rs./Kg.) than other treatment combination. So it was concluded that weaning food can be prepared using wheat flour, lentilflour, potatoflour, carrot flour and sesame seeds flour to improve the health of infants.

INTRODUCTION

The term "Weaning" comes from the word "wemian" which means to accustom. It is the process in which an infant diet pattern is gradually changed from liquid foods like breast milk and substitute milk preparations to cooked solid foods. Weaning begins from the moment supplementary food is started and continues till the child is taken off the breast complementary i.e. before or at 6 month or 3-5 months. Solid food add to an infant's diet is called beikost. There is an increase in activities of the enzymes at the time of weaning.Milk alone is not able to provide sufficient amount of all nutrients needed to maintain growth after the 6 months. Increasing need of calories and proteins of growing children can't be met by minimizing output of mother's milk. Milk is also deficient in Vitamin-D which is essential for expected rate of growth and for health. The age of introduction of supplementation is 3-5 months in urban elite and middle income group. The supplementation is delayed in urban poor by 7-9 months and rural poor by 9-11 months. Introduction of weaning food too late can lead to under nutrition and increased diarrhoealmorbidity. Nutrient density of weaning food of western diet is 1.0 kcal/g of food whereas in Asia the nutrient density is 0.25 kcal to 0.4 kcal/g hence calorie density food like malted food should be given to infants.Homemade processed weaning foods can be prepared by using cereals, pulses, nuts and jaggery with or without milk products. Processed foods like pasta, rusks and biscuits can also be given. Commercially available weaning foods are predigested but are expensive. Commercially available weaning foods like vegetable soups and fruit desserts, puddings and vegetable Juices and fruit juices can be given as part of weaning food (Srilakshmi, 2002).

MATERIALS AND METHODS

The present investigation "Preparation and storage quality of low cost weaning food" was carried out in Research Laboratory, Ethelind School of Home Science, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed-to-be- University) Allahabad during January 2011-August 2011.Wheat, lentil were cleaned, germinated and then dried, roasted and ground separately and thus powder were found (**Srivastava and Kumar 2002**). Sesame seeds, carrot and potato flour were also obtained by same methods but germination process was not done here (**Srivastava and Kumar 2002**). Reconstituted weaning food were evaluated organoleptically by a panel of 5 judges

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selected randomly from the Department of Foods and Nutrition, Ethelind School of Home Science, SHIATS, Allahabad. The judges were requested to score the product with the help of the score card based on 9 point hedonic scale at 0,7 and 14 days intervals (Srilakshmi, 2000). Each samples was replicated four times and chemically analysed for moisture (AOAC, 1960), peroxide value (AOAC, 1975) and bacterial contamination (yeast-mold count) (Mackie and McCartney 1956) at the 0, 7 and 14 days interval by the standardized procedures. The carbohydrate, protein, fat, calcium, iron, phosphorus, carotene and energy of the product were calculated on the basis of raw ingredients by using the food composition *table* given in Nutritive Value of Indian Foods (Gopalan et al. 2004). The cost of the product was calculated on the basis of price of raw ingredients at rupees per kg. Data obtained from the organoleptic evaluation were analyzed using analysis of variance and critical difference techniques (Chandel, 2006).

Development of weaning food: weaning food was developed by mixing all the flours in different proportions and reconstituted with milk and water for sensory acceptability. 100 g of weaning food was dissolved in 220 ml of milk for sensory evaluation.

Details of treatments

Treatments	Wheat	Lentil	Potato	Carrot	Sesame	Jaggery
	flour	flour	flour	flour	seeds flour	(g)
	(g)	(g)	(g)	(g)	(g)	
T 1	35	25	20	15	5	35
Τ ₂	35	20	15	25	5	35
Τ ₃	35	15	25	20	5	35

RESULTS AND DISCUSSION

Sensory characteristics of the prepared weaning food

The highest scores for colour was obtained by T_1 (8.3) followed by T_2 (8.2) and T_3 (7.75), for consistency was obtained by T_1 (8.1) followed by T_2 (7.8) and T_3 (7.6), for taste and flavour by T_1 (8.4) followed by T_2 (8.0) and T_3 (6.32) and for overall acceptability was obtained by T_1 (8.1) followed by $T_{2}(7.9)$ and $T_{3}(7.7)$ in water at 0 day. The highest scores for colour was obtained by T_1 (8.3) followed by T_2 (8.0) and T_3 (7.9), for consistency was obtained by T_2 (8.0) followed by T_3 (7.9) and T₁ (7.8), for taste and flavour by T₁ (8.5) followed by T_3 (7.8) and T_2 (7.7) and for overall acceptability was obtained by $T_1(8.1)$ followed by $T_2(7.9)$ and $T_3(7.7)$ in milk at 0 day. Thus at 7 day the highest score for colour was obtained by T_1 (8.35) followed by T_2 (8) and T_2 (6.32). for consistency by T_1 (8.1) followed by T_2 (8) and T_3 (7.75), for taste and flavour was obtained by T_1 (8.5) followed by T_3 (7.8) and T_2 (7.7). and for overall acceptability was obtained by T_1 (8.2) followed by

 $T_2(7.9)$ and $T_3(7.8)$ in water and in milk was obtained by T_1 (8.4) followed by T_2 (8.0) and T_3 (6.32) for colour, for consistency it was obtained by T_1 (8.2) followed by T_3 (7.8) and T_3 (7.9), for taste and flavour was obtained by T_1 (8.35) followed by $T_{2}(8)$ and $T_{3}(7.85)$ and for overall acceptability it was obtained by $T_1(8.2)$ followed by $T_2(7.9)$ and $T_3(7.8)$. Thus highest scores for colour at 14 days was obtained by T_3 (8.25) followed by T_1 (8.05) and T_2 (8), for consistency it was obtained by T_1 (8.25) followed by T_2 (8.05) and T_3 (8), for taste and flavour was obtained by T_3 (8.35) followed by T_1 (8.0) and T₂ (7.85) and for overall acceptability it was obtained by T_3 (8.09) followed by T_1 (8.07) and T_2 (8.01) in water and in milk it was obtained by $T_2(8.3)$ followed by $T_1(8.1)$ and $T_3(8)$ for colour, for consistency it was obtained by $T_1(8.1)$ followed by $T_{2}(7.9)$ and $T_{2}(7.9)$ for taste and flavour the highest score was obtained by T_3 (8.25) followed by T_1 (8.05) and T_2 (8.0) and for overall acceptability it was obtained by T_1 (8.07) followed by T_2 (8.02) and T_3 (8.02). (Table I)

Table.I: Average sensory scores of prepared weaning food with water and milk at 0,7 and 14 days.

			Water			Milk		
Parameter	Treatments		Days		Days			
		0	7	14	0	7	14	
Colour	T ₁	8.3	8.3	8.05	8.3	8.4	8.1	
	T ₂	8.2	8.0	8.0	8.0	8.0	8.3	
	T ₃	7.7	6.32	8.2	7.9	6.32	8.0	
Consistency	T ₁	8.1	8.35	8.05	7.8	8.2	8.1	
	T ₂	8.2	8.0	8.0	8.0	7.9	7.9	
	T ₃	7.75	6.32	8.25	7.9	7.8	7.9	
Taste and	T ₁	8.4	8.35	8.35	8.5	8.5	8.0	
Flavour	T ₂	8.0	8.0	8.0	7.7	7.7	8.0	
	T ₃	6.32	7.85	7.85	7.8	7.8	8.25	
Overall	T ₁	8.1	8.1	8.07	8.1	8.2	8.07	
Acceptability	T ₂	7.9	7.9	8.02	7.9	7.9	8.01	
	T ₃	7.7	7.8	8.02	7.7	7.8	8.09	

Nutritive value of reconstituted weaning food with water and milk (per 100g).

Result revealed that highest energy was found in T_1 (401 Kcal) followed by T_2 (382 Kcal) and T_3 (371 Kcal). Carbohydrate content was highest in T_2 (84.74g) followed by T_1 (79.8g) and T_3 (75.53g). Protein content was highest in T_1 (10.92g) followed by T_2 (9.9g) and T_3 (8.98g). Fat content was highest in T_1 (4.23g) followed by T_2 (3.96g) and T_3 (3.68g). Calcium content was highest in T_2 (150) followed by T_1 (145.3mg) and T_3 (144.20mg). Phosphorus content was highest in T_1 (386.95mg) followed by T_3 (382.80mg) and T_2 (371.45mg). Carotene content was highest in T_2 (542.05 g) followed by T_3 (443.50 g) and T_1 (360.70 g). Iron content was

highest in T_1 (4.59 mg) followed by T_2 (4.47mg) and T_3 (4.2mg) in water and in milk highest energy was found in T_1 (615Kcal) followed by T_2 (596 Kcal) and T_3 (585 Kcal). Carbohydrate content was highest in T_2 (98.73g) followed by T_1 (93.88g) and T_3 (89.61g). Protein content was highest in T_1 (21.16g) followed by T_2 (20.14g) and T_3 (19.22g). Fat content was highest in T_1 (17.35g) followed by T_2 (17.08g) and T_3 (16.8g). Calcium content was highest in T_2 (534 mg) followed by T_1 (399.7 mg) and T_3 (528.28mg). Phosphorus content was highest in T_1 (674.95mg) followed by T_3 (670.40mg) and T_2 (479.45mg). Carotene content was highest in T_2 648.05g followed by T_3 (549.50 g) and T_1 (466.70 g). Iron content was highest in T_1 (5.23 mg) followed by T_2 (5.11mg) and T_3 (4.84mg) (*Table II*).

Table.II: Nutritive value of reconstituted weaning food with water and milk (per 100g).

Nutrients	Treatments							
	rec	onstitu	ted	reconstituted				
		weaning	g		weaning	g		
	food	d with v	vater	foo	d with 1	nilk		
	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃		
Energy (Kcal)	401	382	371	615	596	585		
Carbohydrate (g)	79.8	84.74	75.53	93.88	98.73	89.61		
Protein (g)	10.92	9.9	8.98	21.16	20.14	19.22		
Fat (g)	4.23	3.96	3.68	17.35	17.08	16.8		
Calcium (mg)	145.3	150	144.2	399.7	534	528.2		
Phosphorus (mg)	386.95	371.45	382.8	674.95	479.45	670.4		
Carotene (mcg)	360.7	542.05	443.5	466.7	648.05	549.5		
Iron (mg)	4.59	4.47	4.2	5.23	5.11	4.84		

Storage quality/Chemical analysis of prepared weaning food.

Moisture percentage:- Moisture percentage of weaning food at 0, 7 and 14 days. Result reveals that highest moisture percentage of weaning foods at 0 day was found in T_1 (0.33%) followed by T_2 and T_3 (0.20%). Highest moisture percentage of weaning food at 7 day is T_1 and T_2 (1.6%) followed by T_3 (1.5%) and at 14 days T_1 (3.3%), followed by T_2 and T_3 (2.8%). On the basis of finding it is clear that the weaning food at the time of storage absorbed some moisture. Similar finding was also reported by **Kent and Evers (1994)** that moisture contents greater than 12%, risk of fat oxidation and development of rancidity increases as compared to flour containing lower

Table.III. Moisture percentage of three treatments of weaning foods at 0, 7 and 14 days intervals.

Days	T ₁	T ₂	T ₃	ISI Std. value (1993)
0 day	0.33%	0.20%	0.20%	<12%
7 days	1.6%	1.6%	1.5%	<12%
14 days	3.3%	2.8%	2.8%	<12%

levels of moisture i.e.7.5%. (Table III)

Peroxide value :- Result revealed that peroxide value was increased with increase of time interval and thus found highest during 14 days but it was under the acceptable value. **(Table IV)**

Microbiological Analysis :- Yeast-mold count of organoleptically best treatment at 0,7 and 14 days was found and is compared with the ISI standard value. Results revealed *Table.IV. Peroxide value (meq/kg) of three treatments of weaning foods at 0, 7 and 14 days*

Days	T ₁	T ₂	T ₃	PFA Std. Value (1977)
0 day	0.5	0.5	0.5	<10meq/kg
7 days	0.67	0.66	0.66	<10meq/kg
14 days	0.77	0.78	0.77	<10meq/kg

that there was no microbial growth at 0 and 7 days but at 14 days yeast-mold count was one which is acceptable. It shows that the prepared weaning food can be kept till 14 days without any microbial growth (**Table V**).

Cost calculation of prepared weaning food :- The cost was calculated on the basis of raw ingredients used. From the result it is evident that the cost of prepared weaning food was lowest in $T_3(26.20$ Rs./Kg.) followed by $T_2(28.30$ Rs./Kg.) and $T_1(30.10$ Rs./Kg.).

CONCLUSION

On the basis of above findings it is concluded that the weaning food can be prepared by using different flour. Sensory score of reconstituted weaning food with water and milk scored highest in T_1 (wheat flour 35g, lentil flour 25g, potato flour 20g, carrot flour 15g, sesame seeds flour 5g and jaggery 35g) in relation to colour, taste and flavour and overall acceptability. The prepared weaning food are rich in carotene,

Table.V: Microbiological analysis (Yeast mold count) of organoleptically best treatment compared to ISI standards.

Days	Treatment	Dilution	Count	Dilution Factor	Count x	Yeast -mold	ISI Std.
				(D.F.)	D.F.	count (cfu/g)	value (1993)
0	T ₁	10-2	0	102	0x101	0 cfu/g	<1.0 x 102cfu/g
7	T ₁	10-2	0	102	0x102	0 cfu/g	<1.0 x 102cfu/g
14	T ₁	10-2	1	102	1x102	100 cfu/g	<1.0 x 102cfu/g

calcium, phosphorus, energy, fat and iron thus the prepared weaning food are nutritious and useful for infants health. No microbial growth (yeast-mold count) was found till 14 days. In prepared weaning food T_3 (wheat flour 35g, lentil flour 15g, potato flour 25g, carrot flour 20g, sesame seeds flour 5g and jaggery 35g) was found cheaper (26.20Rs./Kg.) than other treatment combination. According to ANOVA table the significant difference was found in colour, taste and flavour on 0 and 7 days with milk and colour, taste and overall acceptability with water on 0,7 and 14 days. The moisture percentage and peroxide value was increased with the increase of time- interval and no yeast-mold count was found till 14 days.In prepared weaning food treatment T_3 (26.20Rs./Kg.) was found cheaper than other treatment combinations.

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A cross cultural study on gender differences in emotional well being of adolescents

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ABSTRACT

A cross cultural study on gender differences in Emotional well being of Adolescents was conducted with the following objectives: To find the status of emotional well being of adolescent girls and boys residing in cities. To find the status of emotional well being of adolescent girls and boys residing in rural areas. To find gender based differences of emotional well being of adolescents cross culturally. To find the effect of culture on emotional well being of adolescents. The sample of the study comprised a total of 100 students, 50 adolescents (25 boys and 25 girls) from the rural background and (25 boys and 25 girls) from the urban areas, were selected using random stratified sampling techniques from various colleges of Allahabad city and neighboring village Indalpur General well-being scale devised by Kalia and Deswal (1971) and Socio Economic Status Scale by Kuppuswami (1962) were used for the assessment of emotional well-being and socio economic status of the adolescents. Data was analyzed by frequencies / percentages,mean,standard deviation and t-test. Results revealed that almost all adolescents have good emotional well-being irrespective of gender and cultural settings.Results also revealed that rural boys and girls were significantly better in their emotional well being ($P \le 0.05$) than their urban counterparts and boys were found significantly better ($P \le 0.05$) than their girl counterparts in their emotional well-being. It is concluded from the results that culture has an impact on emotional well-being of adolescents.

Key words: - Adolescents, Gender Differences, Emotional Well-being.

INTRODUCTION

The word Adolescence comes from Latin: adolescere meaning "to grow up". Adolescence is a transitional stage of physical and psychological. In studying adolescent development, adolescence can be defined biologically, as the physical transition marked by the onset of puberty and the termination of physical growth; cognitively, as changes in the ability to think abstractly and multi-dimensionally; or socially, as a period of preparation for adult roles. Major pubertal and biological changes include changes to the sex organs, height, weight, and muscle mass, as well as major changes in brain structure and organization. Human development generally occurring during the period from puberty to legal adulthood. Adolescence describes the teenage years between 13 and 19 and can be considered the transitional stage from childhood to adulthood. Gang violence, school shootings, alcohol-related accidents, drug abuse, and suicides involving teens are frequently portrayed by Media as a negative stage of life. The truth is that adolescents, despite occasional or numerous protests, need adults and want them to be part of their lives Culture often portrays teens as moody, dramatic, and difficult, some young people have serious mental and emotional problems that go

beyond the stereotype., recognizing that they can nurture, teach, guide, and protect them on the journey to adulthood. Homes and schools that are emotionally positive and warm and that provide support for adolescents autonomy and achievement may boost teens' psychological and emotional well-being. The term emotional well-being has been used in the adolescent development literature to cover a wide range of aspects of psychological functioning, such as coping, self-regulation (emotions and behaviors), perceived autonomy and control, and social competence. We use emotional well-being as an umbrella term because of the important role emotions play in all aspects of human behavior and development, including mental and physical health, education and skill development, social competence, and the establishment of positive social relationships. Gender differences in stressful events, specifically in the domain of interpersonal stressful events, may partially mediate gender differences in depression. Individual differences in affective vulnerability, defined predominantly as temperamental differences in negative emotionality, would predict greater emotional reactivity to stress and thus moderate the similarly concluded that females report only marginally higher levels of stress than to do males.

MATERIALS AND METHODS

Total 100 Adolescents from Allahabad city and Indalpur village were selected between the age of 13 to 19 years, out of which 50 Adolescents were from the urban areas where in 25 were girls and 25 are boys and the rest 50 Adolescents were from the rural areas where in 25 were girls and 25 were boys. Stratified random sampling techniques were used for the selection of the respondents. The Socio Economic Status (SES) was ascertained using Kuppuswami (1962) revised three factor index of socio-economic status which used the occupational, educational and economical levels of parents in each household. Each of the three variables was assigned weightage to obtain total score on socio-economic status of family. The maximum possible score on the scale is 29, with a minimum of 3. On the basis of scores obtained the subjects were categorized in three subgroups i.e. Upper Socio Economic Status, Middle Socio Economic Status and Lower Socio Economic Status. General Well-being scale by Kalia and Deswal (1971) was used to study the level of emotional well-being in adolescents, consisted of 55 items ranging from physical well being in first section, emotional well being in second section, social well being in third section and the last section is school well being. The nature of the scale was planned to be verbal and paper-pencil test. The scale was planned to act as self-administering individual as well as group test. It is a self-reporting five point scale. Items of the scale are in statement form followed by five alternatives. In this scale statements are in two forms i.e. positive and negative. The total numbers of answers constitute the final score. Maximum score for a positive item to be awarded is 5 and least is 1. In case of negative items the scoring procedure is to be reversed.

RESULTS AND DISCUSSION

Results in the *table 1* shows that majority of the urban boys (56%) showed emotional well-being of higher level followed by the group who have emotional well-being of an average level (44%). None of the boys in the urban setting were found with lower level of emotional well-being. Good emotional well-being is a result of good quality of life resulting in physical health, good energy levels, positive self-esteem all of which is an outcome of parental interests in their adolescents growth and development especially in an urban

 Table 1: Frequencies and percentage distribution based on emotional well-being of urban boys:

S.No.	Level of emotional well Being	Frequency N=25	Percentage (%)
1.	High	14	56
2.	Average	11	44
3.	Low	-	-

setting where parents now a days are consciously taking good care of their growing adolescents physical and mental health. **Paul (2005)** also reported that quality of family relations are best predictors of children's emotional well being.

 Table 2: Frequencies and percentage distribution based on emotional well-being of urban girls:

S.No.	Level of emotional well Being	Frequency N=25	Percentage (%)
1	High	13	52
2	Average	12	48
3	Low	-	-

Results in the *table 2* reveal that girls in the urban setting also show emotional well-being from higher (52%) to average (48%) levels and none was found with emotional well-being of lower level and reflect that youth in the urban setting are experiencing supportive social settings in promoting positive youth development. For today youth communities have become more transient, social norms have become less rigid and prescribed. Youth is also experiencing positive emotional relationships with care givers which helps in generating a strong sense of self-sufficiency, confidence in one's ability to master the demands of one's world and good emotional coping skills and a sense of attachment and optimize is giving rise to good emotional well being in urban adolescents.

Compas *et.al.* (2001) also reported that coping and emotion regulation is an ongoing process where individuals are continuously regulating their emotions and behaviours in order to maintain positive connections within their physical and social environments. In contrast, coping involves the regulation of behavior and emotion in the face of specific challenge.

S.No	Level of emotional well being	Frequency	Percentage
1	High	20	80
2	Average	5	20
3	Low	-	-

 Table 3: Frequencies and percentage distribution based on emotional well-being of rural boys:

It is clear from the above *table 3* that majority (80%) rural boys showed a higher level of emotional well-being followed by a few falling in the category of an average emotional well being, where as none of the boys from the rural area quite like their urban counter-parts showed lower emotional well-being of lower level. These results could be attributed to the higher level of life satisfaction which is generated through greater opportunities of expression of emotions, spending time with family, strong role models of stable emotionality and strong family bonds leading to better emotional well-being in growing children as well.

	on emotional went being of rarat girls.							
S.No	Level of emotional	Frequency	Percentage					
	well Being		(%)					
1	High	16	64					
2	Average	9	36					
3	Low	-	-					

 Table 4: Frequencies and percentage distribution based on emotional well-being of rural girls:

It is clear from the *table 4* revealed distributions of the girls from rural background in emotional well-being from higher (64%) to average (36%) levels and none was found with emotional well-being of lower level. The results could be attributed to the satisfaction from the subjective indicator of quality of life that focus on the pleasure of basic building block of human happiness and satisfaction drawn from the social environment and human interactions. The fundamental concept of quality in life also comes from value system which serves as one of the important feeders of emotional wellbeing strong in value systems and human interactions create

 Table 5: Comparison of emotional well-being of urban and rural adolescent boys :

Variables	Ν	Mean	Standard deviation	t-cal	t-tab at 0.05% d.f
Urban boys	25	53.28	6.586	17.38	1.71
Rural boys	25	88.00	7.360		

a strong environment for healthy emotional well-being for their growing youth.

It is clear from the *table 5* shows that the't' calculated (1.71) is greater than the 't' tabulated, indicating that there is a significant difference in the emotional well-being of urban and rural boys. Observation of the mean values reveals that boys from the rural background are significantly better in their emotional well-being than their urban counterparts. These results are indicative of increasing social pressures, reducing interpersonal relationships due to the increase in technology usage detaching urban youth from the surroundings. On the contrary rural youth still has over

Table 6: Comparison of Emotional well-being of urbanand rural adolescent girls.

Variables	Ν	Mean	Standard Deviation	t-cal	t-tab at 0.05% d.f
Rural girls	25	63.00	7.360	6.58	1.71
Rural girls	25	50.52	7.030		
(P<0.05)					

abundance of natural space and time for the establishment of positive social relationships which in turn help them harness better emotional well-being and healthy mental health.

It is clear from the *table 6* shows that 't' calculated (6.58) is greater than the 't' tabulated, indicating that there is a significant difference in the emotional well-being of urban and rural girls. Observation of the mean values reveals that girls from the rural background are significantly better in their emotional well-being than their urban counterparts.

 Table 7: Comparison of Emotional well-being of urban boys and girls:

Variables	N	Mean	Standard	t-cal	t-tab			
			Deviation		0.05% d.f			
Urban boys	25	53.28	6.58	1.51	1.71			
Urban girls	25	50.52	7.03					
(P<0.05)								

It is clear from the *Table 7* that the 't' calculated (1.51) is smaller than the 't' tabulated, indicating that there is a nonsignificant difference in the emotional well-being of urban boys and urban girls. Observation of the mean values reveal that boys of urban areas were marginally better in their emotional level than their girl counterparts from the urban areas.Strong relationships with family and peers are vital for healthy social and emotional development. Parents and peers tend to influence the emotional framework of the adolescents and urban adolescents. Probably receive better responses and spend more quality time with the family as well as with friends which is why they show more strength in their emotional make up than their counterparts from the villages.

 Table 8: Comparison of Emotional well-being of rural boys and girls:

boys and girls.								
Variables	Ν	Mean	Standard	t-cal	t-tab			
			Deviation		0.05 % d.f			
Rural boys	25	88.00	7.36	12.00	1.67			
Rural girls	25	63.00	7.36					
(P < 0.05)								

It is clear from the *Table 8* that the 't' calculated (12.00) is greater than the 't' tabulated, indicating that there is a significant difference in the emotional well-being of rural boys and girls. Observation of the mean reveals that boys from the rural background are significantly better in their emotional level than their girl counterparts from the rural areas. The findings could be attributed to the family context again as boys in the rural setting are receiving most of their parental attention, affection and warmth which leads to better emotional makeup and well-being.

CONCLUSIONS

It is concluded from the findings that in todays context adolescents mostly have good emotional well-being irrespective of their gender and cultural backgrounds. Though rural setting is found to be more effective in nurturing emotional well-being in adolescents but urban adolescents are not far behind their rural counterparts. It is also concluded that boys are stronger in their emotional well-being in comparison to their girl counterparts. So it is inferred that culture significantly influences the emotional well-being of adolescents.

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Inter-gender participation in agriculture and allied activities

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ABSTRACT

Women have always played an important role in agriculture, undertaking a wide range of activities relating to food production, processing and marketing. Beyond the farm, women play a key role in land and water management in all developing countries. Rural women often manage complex households and pursue multiple livelihood strategies. Their activities typically include producing agricultural crops, tending animals, processing and preparing food, working for wages in agricultural or other rural enterprises, collecting fuel and water, engaging in trade and marketing, caring for family members and maintaining their homes. Therefore, a study was carried out to find inter-gender participation in agriculture and allied activities in Hisar and Jhajjar district of Haryana state. One block from each district was selected randomly (Hisar-I from Hisar and Bahadurgarh from Jhajjar) and one village viz, Dahima from Hisar-I and Sankhol from Bahadurgarh was selected randomly. Total sample of 160 respondents were selected randomly including 80 respondents from Dahima and 80 from Sankhol. Major findings revealed that agricultural activity such as irrigation, selection of crop, field preparation, hoeing and marketing of vegetable and wholesale products were performed by adult males, whereas activities like taking food to farm, weeding, harvesting and storage were performed by adult females. Study further unveiled that activities related to animal husbandry were mainly performed by adult females such as preparation of animal food, milking, collection of animal dung, cleaning of animals and their habitat, taking care of sick, pregnant animals and new born calves, where sale and purchase of animals was mainly done by adult males

INTRODUCTION

Agriculture sector occupies the centre stage of India's social security and overall economic welfare. Since Independence, India has witnessed significant increase in food grain production (green revolution), oilseeds (yellow revolution), milk (white revolution), fish (blue revolution), and fruits and vegetables (golden revolution). India has the second largest area of arable land in the world and is a major producer of a number of agricultural products. Such Buffalo milk, Bananas, Paddy rice, Cow milk, Wheat, Sugar cane, Fresh vegetables, Potatoes and cotton lint.

Female share of non-agricultural wage employment is only 17.0 per cent. Participation of women in the workforce is only 13.9% in the urban sector and 29.9 per cent in the rural sector. Women's wage rates are, on an average only 75.0% of men's wage rates and constitute only 25.0 per cent of the family income. In no Indian State do women and men earn equal wages in agriculture.

About 60 percent of agricultural operations like sowing of seeds, transportation of sapling, winnowing, storage of grain, making seedbeds, plugging and transplanting saplings, lifting weeds, harvesting, threshing husking rice etc. They do 68.5 per cent of total agricultural work where as men do 31.5 per cent of total agricultural work. Women contribution to farm work is as high as between 60 and 90 per cent of the total farm task performed. More than 50 percent of the labor force, and they are responsible for three-quarters of food

production in sub-Saharan Africa (Aggarwal, 2003, Das, 2003, Damisa *et al.*, 2007, World Bank, 2007).

MATERIALS AND METHODS

The present study was carried out in Haryana state. From Haryana state two districts were selected randomly viz. Hisar and Jhajjar. One block from each district was selected randomly (Hisar-I from Hisar and Bahadurgarh from Jhajjar) and one village viz., Dahima from Hisar-I and Sankhol from Bahadurgarh was selected randomly. Total sample of 160 respondents were selected randomly including 80 respondents from Dahima and 80 from Sankhol. A structured interview schedule was developed to assess inter-gender participation in agriculture and allied activities and data were collected personally by researcher. This was dully pretested before administration. Weighted mean score was used for statistical analysis.

RESULTS AND DISCUSSION

Gender wise participation in agricultural activities of the respondents' family

Major agricultural activities were performed by adult male (2.29 and 2.33 mean score) followed by adult female (1.89 and 1.73 mean score), male child (1.35 and 1.31 mean score), female child (1.27 and 1.13 mean score) and jointly (1.19 and 1.13 mean score) in both villages i.e. Dahima and Sankhol, respectively. It further indicated that activities related to

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weeding (2.80 and 2.50 mean score) and storage (2.91 and 2.89 mean score) were mainly performed by adult female in both Dahima and Sankhol villages, respectively. On the other hand activities related to marketing and irrigation were mainly performed by adult male (*Table 1*).

Women in India are major producers of food in term of value, volume and number of hours worked. Nearly 63 per cent of all economically active men are engaged in agriculture as compared to 78 per cent of women. Almost 50 per cent of rural female workers are classified as agricultural labourers and 37 per cent as cultivators. Major findings revealed that agricultural activity such as irrigation, selection of crop, field preparation, hoeing and marketing of vegetable and wholesale products were performed by adult males, whereas activities like taking food to farm, weeding, harvesting and storage were performed by adult females. **Das (2011) Grover** *et al.* **(2011), Deka** *et al.* **(2011) and Tripta (2007)** supported the findings.

											N=160
Sr. No.	Parameters		Da	hima (WI	MS)		Sankhol (WMS)				
		AM	AF	MC	FC	Joint	AM	AF	MC	FC	Joint
1.	Taking food to farm	1.40	2.08	1.40	1.51	1.02	1.30	2.16	1.38	1.10	1.02
2.	Sowing and transplanting	1.88	2.00	1.67	1.15	1.30	2.23	1.70	1.95	1.06	1.15
3.	Irrigation	2.89	1.02	1.58	1.00	1.02	2.92	1.00	1.40	1.00	1.00
4.	Selection of crop	3.00	1.00	1.17	1.00	1.00	3.00	1.00	1.00	1.00	1.00
5.	Field preparation	2.82	1.60	1.59	1.00	1.04	2.89	1.17	1.50	1.00	1.00
6.	Hoeing	2.79	1.87	1.30	1.15	1.20	2.90	1.30	1.25	1.00	1.00
7.	Weeding	1.60	2.80	1.22	1.39	1.25	2.00	2.50	1.15	1.20	1.20
8.	Harvesting	2.54	2.67	1.43	1.67	2.00	2.30	2.60	1.35	1.10	1.90
9.	Storage for domestic purpose	1.10	2.91	1.06	1.85	1.06	1.06	2.89	1.15	1.84	1.04
10.	Marketing of vegetable &	2.89	1.00	1.12	1.00	1.00	2.75	1.00	1.06	1.00	1.00
	wholesale products										
	Overall mean score	2.29	1.89	1.35	1.27	1.19	2.33	1.73	1.31	1.13	1.13
	Rank	Ι	I	Ш	ĪV	V	Ι	I	Ш	IV	IV
	*Multiple responses *WMS	-Weighte	ed Mean S	Score							

Table 1: Gender wise participation in agricultural activities of the respondents' family

*Multiple responses *WMS-Weighted Mean Score AM- Adult Male AF- Adult Female MC-Male Child

FC-Female Child

Table 2: Gender wise participation in animal husbandry activities of the respondents' family

											N=160
Sr. No.	Parameters		Da	hima (WI	MS)		Sankhol (WMS)				
		AM	AF	MC	FC	Joint	AM	AF	MC	FC	Joint
1.	Fodder collection	1.68	2.56	1.16	1.25	1.10	2.66	1.62	1.42	1.10	1.40
2.	Preparation of food	1.33	2.76	1.07	1.20	1.04	1.28	2.50	1.10	1.25	1.20
3.	Milking	1.44	2.84	1.00	1.22	1.10	1.65	2.76	1.06	1.10	1.04
4.	Collection of animal dung	1.13	2.91	1.13	1.27	1.15	1.27	2.89	1.10	1.20	1.03
5.	Cleaning of animal and their	1.16	2.81	1.18	1.24	1.04	1.40	2.70	1.25	1.11	1.06
	habitat										
6.	Taking care of sick animal	1.66	2.37	1.12	1.06	1.03	2.00	1.94	1.20	1.06	1.10
7.	Care of pregnant animals	1.22	2.80	1.00	1.00	1.04	1.60	2.44	1.04	1.12	1.06
8.	Care of new born calves	1.28	2.84	1.12	1.25	1.06	1.30	2.88	1.10	1.08	1.10
9.	Sale and purchase of animal	3.00	1.00	1.03	1.00	1.00	3.0	1.00	1.11	1.00	1.00
	Overall mean score	1.54	2.54	1.09	1.16	1.06	1.79	2.30	1.15	1.11	1.11
	Rank	I	Ι	IV	Ш	V	I	Ι	Ш	IV	IV
	*Multiple responses *WMS-Weighted Mean Score										

AM- Adult Male

FC-Female Child

Gender wise participation in animal husbandry activities of the respondents' family

Activities related to animal husbandry were performed by adult female with highest (mean score 2.54 and 2.30) followed by adult male (1.54 and 1.79), female child (1.16), male child (1.09 and 1.15) and jointly (1.06 and 1.11) in both villages i.e. Dahima and Sankhol. It further revealed that activities related to money matter like sale and purchase of animals were mainly done by adult male in both the villages with 3.0 mean score (*Table 2*).

There are considerable evidences to show that livestock and management related activities continue to be predominately rural women's responsibility and domain. There are 75 million women engaged in dairying as against 15 million men and 20 million in animal husbandry as compared to 1.5 million men. Present study revealed that activities related to animal husbandry were mainly performed by adult females such as preparation of animal food, milking, collection of animal dung, cleaning of animals and their habitat, taking care of sick, pregnant animals and new born calves, where sale and purchase of animals was mainly done by adult males. It indicated that females only can perform those activities which are inside the four walls, beyond this their role become inactive. Narmata (2009) and Sikka et al. (2005) and Singh et al. (2012) also supported the findings. According to Kanwar (2002) among the predominant activities of the females, the maximum participation was noticed in preparation of milk and milk product (84.67%) followed by cleaning shed (83.33%) and harvesting of green fodder (75.33%). The minimum participation was observed in feeding (58.67%) and bathing of animal (58.67%).

CONCLUSION

It may be concluded from the results of the above study that agricultural activity such as irrigation, selection of crop, field preparation, hoeing and marketing of vegetable and wholesale products were performed by adult males, whereas activities like taking food to farm, weeding, harvesting and storage were performed by adult females. In Case of activities related to animal husbandry, mainly performed by adult females except sale and purchase of animals. This was mainly done by adult males. It indicated that females only can perform those activities which are inside the four walls, beyond this their role become inactive.

RECOMMENDATIONS

- Women's perspectives should be included in designing and implementing macro-economic and social policies by institutionalizing their participation in such processes.
- To develop appropriate technologies suited to women's

needs as well as to reduce their drudgery should be given a special focus.

- Develop women friendly agricultural technologies to reduce dependency of female on male partner.
- To appoint women extension worker for the dissemination of women friendly technologies.

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Content Analysis of English News Paper with Special reference of Common Wealth Games

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ABSTRACT

A Newspaper is one of the most common ways to receive the latest news. It is the communication of selected information on current events. It is shared in various ways among individuals and small groups with wider audiences by publishing, either in print or in ways that blend those traits. Content analysis refers to general set of techniques useful for analyzing and understanding collections of text. There is considerable work done in this area, which predates internet, research by decades. In the context of understanding the impact of digitized collection and websites, one particularly relevant type of content analysis is the analysis of news articles. These news articles may be about the collection, or they may be about the type of resource in general. The present study was an attempt to assess the Content Analysis of English Newspaper reference to Common Wealth Game. The different types of newspaper published from different place in our country. The Hindu Newspaper had been selected for thesis work, daily news conference to Common Wealth Game newspaper gives widely and daily information in the social Culture and human personality. The English Leading Newspaper - The Hindu was selected for making a sample of one issue for a newspaper for a period of one month from 29 September to 18 October, 2010 were selected for study. The news which has appeared twenty one days were collected clipping were made and analyzed in view objective of the study.

INTRODUCTION

News is received or noteworthy information especially about recent or important information. It is also known as a person or thing considered interesting enough to be reported in the news. It is fresh information concerning something that has recently take place. It is something which somebody wants suppressed. It is also means neither to unknown things. The content of the newspaper can be broadly divided into many parts-news, articles, features, opinion piece such as editorials, comments letter to the editorial, review, column and advertisement. Content analysis as a research technique for the objective, systematic and quantitative description of the content of research data. Young (1966) defined content analysis is a research technique for making replicable and valid inferences from that and their context. A summative content analysis involves counting and comparison, usually of keywords or content, followed by the interpretation of the underlying context. Newspaper content analysis is intended for everyone who wants to establish a reliable measure of what news and information appears in a newspaper and in what proportion. It is also known as as a method in the social sciences for studying the content of those types of empirical documentation which can be briefly referred to as mute evidence.

METHODOLOGY

The state of U.P. comprises of 72 districts. The district of Varanasi is the Eastern part of U.P. which was selected purposively for study. The study of newspaper content analysis was made in one language. 'The Hindu' English newspaper was selected randomly. The Hindu was selected for making a sample of one issue for a newspaper for a period of one month from 29 September 2010 to 18 October 2010 were selected for study. Variable was taken into account as how many words a news contain n its title and news content. Placement indicated as the way the news is placed in the newspaper that is upper half and lowers half.

RESULTS AND DISCUSSIONS

Week wise frequency distribution of picture part of CWG news appeared in selected newspaper.

The table indicates that the frequency of coverage of CWG picture. It was found that the total number of picture in that selected newspaper had appeared 139 out of which the maximum number of picture had appeared during 2nd week of October, where its total was 139 during the 2nd week, followed by 1st and 3rd week. It may be concluded that the majority of pictures had appeared during the 2nd week.

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Frequency of different forms of CWG episode appeared in selected newspaper.

The *table* reveals that the frequency of CWG indicated. The maximum frequency of CWG news were found in the form of 985 news followed picture, publicity & articles in the Hindu newspaper the total of 1373 different forms of CWG. 985 times had appeared in news form followed by 330 pictures, 34 no. of publicity, 24 news were the articles pieces. It is conclude that the newspaper gives more importance to news.

Location of CWG coverage content.

Table shows that maximum 136 news had appeared on the 17 page during 21 days of study followed 110, 85, 79, 74, 69, 45, 30, 16, 15, 14, 11, 9, 7, 5, 4, 3, 1 respectively. The maximum 136 news had appeared in the Hindu on page no. 17 in selected newspaper. The minimum 1 news were published on the page no. 15 in the Hindu newspaper. So, it may be concluded that the majority of common wealth game news were localized on the page no. 17 in selected news papers.

Table 1. Week wise frequency distribution of picture part of CWG news appeared in selected newspaper.

Name of Newspaper	Frequency of CWG						
	1 st week	2 nd week	3rd week				
The Hindu	30	74	35				

Table 2. Frequency of different forms of CWG episode appeared in selected newspaper

Name of News paper	Frequency of CWG news coverage						
	News	publicity	articles	picture	Total		
The Hindu	985	34	24	330	1373		

Table 3.	Location	of CWG c	overage	content
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Name of News Paper Page No	Frequency of CWG coverage The Hindu
1	30
2	11
3	9
4	16
5	7
6	5
7	3
8	5
9	4
10	5
11	7
12	1
13	-

14	3
15	45
16	110
17	136
18	54
19	74
20	85
21	79
22	15
23	64
24	4

CONCLUSION

Newspaper is the mirror of the society it provides the true and fact full news which help to change the attitude and awareness of the people and society. It also acts as a catalyst all the newspaper shows that the Indian politics was unstable but it has transparent democracy too day by day. India is improving in sports, science and agriculture sector. According the analysis of newspaper there was every news of CWG in different forms. Every content has its own explanation and its own presentation. The picture and title were so highlighted that made very interesting every news. Starting pages have maximum coverage.

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Effect of different supplements with neem cake on the fungal competitors and yield of *Pleurotus sajor-caju* (Oyster mushroom)

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ABSTRACT

Oyster mushroom (*Pleurotus* spp.) is recognized by its cheap and easy cultivation technology with a high potential in converting celluloses into vegetable protein. An experiment was conducted to determine the effect of different supplements with neem cake on the fungal competitors and yield of *Pleurotus sajor-caju* cultivated on wheat straw. Five replications were maintained for five treatments (control, chicken manure (6g) + neem cake (NC) (4g), wheat bran (6g) + NC (4g), gram powder (6g) + NC (4g), neem cake (4g) in winter conditions of Allahabad region. Chicken manure (6g) in combination with neem cake (4g) gave maximum inhibitory effect on the incidence of *Trichoderma* sp. followed by *Aspergillus* sp, and *Penicillium* sp. It had significant effect on the number of days taken for spawn run (17days), pin head initiation (19 days) and yield (204.2g) of *sajor-caju* as compared to control and other treatments.

Key Words :- Mushroom, Pleurotus sajor-caju, Supplements.

INTRODUCTION

Cultivation of oyster mushroom is becoming popular throughout the world because of their ability to grow at a wide range of temperature and to utilize various lignocelluloses Baysal et al., (2003). Oyster mushroom (Pleurotus spp.) are considered to be one of the most efficient producers of food protein, producing 30 percent of its dry weight Oguitdana aad Obogbo, (1981) and are excellent source of dietary fiber Cheung and Lee, (2000). They also produce vitamins (B_1, B_2, B_{12}, C, D) , folates, niacin and mineral elements. These are nutritious as well as medicinal mushroom that are in great demand by mushroom industry Supplementation is a means fey which mushroom cultivators can supply a crop with nitrogen which is necessary for increased fruiting. The substrates on which oyster mushroom are grown is what provide them with nutrients. Usually, this substrate is composed of cereal straw, which is nitrogen poor. Adding different supplements to that cereal straw, such as chicken manure, gram powder, wheat bran etc. can provide differing amount of nitrogen to the mushrooms. Mushrooms are subject to attack by disease causing organisms, including fungi, bacteria, viruses and nematodes. These undesirable weed fungi compete for nutrients and impair the mushroom yield. Oyster mushroom cultivation is normally practiced on paddy and wheat straw. These straw substrates get heavily contaminated with harmful fungi, resulting in a partial or total failure of the mushroom cultivation. Nine fungal and four bacterial pathogens have been reported to parasitize Pleurotus fruiting bodies and causing economic losses up to 76%. Attempts were made by different workers to manage these fungal competitor moulds and get increased yields Vijay and Sohi (1987). Trichoderma, Aspergillus and Penicillium were identified as important competitors of Pleurotus spp. Senthilpandia and Sivasankar, (1996). Some of them are capable of reducing the yield significantly or even result in crop failure depending upon their severity and stage of appearance. However, low yield levels due to growth of fungi in the substrate is the major limitation affecting its adoption as a favourite mushroom species for cultivation. Chemical fungicides are the primary means for management of fungi but they are harmful to environment as well as human health. The information on competitor moulds prevalent in mushroom house particularly during cultivation of *Pleurotus* spp. is lacking. Eco-friendly management has emerged as one of the most promising alternative to chemicals therefore, keeping in view all the above points the present study was undertaken to determine the effect of different supplements with neem cake on the disease incidence and yield of Pleurotus sajor-caju.

MATERIALS AND METHODS

Pure culture of *Pleurotus sajor-caju* was procured from Mushroom Research and Training centre, Pantnagar, Uttarakhand. Spawn was prepared by adopting standard methodology on wheat grains **Sharma**, (2003). Chopped wheat straw was soaked over night in water containing 500 ppm formalin and 50 ppm of carbendazim for substrate sterilization. Spawn was mixed @ 2 % of the wet substrate weight. Supplements viz. chicken manure, wheat bran, gram powder in combination with neem cake were sterilized (formalin 4%) and then added to substrate. Five treatments (Control, chicken manure (6g) + neem cake (4g), wheat bran (6g) + neem cake (4g), gram powder (6g) + neem cake (4g) and neem cake (4g) were maintained with live replications. The filled polythene bags (5 kg substrate) were then tied at its open end and pricked with a sterillized needle to make few holes of 0.5 cm diameter and kept close to each other in dark room at required temperature of 20-30° C and relative humidity of 80-90%, Moisture level was maintained by frequent watering till the completion of spawn run After the full spawn run, the polythene bags were removed and blocks were kept at a distance of 6-9 inches. Fungal competitors were calculated on the basis of samples examined and the presence in the samples. Serial dilution technique was applied to confirm the presence of fungal competitors in the treatment (Aneja, 2004). The observations recorded were time taken for spawn run, pinhead initiation and number of fruiting bodies per bag and weight of fruiting bodies.

RESULTS AND DISCUSSION

In the present investigation, association of several fungal competitors was found during cultivation period. These were identified as *Trichoderma* sp., *Penicillium* sp. and *Aspergillus* sp. **Gupta and Raina (2008)** and **Moorthy**

and Mohan (1996) have also reported similar observations on fungal/weed fungi contamination during cultivation of P. sajor-caju in different seasons. Among the five treatments, treatment T_1 (chicken manure + NC), T_2 (wheat bran + NC), T_3 (Gram powder + NC) and T_4 (Neem cake) showed less incidence of all three pathogenic fungi as compared to control (Table 1). This may be due to the antifungal property of neem cake (4g), present in all the four treatments. Effect of different treatments on the number of days taken for spawn run, pinhead initiation and number and weight of fruiting bodies was studied (Table 2). Treatment with chicken manure (6g) in combination with neem cake (4g) had significant effect on the number of days taken for spawn run (17 days), pin head initiation (19 days) and number (26.8) and weight (204.20 g) of fruiting bodies as compared to control and other treatments. Similar findings have been reported earlier by Vijay and Upadhyay (1989) wherein they found that chicken manure followed closely by gram powder whereas maize meal and wheat bran were the promising supplements in enhancing the overall sporophore yield of sajor-caju, P. citrinopileatus and P. eous. Chhata and Thakore (2010) reported that competitor fungi (Aspergillus niger, Curvularia lunata, Rhizopus sp., Fusarium sp.) caused yield reduction up to 40% in sporophores of *florida*. The probable reason for reduction in the sporophore yield may be due to fast growth rate, rapid multiplication and colonization of substrate by competitor moulds.

 Table 1: Effect of different supplements with neem cake on the per cent occurrence of fungal competitors in the substrate of Pleurotus sajor-caju

Treatments	Per cent occurrence of fungal competitors						
	Trichoderma sp.	Penicillium sp.	Aspergillus sp.				
T ₀ control	22.0	16.00	7.00				
T_1 chicken manure + NC	7.00	5.00	1.00				
T_2 wheat bran + NC	7.50	5.30	1.20				
T_3 gram power + NC	7.50	5.30	1.20				
T ₄ neem cake	7.20	5.20	1.20				

Table 2: Effect of differen	t supplements with neem	cake on growth	parameters and vi	ield of Pleurotus sa	ior-caiu

Treatments	Time taken for spawn run (days)	Time taken for pin head initiation (days)	Number of fruiting bodies	Weight of fruiting bodies
T ₀ control	22.0	25.0	16.20	120.80
T_1 chicken manure + NC	17.0	19.0	26.80	204.20
T_2 wheat bran + NC	20.2	22.3	19.14	126.50
T_3 gram power + NC	18.3	20.0	21.40	160.00
T ₄ neem cake	21.0	23.0	17.50	122.40
CD(P=0.05)	0.88	0.92	2.06	1.89

(NC=Neem cake)

From the results of present investigation it can be concluded that chicken manure (6g) in combination with neem cake (4g) is effective in reducing the population of competitor moulds in the substrate and gave significant yield (204.2g) in *Pleurotus sajor-caju*.

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Efficacy of certain Bioagents, Plant extracts and Fungicides against Alternaria blight in Indian Mustard (*Brassica juncea* L.)

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ABSTRACT

A field experiment was conducted at the research plot of the Department of Plant Protection, SHIATS, Allahabad, U.P. during the rabi season of 2011-12 to test the efficacy of certain bioagents, plant extracts and fungicides as seed treatment and foliar spray against Alternaria blight in Indian mustard (*Brassica juncea* L.). Bioagents, plant extract and fungicides used as seed treatment were *Trichoderma harzianum* @10g/kg, Bavistin @ 2g/kg, *Allium sativum* @ 1% (w/v), *Azadirachta indica* @ 1% (w/v) and as foliar spray were *T. harzianum* @10g/l, Bavistin @ 2g/l, Ridomil MZ 72WP @ 2g/l, *Pseudomonas fluorescens* @ 10g/l, *A. sativum* @1% (w/v), *A. indica* @ 1% (w/v). Disease severity on leaves was recorded at 60, 75 and 90 DAS whereas Alternaria pod blight was recorded at 75, 90 and 105 DAS. Results showed that seed treatment with *Trichoderma harzianum* @10g/kg followed by the foliar spray of Ridomil MZ 72 WP @2g/l significantly reduced Alternaria blight and was found most effective treatment in reducing disease intensity in both leaves as well as pod under Allahabad conditions.

Key words: Indian mustard, Alternaria blight, Trichoderma harzianum, Pseudomonas fluorescens, Allium sativum, Azadirachta indica, fungicides.

INTRODUCTION

Mustard is one of the major *rabi* oil seed crop of India. It occupies a prominent place being next in importance to ground nut, both in area and production. Indian mustard [Brassica juncea L.] contributes about 85% of the total rapeseed -mustard produced in India (Kumar and Chauhan, 2005); (FAO 2010). Wide gap exists between the potential yield and the yield realized at the farmer's field which is largely because of number of biotic and abiotic stresses to which the rapeseed- mustard crop is exposed. Among the biotic stress Alternaria blight disease caused by Alternaria brassicae (Berk.) Sacc. and brassicicola (Schw.), is one of the important diseases of Indian mustard which has been reported from all continents of the world, causing 10-70% yield losses depending on the crop species (Chattopadhyay, 2008). With the growing awareness of harmful effects of pesticides, integration of bioagents, plant extracts in the management of diseases is gaining importance in recent years. The concept of integrated disease management seeks to minimize the use of fungicide. In present study different bioagents, plant extracts and fungicides were evaluated as seed treatment and foliar spray against Alternaria blight in Indian mustard to find out effective and economical management of the disease.

MATERIALS AND METHODS

A field trial was conducted to check the efficacy of seed treatment and foliar spray with bio-agents, plant extracts and fungicides on Alternaria blight of mustard at the research plot of the Department of Plant Protection, Sam Higginbottom Institute of Agriculture, Technology & Sciences (deemed to be university) Allahabad. The experiment was analysed by using RBD (randomized block design) with three replications in a plot size of 2x1m2, using highly susceptible cultivar Varuna. The treatments composed of T₁ - Trichoderma harzianum @ 10g/kg (ST) + T. harzianum 10g/l (FS), T₂- Bavistin @ 2g/kg (ST) + Bavistin @ 2g/l (FS), T₃- T. harzianum @ 10g/kg (ST) + Ridomil MZ 72WP @ 2g/l (FS), T₄ -Pseudomonas fluorescens @ 10g/l (FS), T₅-Allium sativum @1%(w/v)(ST) + A. sativum @ 1% (w/v) (FS), T_{c} - Azadirachta indica @ 1% (w/v) (ST) + A. indica @ 1% (w/v) (FS) (Guleria S. Kumar, 2006), (Rathi and Singh, 2009) (Moslem and Kholic, 2009) and the untreated control. The treatments were applied as foliar spray after 50-60 DAS at regular intervals. Observation recorded were disease intensity on leaf at 60, 75 and 90 DAS, per cent Alternaria pod at 75, 90 and 105 DAS and yield (q/ha).

Disease intensity (%) was calculated by using the following formula:-

Sum of all individual rating Disease intensity (%) = $\frac{1}{100}$ x 100 Total no. of rating x maximum disease grade

RESULTS AND DISCUSSION

Data in *Table 1* reveals that seed treatment with *Trichoderma harzianum* followed by foliar spray with Ridomil MZ 72 WP significantly reduced the Alternaria leaf blight at 60, 75, and 90 DAS upto 20.95, 33.98, 52.39, respectively. The same treatment was found effective at 75, 90 and 105 DAS for reducing the Alternaria pod blight upto 12.03, 19.14, 23.83 respectively.



Fig.2 - Symptoms of Alternaria pod blight in mustard silique

Table-1:	Alternaria leaf a	and pod blight	in mustard as effected	by different treatments
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Treatments	Mear	nALB Sev	erity (%)	Mean APB Severity (%)			Yield (q/ha)
	60DAS	75DAS	90DAS	75DAS	90DAS	105DAS	
Control	38.07	62.00	70.85	28.22	37.35	44.04	9.17
Trichoderma harzianum@	23.36	37.23	55.07	14.63	21.45	27.42	13.08
10g/kg + T. harzianum @ 10g/kg							
Bavistin @ 2g/kg + Bavistin @ 2g/l	32.32	49.22	64.94	21.04	31.81	37.23	10.58
T. harzianum @ 10g/kg + Ridomil	20.95	33.98	52.39	12.03	19.14	23.83	13.58
MZ 72 WP@ 2g/l							
Pseudomonas flourescens @ 10g/l	35.15	53.07	66.08	24.88	34.90	41.22	10.25
Allium sativum @ 1% (w/v)	25.69	40.16	57.36	16.12	24.88	34.47	12.33
+ A.sativum @ 1% (w/v)							
Azadirachta indica @ 1% (w/v) +	28.86	45.94	60.29	18.14	27.17	34.17	12.00
A. indica @ 1% (w/v)							
Over all mean	29.20	46.03	60.29	19.13	28.00	34.05	11.56
S.E.d(±)	0.870	0.972	1.031	0.731	1.160	1.089	0.771
C.D. (P=0.05)	1.844	2.060	2.186	1.550	2.459	2.309	1.634



Fig. 1.- Symptoms of Alternaria leaf blight

Significant increase in seed yield up to 13.58(q/ha) was also recorded in this treatment. Seed treatment with *T. harzianum* @ 10g/kg followed by foliar spray with *T. harzianum* @ 10g/l and seed treatment with *A. sativum* @ 1% (w/v) followed by foliar spray with *A. sativum* @ 1% (w/v) after 50-60 days of sowing, have shown results at par with the above treatment.

Seed treatment and foliar spary of bio-agents and plant extract viz., aqueous bulb extract of *Allium sativum*, *Azadirachta indica*, *Trichoderma harzianum* and *Pseudomonas fluorescens* showed evidence of their effectiveness in controlling the disease.Use of antagonists, particularly *Trichoderma* species has been reported quite effective against different pathogens (**Chattopadhyay** *et al.*, **2002**) particularly as seed treatment followed by fungicidal spray in managing many fungal diseases in various host pathogen combinations (Rohila, *et.al.*, 2001).

CONCLUSION

Use of *Trichoderma* species has been found effective against Alternaria blight particularly as seed treatment followed by fungicidal spray. The statistical analysis of data showed that all treatments were significantly effective. It was observed that seed treatment with *T. harzianum* @10g/kg and foliar spray with Ridomil MZ 72 WP @ 2g/l was most effective against Alternaria blight of mustard followed by seed treatment with *Trichoderma harzianum* @10g/kg and foliar spray with *T. harzianum* @ 10g/kg and foliar spray with *T. harzianum* @ 10g/kg and foliar spray with *T. harzianum* @ 10g/l. However, the present study was limited to one season only therefore, to substantiate the present result more trials are needed for few seasons to come out with sound recommendations.

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Comparative Study of Certain Plant Extracts and *Trichoderma viride* in the Management of Alternaria Leaf Spot of Cabbage

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ABSTRACT

Field experiment was conducted at the research plot of the Department of Plant Protection, SHIATS, Allahabad, U. P. during the Rabi season of 2011-2012 to test the efficacy of certain plant extracts, *Trichoderma viride* and Mancozeb for the management of Alternaria Leaf Spot of Cabbage (*Brassica oleaceous* var. *capitata* L.). Disease severity on leaf was recorded at 45 and 60 days after transplanting. Results showed that seed treatment with *Trichoderma viride* @ 5g/kg followed by the foliar spray of Mancozeb (0.25gm/l) significantly reduceed Alternaria leaf spot and was most effective treatment. Seed treatment of *Trichoderma viride* @ 5g/kg was also effective as compared with other treatments. Further, it was observed that the seed treatment and foliar spray of *Azadirachta indica* @ 1% (w/v) was effective in reducing Alternaria leaf spot as compared with foliar spray of *Solanum nigrum* @ 10% (w/v) which was found effective in reducing disease intensity in both leaf as well as head under Allahabad conditions.

Key words: Cabbage, Alternaria leaf spot, Plant extracts, Tricoderma viride, Mancozeb.

INTRODUCTION

India is the second largest vegetable producer in the world, next only to China with an annual production of 127 million tonnes (Anonymous, 2012). Among the vegetables, cabbage (*Brassica oleraceae var. capitata* L.), a member of the family Brassicaceae, is a winter vegetable widely cultivated in cool, moist climate and heavy sandy loam soil. It contains large amount of water (91%), protein along with small amount of sugar, starch and mineral salts. The leaves are eaten as salads or cooked (Pandey *et al.*, 1993).

The causal agent of the leaf spot disease of cabbage is known to be *Alternaria brassicicola*. The infected leaves appear dark brown to black, zonate spots are circular (1 to 10 mm in diameter), in culture the colonies look amphigenous dark olivaceous brown. The mycelium is septate, hyphae branched, hyaline to brown, inter and intracellular. Conidiophores arise singly or in groups. The conidia are in chains, some times branched, arise through small pores from the conidophore wall, straight, tapering towards the apex, the basal cell rounded, the beak present or absent, apical cell more or less rectangular, contain less than 6 transverses septa and few longitudinal septa. Conidia are constricted at the septa **(Ellis, 1971** and **Singh, 1982)**.

Black leaf spot caused by *Alternaria brassicicola* (Schw.) Wiltshire is a common disease of crucifers worldwide. The disease can cause significant losses in yields and quality of crucifer crops. Although the use of resistant cultivars is an ideal solution to the disease, crucifer cultivars resistant to black leaf spot are currently unavailable. The use of fungicides is still the most popular method for control of black leaf spot of crucifers However, there are increasing concerns on the use of chemical fungicides because of their potential harmful effect to the environment, on the health of humans and animals, other collateral damages to non-target microorganisms. However, biocontrol agents and phytoextracts are safe, and are cheaper; they are equally effective as compared to fungicides. Hence, IDM should be incorporated.

MATERIALS AND METHODS

The investigations on *A. brassicae* causing leaf spot of cabbage were carried out in the department of Plant Protection, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to be university) Allahabad. The cabbage (*Brassica oleracea* var *capitata* L.) variety Golden Ball used in the investigation is susceptible to Alternaria leaf spot.

S.	Treatment	Plant extract with various
No.		concentration
1	T ₀	Control
2	T ₁	ST Neem Leaf Extract Azadirachta
	-	indica@1%(w/v)+SP Neem Leaf
		Extract Azadirachta indica @1%(w/v)
3	T ₂	SP Black Nightshade Leaf Extract
		Solanum nigrum @10%(w/v) (foliar
		spray)
4	T ₃	ST Garlic Bulb Extract Allium sativum
	-	@1%(w/v)+SP Garlic Bulb Extract
		Allium sativum @1%(w/v)
5	T ₄	ST Onion Bulb Extract Allium cepa
		@1%(w/v)+SP Onion Bulb Extract
		Allium cepa @1%(w/v)
6	T ₅	SP mancozeb @(0.25gm/l)(foliar spray)
7	T ₆	ST Trichoderma viride (5gm/kg)

TREATMENT DETAILS:

ST- Seed treatment, FS-Foliar Spray

RESULTS AND DISCUSSION

A field trial was conducted to check the efficacy of seed treatment and foliar spray with plant extracts, bio-agent and fungicide on Alternaria leaf spot of cabbage. The experiment was analysed by using RBD (randomized block design) with three replications in a plot size of 2x 1m2., Six treatments (T0-control, T1-- NLE @ 1% (w/v) + NLE @ 1% (w/v), T2-*Solanum nigrum* @10%(w/v) (foliar spray), T3-GBE @ 1%(w/v), T5-mancozeb @ (0.25gm/l)(foliar spray), T6 *Trichoderma*

viride(5gm/kg) (seed treatment) were taken up as seed treatment and foliar spray. Observation recorded were disease intensity in cabbage plant at 45 and 60 DAT, Experiment revealed that seed treatment with Trichoderma viride @ 5 g/ kg followed by foliar spray of Mancozeb @ 0.25 g/ l significantly reduced the Alternaria leaf and head spot and increased the yield followed by seed treatment of Trichoderma viride @ 5 g/l was also found effective in reducing Alternaria leaf and head spot. seed treatment with Azadirachta indica @ 1% (w/v) followed by foliar spray Azadirachta indica @ 1%(w/v) and seed treatment with Allium sativum @ 1%(w/v) followed by foliar spray of Allium sativum @ 1% (w/v) seed treatment with Allium cepa@ 1%(w/ v) followed by foliar spray of Allium cepa@ 1% (w/v) foliar spray Solanum nigrum @10%(w/v) have shown results almost at par with the above treatment. It is concluded that Trichoderma viride @ 5 g/kg followed by foliar spray of



Table 1 : Effect of different treatments on disease intensity(%) of Cabbage (Brassica oleracea var. capitata L.) atdifferent intervals

Table 1 :- Effect of different treatments on disease intensity (%) of Cabbage (Brassica oleracea var. capitata L.) at different intervals

Treatment No.	Treatment	Disease intensity (%)				
		Before spray	45 DAT	60 DAT		
T ₀	Control	22.67	36.83	59.90		
T ₁	Neem leaf extract 1% (w/v) (seed treatment) + Neem leaf extract 1% (w/v) (foliar spray)	14.33	20.67	31.90		
T ₂	Solanum nigrum extract 10% (w/v) (foliar spray)	19.55	29.06	43.22		
T ₃	Garlic bulb extract 1% (w/v) (seed treatment) + Garlic bulb extract 1% (w/v) (foliar spray)	17.00	24.40	32.37		
T_4	Onion bulb extract 1% (w/v) (seed treatment) + Onion bulb extract 1% (w/v) (foliar spray)	18.67	24.90	32.63		
T ₅	Mancozeb (0.25 g/l) (foliar spray)	13.07	20.31	31.30		
T ₆	Trichoderma viride (5 g / kg) (seed treatment)	11.27	18.93	29.33		
	S. Ed. (±)	0.45	0.16	0.15		
	C. D. (P=0.05)	0.98	0.35	0.33		

NLE = Neem leaf extract, OBE = Onion bulb extract, GBE = Garlic bulb extract

mancozeb @ 0.25g/l was significantly superior as compare to other treatments and is most effective in management of Alternaria leaf spot of cabbage.

CONCLUSION

From the above study it is concluded that the Alternaria is a very destructive fungus for cabbage, but with the utilization of advanced techniques it becomes easier to control this cosmopolitan fungus. Experiment revealed that seed treatment with *Trichoderma viride* @ 5 g/kg followed by foliar spray of mancozeb@ 0.25 g/l significantly reduced the Alternaria leaf and head spot and increased the yield. However, the present study was limited to one season only, therefore to substantiate the present result more trials are needed for few seasons to come out with sound recommendations.

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Efficacy of selected insecticides and neem oil against shoot and fruit borer (*Earias vittela* Fab.) on okra (*Abelmoschus esculentus* L.)

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ABSTRACT

A field experiment was conducted to evaluate the efficacy of selected insecticides and neem oil against shoot and fruit borer (*Earias vittella* Fab.) pest of okra at the experimental field of Department of Plant Protection, Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS), Allahabad in *kharif* season of July to November 2011-2012. Seven treatments including control with three replications were taken up using RBD. Foliar spray of insecticides *viz*. imidacloprid @ 0.3ml/l, cypermethrin @ 0.5ml/l, emamectin benzoate % 0.4g/l ,neem oil @lml/l, spinosad @ 0.3ml/l, quinalophos @ 0.3ml/l were given at an interval of 5, 10 and 15 days while check plots were sprayed with water. Spinosad @ G, 3ml/l proved superior against the larval infestation of shoot and fruit damage per cent of fruit borer as compared to other treatment due to *E. vittella* Fab. in comparison to untreated control.

Key words: Insecticides, neem oil, shoot and fruit borer, okra.

INTRODUCTION

Okra (Abelmoschus esculentus L.) commonly known as lady's finger (Bhindi) belongs to the family Malvaceae. It is a popular fruit vegetable crop. It is a major vegetable being cultivated all over India with a major share in the states of Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat and Maharashtra (Shinde et al., 2007). The major notorious pest of okra is shoot and fruit borer (E. vittella) having endemic nature, inflict direct losses in yield of marketable fruit. The losses in the yield of okra by fruit were 69.0 per cent (Rawat and Sahu, 1973). Krishnaiah (1980) reported that losses in okra due to fruit borer (E. vittella Fab.) was 49 to 74 per cent. The damage to the crop is done by two ways. First, the terminal portions of growing shoots are bored by the caterpillars, which move down by making tunnels inside. As a result, the shoots droop downward or dry up. Second, the larvae enter the fruits by making holes, rendering them unfit for human consumption (Gopalan et al., 2007). A number of insecticides and bio-pesticides have been found effective and recommended to control this insect. Botanicals like neem (Azardirachta indica) possess desired properties like antifeedant, growth inhibitor, repellent and moulting disruptor against insect. Keeping the above in view, an experiment was conducted to evaluate the efficacy of some insecticides and neem oil against larval infestation of shoot and fruit borer (E.vittella Fab.) on okra.

MATERIALS AND METHODS

The trial was laid out in randomized block design (RBD) with three replications and seven treatments including check in the experimental field of Department of Plant Protection, Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS), Allahabad during kharif season of 2011-2012. Each treatment consisted of 3 replications in 2×1 m² plot each. The pea crop cv. "Arka Anamika" was sown in July with a spacing of 60 x 45 cm. Fertilizers NPK (120:70:60 kg/ha) were applied as per recommended dose. Foliar spray of six insecticides viz. Imidacloprid 200 SL@ 0.3ml/l, Cypermethrin 25 EC @ 0.5ml/l, emamectin benzoate 25 WG @ 0.4g/l, neem oil @ lml/1, spinosad 45 SC @ 0.3ml/l and quinalophos 25 EC @ 0.3 ml/l as per treatment was applied at the onset of larvae. First spray was done with the initiation of shoot borer (55 DAS) and second spray was given at the initiation of fruit infestation (75 DAS). The shoot borer population and fruit borer infestation was recorded randomly on five selected tagged plants one day before and 5, 10, and 15 days after treatment. The infection and yield data was subjected to the statistical analysis. Cost benefit ratio was calculated by considering additional cost and benefit (compared to control) in the respective treatments.

RESULTS AND DISCUSSION

Shoot borer- The data on surviving larval population (*Table 1*) indicated that the differences in larval population of shoot borer at 5, 10 and 15 days after spray (DAS) were significant. All the insecticides recorded significantly lower larval population than untreated control Spinosad 45SC @ 0.03 ml/1 significantly minimized the larval population at 5,10 and 15 DAS. The mean larval population under spinosad 45 SC @ 0.3 ml/1 (0.33, 0.27 and 0.13 larva/5 plants), followed by emamectin benoate 25 WG @ 0.4g/l (0.40, 0.33 and 0.20 larva/5 plants), cypermethrin 25 EC @ 0.5ml/l (0.47, 0.40 and 0.27 larva/5 plants), imidacloprid 200SL @ 0.3ml/l (0.53, 0.47 and 0.33 larva/5 plants), and neem oil (0.73, 0.60 & 0.53 larva/5 plants) as against untreated control of (0.93, 1.00 & 1.07 larva/5 plants). These findings are in agreement with **Shinde**

Table 1:	Efficac	y of in	isectio	cides	and	neem	oil	against
	Earias	vittella	Fab.	larva	ıl po	pulatio	on o	on okra

Treatment	Conc.	Mean larval population			oulation
	(%)	1DBS	5DAS	10DAS	15DAS
T ₁ Imidacroprid	0.3ml/1	0.60	0.53	0.47	0.33
T ₂ Cypermethrin	0.5ml/1	0.60	0.47	0.40	0.27
T ₃ Emamectin	0.4g/l	0.67	0.40	0.33	0.20
benzoate					
T ₄ Neem oil	1ml/1	0.73	0.73	0.60	0.53
T ₅ Spinosad	0.3ml/l	0.53	0.33	0.27	0.13
T ₆ Quinolphos	0.3ml/1	0.60	0.60	0.53	0.40
T ₀ Control	-	0.87	0.93	1.00	1.07
CD (P=0.05)			0.18	0.09	0.17
S.Ed. ±			0.08	0.20	0.08
CV %			18.49	21.91	22.50

et al. (2007), Sharma *et al.* (2007), Mane *et al.* (2010) and Galvan *et al.* (2005) who all reported that spinosad was the most effective insecticide.

Fruit borer- The data on fruit damage due to fruit borer in various spray schedules arc presented in table 2 the treatment spinosad 45SC @ 0.03 ml/I significantly minimized the fruit damage (%) at 5, 10 and 15 DAS. The mean fruit damage (%) under spinosad 45 SC % 0.3 ml/l (20.85, 23.15 and 23.72%) gave the best protection followed by emamectin benoate 25 WG % 0.4g/l (21.64, 26.19 and 28.27 %), cypermethrin 25 EC @ 0.5ml/I (22.63, 28.11 and 30.25%), imidacloprid 200SL @ 0.3ml/1 (24.85, 29.92 and 31.35 1%), quinalphos 25WP % 0.3ml/ 1 (25.43, 30.89 and 33.36%) and neem oil (27.31, 31.44 and 35.88 %) as against untreated control of (33.11, 35.24 and 40.88 %). These findings are in agreement with Shinde et al. (2007), Sharma et al. (2007), Mane et al. (2010) and Galvan et al. (2005). They also reported that spinosad was the most effective insecticide. it is reported that spinosad protected the cotton crop with minimum incidence of spotted bollworm leading to increased seed cotton production.

The cost benefit ratio (CBR) in various treatments ranged from 1:2.73 to 1:1.68. The highest CBR (1:2.73) was observed in the treatment of Emamectin benzoate 25 WG It was followed by the Cypermethrin 25 EC (1:2.61), Quinalphos 25 EC (1:2.48), Spinosad 45 SC (1:2.02), imidacloprid 200 SL (1:2.02), Neem oil (1:2.00) and compression to control (1:1.68). The highest marketable fruit yield (85.71q/ha) but less CBR (1:2.02) was obtained due to the high cost of spinosad. **Basavaraj and Gupta (2006), Mane** *et al.* (2010) and **Narottam** *et.al.*, (2011) recorded higher yield of good quality seed cotton from the plots protected by spinosad and the cost benefit ratio was more in Emamectin benzoate followed by spinosad.

Table 2: Efficacy of insecticides and neem oil against Earias vittella Fab. fruit damage per cent on okra

Treatment	Conc. (%)		Mean lar	Benefit cost ratio		
		1DBS	5DAS	10DAS	15DAS	
T ₁ Imidacropried	0.3ml/l	20.13	24.85	29.92	31.35	1:2.02
T ₂ Cypermethrin	0.5ml/l	16.13	22.63	28.11	30.25	1:2.61
T ₃ Emamectin benzoate	0.4g/l	18.31	21.64	26.19	28.27	1:2.73
T ₄ Neem oil	1ml/l	19.09	27.31	31.44	35.88	1:2.00
T ₅ Spinosad	0.3ml/l	20.66	20.85	23.15	23.72	1:2.02
T ₆ Quinolphos	0.3ml/l	19.95	25.43	30.89	33.36	1:2.48
T ₀ Control	-	20.13	33.11	35.24	40.38	1:1.68
CD (P=0.05)			4.09	3.45	3.44	
S.Ed. ±			1.88	1.59	1.58	
CV %			9.15	6.63	6.06	

DAS= Days after spray

DBS= Days before spray

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In vitro efficacy of Beauveria bassiana (Balsamo) Vuill. (Deuteromycotina: Hyphomycetes) against Odontotermes obesus (Rambur) (Isoptera: Termitidae)

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ABSTRACT

Study was under taken with five treatments including control with Different concentrations of *Beauveria bassiana* viz, 0%, 0.5%, 1%, 1.5% and 2% were tested on adults of *Odontotermes obesus*. It was noted that the concentration and mortality rate are directly proportional to each other i.e. when the concentration was increased the mortality rate also increased. Same was observed for time also. In case of *Odontotermes obesus* the highest net mortality i.e. 54.225% was recorded after 72 hours of treatment at 2% concentration, while the lowest 11.565% was recorded after 24 hours of treatment at 0.5% concentration.

Key words: Beauveria bassiana, Mortality rate, Odontotermes obesus.

INTRODUCTION

A chemical pesticide is used to protect crops and to kill pests. Use of synthetic pesticides causes some unfortunate consequences like environmental pollution, pest resistance and toxicity to other non target organisms. To ally the fear of the hazardous effect of chemical residues to human and animal health, several studies were conducted to determine the most effective control methods without using insecticides. One of the latest discovered methods is the use of the natural enemies of the insects such as bacteria, virus and fungi (Quintela and McCoy, 1997). Among the insect pathogens, fungi constitute the largest group with more than 700 species causing mycosis in insects. The class Phycomycetes and Deuteromycotina include most of the important fungal pathogens and the genera Entomophthora, Metarhizium, Beauveria, Nomuraea and Verticillium are noteworthy (Bell, 1974; Ferron, 1978). Fungal diseases are commonly seen in insect orders such such as Homoptera, Lepidoptera, Hymenoptera and Diptera (Keller, 1992; Kerwin, 1992). Of the 700 species of entomopathogenic fungi currently known, only 10 species have been, or are presently being, developed for control (McCoy et al. 1988, Robert and Hajek, 1992) and the full potential of entomopathogenic fungi has not been approached. Termites cause serious economic damage to crop, forest trees, structural timber in buildings and pasture in the tropics and subtropics which unfortunately covers the entire Mill (Wood and Pearce, 1991; Logan and Buckley, 1991; Sen Sarma, 1995). Edwards and Mill, 1986 and Sen Sarma, 1995 reported that cost involved in the operation of termite control worldwide and in India to the tune of USD 1,920,000 and USD 800,000 per annum respectively. Around

200 species are found in India, *Odontotermes, Microtermes, Coptotermes, Heterotermes, Cryptotermes* and *Microcerotermes* are considered to be major pest in several parts of the country (**Roonwal, 1979**).

MATERIALS AND METHODS

Maintenance of Beauveria bassiana

The study was conducted in research laboratory of plant protection department, S.H.I.A.T.S, Allahabad. The fungus was isolated from dead *Inderbella quadrinotata*, the guava bark eating caterpillar larvae on guava trees in orchards of, S.H.I.A.T.S Allahabad. The culture was then purified on PDA medium and maintained for use in the various experiments. Fungal preparation was prepared by serial dilutions of *Beauveria bassiana* (Balsamo). Four different concentrations i.e. 0.5, 1, 1.5, 2 ml of 1 x 109 conidia per ml was prepared by serial dilutions Conidial count was done for each suspension using an Haemocytometer for conidia/ml of dilution and recorded separately.

Termite collection and maintenance

The workers of the termite species (*Odontotermes obesus*) were collected from field, they were reared in plastic tubs (12cm height and 36 cm diameter) with soil amended with dried wooden sticks of *Glyricidia sepium, Bambusa* sp., *Tectona grandis*, and saw dust (**Roonwal, 1979**). The temperature of the tubs were maintained at 25- 26°C and moisture level was at 80-90%. The worker termites were acclimatized for a period of seven days for all bioassay experiments. The photoperiodic regime was 12L: 12D (**Roonwal, 1979**)

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Bioassay tests

For bioassay, Fifty worker termites were introduced in each plastic cups (5cm height and 4cm diameter) with 40g soil and sawdust and three replicates were kept for each treatment. Spore collections of Beauveria bassiana such as 109 conidia /ml were tested against Odontotermes obesus with three replicates for each treatment and a set of control without any treatment were kept separately. For this purpose 0.5%, 1%, 1.5%, 2% of the test solution of Beauveria bassiana was inoculated with glass pipette for each treatment. After inoculation the treated cups were covered with black cotton cloth. Observation of mortality rate, were made at regular intervals of 24 hours for a period of 3 days. Throughout the experiment proper aeration and moisture contents (80-90%) were maintained. All the bioassays were performed under aseptic laboratory conditions with temperature, humidity and light intensity from 27 - 30°C, 70-90%, 12L: 12D respectively. For the observation of mycosis effect, the dead termites from the treatment and control were collected and surface sterilized for two minutes in 0.2 % mercuric chloride solution then for 2 minutes in 70% ethanol and plated in water agar medium and incubated at 25°C for 48 hours. After which microscopic observation were performed to study the growth, sporulation and germination of the fungus. Data collected were subjected to Analysis of Variance (ANOVA) and were compared between treatments based on critical difference at 0.05 probability level. Data of mortality rate of Odontotermes obesus at different days of exposure subjected to ANOVA the data were analyzed using computer based IRRISTAT analysis developed by International Rice Research Institute, Philippines.

RESULTS AND DISCUSSION

From the bioassay, a linear relation between per cent mortality and dose concentrations were observed. Like many other entomopathogenic fungi, B. bassiana kill their host insect through the action of the hyphae which germinate from spores outside the body, penetrate the exocuticle, invade and ramify inside the body and subsequently destroy the internal tissues (Schaerfenberg, 1964). Workers of O. obesus were probably infected by the same way. Dead worker termites become hard, change in color from golden yellow to dark blackish brown and their appendages turn brittle. About 24-48 hr. after death, whitish mycelia began to appear on the intersegmental regions and joints of the appendages of the dead worker termites. Sporulation on the body surface of the workers occurred on the fifth and sixth day due to infection by B. bassiana. Virulence is a function of fungal species. However, spore concentration was also found to be an important factor in the expression of virulence of the fungal isolates (Burdeos and Villacarlos, 1989). In the bioassay with B. bassiana against Odontotermes obesus, per cent mortality increased from 11.56 to 54.22 per cent respectively as the dose was increased from 0.5 to 2 per cent. In a similar work, El-Khawas et al. (2002) recorded that the LD50 for S. *litoralis* was 30.65×107 conidia/ml. They also suggested that the treatments with fungi caused an elongation in larval and pupal duration and mortality ranged from 59 to 92 per cent. In the present study, among the applied doses, higher concentration recorded the highest mortality whereas in less concentration, various morphological abnormalities such as malformed larvae, pupae and adults were noticed. All the doses of fungus revealed certain severe pathological alterations also. Treated larvae became sluggish and stopped

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	Treatments		24 hrs	48 hrs	72 hrs	Mean
T ₁	Beauveria bas	ssiana 0.5%	11.565	14.685	24.648	16.97
T ₂	Beauveria bas	ssiana 1%	19.728	23.077	33.099	25.30
T ₃	Beauveria bassiana 1.5%		25.170	30.769	41.549	32.50
T ₄	Beauveria bas	ssiana 2%	33.333	39.860	54.225	42.47
T ₀	Control		0.000	0.000	0.000	0.000
Mean			17.959	21.678	30.704	
comparisons S.Ed.		C.D. at	5%	•		
F-Test	S	S				
Hours	0.816	1.66				
Treatme	ents	1.884	3.846			

[135]

Table 1: Comparison effect of different concentrations of Beauveria bassiana on percent net morality of Odontotermes obesus showing after treatment at different hours of interval.

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feeding after 24-48 h. The cuticle of treated larvae blackened which may due to excessive melanization indicating direct attack of fungus on the defense system of these insects.

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Air quality assessment at Delhi

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ABSTRACT

Due to increase in industries, number of vehicles, energy consumption, and burning of wastes air pollution at Delhi is striking highly. It results in increase in annual average levels of suspended particulates which is responsible for number of respiratory health problem. The present study investigates the level of different air pollutant at four different location of Delhi with the help of Delhi Pollution Control Committee.

For the purpose high volume samplers and PM 2.5 samplers were run at different selected location and SOx and NOx were also measured simultaneously. Analysis was conducted at the laboratory of DPCB. Monitoring and Analysis were carried out as per the guideline provided by the CPCB.

All the sites show very much high value of all four air pollutants as compare to National Ambient Air Quality Standard. On the basis of parameter study site 1 (R.K. Puram) was found to be most polluted however in overall performance site 2 (mandir marg) is second most polluted. Among all four sites the pollution level show as Site 1 >Site 2 >Site 3 >

Keywords: air quality, pollution, particulate matter

INTRODUCTION

Rapid industrialization, urbanization has resulted in the emergence of industrial centers without a corresponding growth in civic amenities and pollution control mechanisms. This leads to different environmental disorders. Air pollution is a major issue of concern among it, affecting the developing and the developed countries alike. The effects of air pollution on health are very complex as there are many different sources and their individual effects vary from one to the other. Epidemiological studies suggest that more than 500,000 people die each year from cardiopulmonary disease linked to breathing fine particle air pollution (WHO, 2005). Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, the individual's health status and genetics. PM 2.5 is more dangerous than PM_{10} as when inhaled, they may reach the peripheral regions of the bronchioles, and interfere with gas exchange inside the lungs. The mortality in cities with high levels of pollution exceeds that observed in relatively cleaner cities by 15-20 % (WHO, 2005). An increase in PM_{10} by $10\mu g/m^3$ has been reported to cause 0.76% excess deaths from cardiovascular causes and 0.58% excess mortality from respiratory diseases (Analitis et al., 2006).

In Delhi automobiles, industries and thermal power plants are the major contributors to increase in ambient air pollution. Due to increase in population industrialization, number of vehicles, energy consumption, and burning of wastes are also increases. It results in increase in annual average levels of total suspended particulates (TSP) which is responsible for number of respiratory health problem. Central Pollution Control Board initiated an Epidemiological study in Delhi with the help of Chittaranjan National Cancer Institute, Kolkata. They concluded that level of PM₁₀ (µg/m³) was 136.8 \pm 16.5, SO₂ (µg/m³) was 9.4 \pm 1.3, NO₂ (µg/m³) was 43.4 \pm 5.9 during 2008. Increase in population, industrialization, number of vehicles, energy consumption, and burning of wastes increases annual average levels of total suspended particulates (TSP) which is responsible for number of respiratory health problem. In Delhi such an increase in air pollution is associated with 2.3% increase in deaths and has the greatest impact on the 15--44 age group.

Delhi is the capital city of India and is the largest metropolis by area and the second-largest by population in India. This led us to study the level of ambient air quality of different area of Delhi to understand the exposure level of resident and future aspect of air borne health issue.

For the purpose four different sites viz; R. K. Puram, Mandir Marg, Punjabi Bagh and Civil Lines were selected at Delhi on the basis of residential and commercial area. Where there is more and long term exposure of human is possible. And PM 10, PM 2.5 were measured for particulate matter level and NOx and Sox were for gaseous pollution.

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MATERIALAND METHOD

The study was conducted with the help of the Delhi Pollution Control Committee from the period of January to June 2012. All the sites were monitor for 15 days on regular basis (60 days in total). And analysis was carried out as per the guideline provided by CPCB. Air quality is compared with National Ambient Air Quality Standard 2009. The methods used for specific pollutants are given in *Table 1*.

pollutant	Instrument	Method of measurement
PM 10		Gravimetric method (Avg. flow
PM 2.5		rate not less than 1.1 m3/min
	High	
SOx (Oxides	volume	Improved West and Geake
of Sulphur)	sample	Method
NOx (Oxides		Jacob & Hochheiser modified
of Nitrogen)		(NaOH-NaAsO ₂) Method
		through Spectrophotometer



Fig: Sampling site at Delhi

RESULT AND DISCUSSION

Ambient air quality at different sites:

The term air quality means the state of the air around us. Ambient air quality refers to the quality of outdoor air in our surrounding environment. It is typically measured near ground level, away from direct sources of pollution. During our study period we find day to day variation in all the parameter analyzed which was basically due to variation in traffic input and weather conditions. Results have been discussed area wise and fifteen days monitoring results of in different parameters were given in *table 1, 2, 3,4* and 5. Further the comparison of average value (ambient condition) with standard value is shown through the *figures 1, 2, 3, 4* and 5.

Table No.1: 15 days value of different parameter analyzed at R.K. Puram

Days	PM 10	PM2.5	NOx	SOx
č	(µg/m ³)	(µg/m³)	$(\mu g/m^3)$	$(\mu g/m^3)$
D1	369.54	164.95	415.5	18.6
D2	406.62	194.83	196.2	21.6
D3	382.89	215.04	91.3	30.2
D4	434.2	170.62	202.2	32.7
D5	343.16	178.7	411.5	22.5
D6	332.9	243.73	56.5	30.5
D7	196.83	77.54	85.7	21.6
D8	242.95	98.58	116.7	8.6
D9	283.2	170.33	330	15.2
D10	332.79	212.54	309.4	12.7
D11	389.16	109.91	303.4	11.5
D12	324.04	227.22	239.4	12.9
D13	351.91	199	290.0	21.6
D14	410.37	190.9	312.6	26.7
D15	332.29	145.62	220.7	19.7
Average (µg/m ³)	342.15	173.3	258.8	20.4



Table No.2: 15 days value of different parameter analyzed at Mandir Marg

Days	PM 10	PM2.5	NOx	SOx
-	$(\mu g/m^3)$	$(\mu g/m^{3})$	$(\mu g/m^3)$	$(\mu g/m^3)$
Dl	228.58	126.56	78.4	35.4
D2	188.91	149.12	51.8	16.4
D3	287.7	163.7	113.2	22.3
D4	300.83	170.45	252.7	19.3
D5	356.79	128.66	170	16.5
D6	349.25	206	150.7	21
D7	427.62	106.58	224.8	19.7
D8	294.04	79.91	242.95	19.3
D9	290.91	143.5	133.4	32.2
D10	388.16	164.58	204	33.5
D11	336.45	95.79	190.6	27.3
D12	330.16	118.8	67.4	16.7
D13	199.33	135.5	45.8	23.8
D14	188.58	159.08	80.5	16.9
D15	140.66	108.08	61.7	26.1
Average (µg/m ³)	287.2	137.09	125.6	23.4



Figure 2- Ambient Air Quality at Mandir Marg

Punjabi Bagh:

Table No.3:	15	days	value	of	different	parameter	
analyzed at Punjabi Bagh							

Days	PM 10	PM2.5	NOx	SOx	
	$(\mu g/m^3)$	$(\mu g/m^3)$	$(\mu g/m^3)$	$(\mu g/m^3)$	
D1	228.58	126.56	78.4	35.4	
D2	188.91	149.12	51.8	16.4	
D3	287.7	163.7	113.2	22.3	
D4	300.83	170.45	252.7	19.3	
D5	356.79	128.66	170	16.5	
D6	349.25	206	150.7	21	
D7	427.62	106.58	224.8	19.7	
D8	294.04	79.91	242.95	19.3	
D9	290.91	143.5	133.4	32.2	
D10	388.16	164.58	204	33.5	
D11	336.45	95.79	190.6	27.3	
D12	330.16	118.8	67.4	16.7	
D13	199.33	135.5	45.8	23.8	
D14	188.58	159.08	80.5	16.9	
D15	140.66	108.08	61.7	26.1	
Average(µg/m ³)	287.2	137.09	125.6	23.4	



Figure 3: Ambient Air Quality at Punjabi Bag

Civil Lines:

 Table No.4:
 15 days value of different parameter

 analyzed at Civil Lines

Days	PM 10	PM2.5	NOx	SOx
	$(\mu g/m^3)$	$(\mu g/m^3)$	$(\mu g/m^3)$	$(\mu g/m^3)$
	322.89	99.05	69.23	37.86
D2	203.21	64.51	56.27	29.59
D3	218.89	72.07	48.09	21.69
D4	258.62	89.5	80.9	28.38
D5	382.11	137.4	59.03	32.69
D6	451.68	164.85	75.29	27.2
D7	470.07	120.26	98.58	35.49
D8	422.21	101.9	83.82	45.06
D9	398.6	103.98	84.93	31.39
D10	357.76	75.29	86.64	29.97
D11	407.11	69.41	64.69	21.51
D12	464.47	72.73	59.33	31.82
D13	381.9	68.17	78.71	22.66
D14	437.31	60.91	38.71	26.22
D15	333.62	39.01	55.06	18.13
Average(µg/m ³)	367.36	89.27	69.42	29.34



Figure 4: Ambient Air Quality at Civil Lines



Figure 5 - compare of ambient air quality for all four sites

Our results suggest that among all the four sites, ambient air quality of site 1 (R. K. Puram), shows highest pollution level, the approximate average value for NOx 258 ug/m³, for SO x 20 ug/m³, for PM₁₀ 342 ug/m³ and for PM_{2.5} it was 173 ug/m³. This site is mainly residential area, but because of hosting JNU and some other institution along with market

cvomplexes nearby advocates a high traffic density. But being residential area it should be matter of great concern as such high level of RSPM and TSP might aggravate respiratory illness (Cropper et al., 1997; WHO, 2005) Site 2 (Mandir Marg) was the second most polluted area in which the approximate average values of different pollutants was as NO x 125 ug/m³, SO x 23 ug/m³, PM₁₀ 283 ug/m³ and PM₂₅ 137 ug/m³. This site joins all road to Connaught place which is biggest commercial place in Delhi, due to this traffic load is very much high there, and this site is commercial as well as residential area which is another reason of high population as well as high pollution level. Site 3 (Punjabi Bagh), was the least polluted area than other 3 sites during the study period. But the value of PM_{25} was the highest here among all four sites which may have its own impact as suggested by Goldberg, et al., in (2002). They hypothesize that ambient particles can affect the heart indirectly through a modification of pulmonary endothelin homeostasis. This is based partly on the findings that human subjects exposed to ambient PM₂₅ exhibit dose-dependent increases of levels of circulating endothelins. The approximate average value of different pollutants was SO x as 30 ug/m3, PM10 as 137 ug/m3 and PM2.5 as 259 ug/m3. At Site 4 (Civil Lines) average values of NOx, SOx and PM_{25} were lower than compare to other sites but but value of PM₁₀ was very much high than all other sites. This was the third most polluted sites in the study period. The average values for NOx, Sox, PM₁₀ and PM₂₅ was 69 ug/m3, 29 ug/m3, 367 ug/m3, 89 ug/m³ respectively. NOx and Sox values are less because of less traffic load in that area in the study period. Overall SO2 and NO₂ level was less in Delhi but RSPM was exceeded and SPM level was fluctuating (Central Pollution Control Board, 2006). Central Pollution Control Board in 2008 initiated an epidemiological study in Delhi, they concluded that level of PM_{10} (µg/m³) was 136.8 ± 16.5 , SO₂ (µg/m³) was 9.4 ±1.3 , NO₂ (µg/m³) was 43.4 ±5.9 , Benzene (μ g/m³) level was 12.4±12.7, t,t-MA in urine (μ g/g creatinine) level was 218. The ten year study conducted by Central Pollution Control Board shows ambient air quality trend for annual average concentration with respect to three criteria pollutants such as SO2, NO2 and RSPM for BSZ Marg, a major traffic intersection in (ITO), Delhi. The 10 years trend revealed that SO₂ indicated slightly decreasing trend while NO₂ had shown decreasing trend after 2003 and RSPM had shown decreasing trend after 2005. Although there is no standard for traffic intersections but Nitrogen dioxide has shown above the national standard since 2003 to 2005, but in 2006 onwards it had shown within the national standard, if considered commercial or industrial areas as 80 $\mu g/m^3$.

The respirable particulate matter had shown increasing trend during 2001 to 2002 but fluctuating during 2003 to 2005

and shown stable trend during 2006 to 2008 due to several interventions at source level taken by the Government. But after 2010 it gradually increases which shows in my study period the ambient air quality is very much high than National Ambient Air Quality Standards. It shows that air quality is very much polluted in these days due to the increase in the standard of living including number of vehicles as well as construction process.

CONCLUSION

All the sites show high value of all four air pollutants as compare to National Ambient Air Quality Standard. On the basis of parameter study site 1(R.K. Puram) was found to be most polluted however in overall performance site 2 (mandir marg) is second most polluted. Among all four sites the pollution level show as Site 1 >Site 2 >Site 4 >Site 3.

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Impact of mass bathing on water quality of River Ganga during Mahakumbh (2013) at Allahabad

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ABSTRACT

A water quality survey of river Ganga at Allahabad was conducted to assess the water quality fluctuations before, during and after Mahakumbh. The pollution load on the river was investigated at 5 sampling sites.

The study highlighted that mass bathing indicated that water is not fit for either drinking or bathing purposes. The presence of faecal coliforms in water also hints at the potential presence of pathogenic microorganisms, which might cause water borne diseases. Although the water was found to be safe with respect to dissolved oxygen content, the values of BOD and COD exceeded the maximum permissible limit during bathing.

The average concentration of pH, alkalinity and chloride are also found very high in comparison to standard value of central pollution control board.

Key words: Ganga River, BOD, COD, pH, chloride, alkalinity, India.

INTRODUCTION

For centuries a dip in the Ganges has remained the most sanctifying event for the Hindus. Various pilgrim centers, which develop by the side of Ganga, are known virtually for the sanctification of mind and soul. Both the Kumbh and Maha Kumbh mela are regarded in the high esteem for an organized dipping in the river Ganga. The Maha Kumbh was celebrated at Hardwar, Uttaranchal between 26th January and 15th May 2004. This unique celebration of faith, hope, joy and immortality was spread over 135 sq km and it is estimated that 60 lakh people had taken the holy dip in this area on 12 different auspicious dates. God knows that whether the mind and soul of such a large crowd will be sanctified or not but it is evident from a course of studies carried out by different researchers (Tiwari and Mishra, 1986; Srivastava et al., 1996; Gupta and Deshpande, 2004 and Narain, 2004) that water resources of our country including Ganga water is highly contaminated and people can be infected with various diseases by taking bath in Ganga. Keeping in view all these facts in mind, the present study had been designed to detect the changes in number of total coliforms, faecal coliforms, dissolved oxygen, chemical oxygen demand and biological oxygen demand before and after the holy dip of Mahakubh. 30 million people visited the Maha Kumbha Mela on 10 February 2013 and an estimated 100 million are expected to visit the place during the festival spread over 55 days.

MATERIALAND METHOD

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The present study was carried out at various inlet and outlet points of river Ganga at Allahabad during 2013 for effective sampling and its observation.

Sampling :

Samples (Ganga water) was randomly collected over the 50 -60 m stretch of 5 selected sites viz.

S.No.	Sample collection	Location
1	Ganga-I(G1)	Shastri bridge
2	Ganga-II(G2)	500m away from Shashtri
		bridge.
3	Sangam (G3)	Sangam Ghat
4	Outflow-I(G4)	Krailghat
5	Outflow II (G5)	500m away from Krailghat

Temperature - Temperature was measured in °C at the time of samples collection by thermometer.

Electrical conductivity :- pH, alkalinity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO) chloride content (Cl) and hardness of the water samples were determined using the method as described in standard method for the examination of water (A.P.H.A. - A.W.W.A-W.P.C.F., 1975).

Electrical Conductivity :- Electrical conductivity (EC) of the water samples was determined by using Conductivity Bridge type CM 82 T.

pH :- pH of the water samples was measured by a digital pH meter (Model: PR 8404) using glass electrode. (JACKSON 1958).

Total Alkalinity :- Take 100 ml of sample in a a conical flask and add one drop of methyl orange indicator. If it gives yellow colour then titrate the sample with N/50 H_2SO_4 solution until orange colour appears. Note down the volume of H_2SO_4 . Rundown.

Biological oxygen demand (BOD), Dissolve Oxygen(DO) and Chemical oxygen demand (COD) :- Take the 300 ml water sample in a B.O.D. bottle and incubate it in the incubator for 5 days. On 5th day keep it out from the incubator. Add 2 ml of mangnous sulphate solution add 2 ml of alkali iodide azide solution in the bottle by the pipette. After 2 minutes add 2 ml of concentrated H_2SO_4 and mix it carefully. Take 203 ml solution from the bottle and add 1-2 ml starch indicator and then titrate with sodium thiosulphate solution taken from burette. Note the volume of sodium thiosulphate solution used to and end where color changed blue to white i. e. reading for final D.O.

Chemical oxygen demand (COD) was measured by Dichromate reflux method and chemical characters of water were analyzed as per **APHA** (1998). Transmittance wasmeasured with the help of spectrophotometer.

Chloride :- Take 50 or 100 ml of water sample. Add 1 ml of potassium chromate indicator. If it gives yellow colour titrate it with $AgNo_3$ until brick red colour appears. Note down the volume of $AgNo_3$ run down. The chloride content was calculated by using formula (mg/l)

 Table 1: Average pH of the water samples collection at different date from different areas of Ganga river during the Mahakumbh.

Bathing Day		Avera	ge pH		
	G1	G2	G3	G4	G5
Before mahakumbh	7.4	7.6	7.4	6.9	6.5
Before mahakumbh	8.6	8.5	8.8	8.4	8.2
Maker Sankarnti	8.3	8.06	8.4	7.6	7.8
Paush Purnima	8.2	7.6	7.7	7.9	7.6
Ekadashi Snan	8.7	8.6	8.8	8.4	8.3
Mauni Amavasya	7.8	7.5	7.6	8.4	8.2
Basant Panchami	7.6	7.5	7.4	8.2	7.4
Rath Saptami snan	8.4	8.3	8.5	8.1	7.3
Bhisma Ashtami	8.2	8.2	8.3	8.1	7.7
Snan					
Maghi Purnima	8.0	7.8	7.8	7.1	7.4
Shivaratri Snan	7.4	7.2	7.4	7.2	6.9
After Mahakubh	7.8	7.6	8.2	8	7.7
		F-test	$S.Ed(\pm)$	C.D. at 5%	
Due to place		S	0.176	0.370	
Due to days		S	0.114	0.239	

Hardness :- Take 50 ml of sample Add 2 ml of ammonia buffer solution and 3 drops of erichrome black T indicator, the colour of the sample changed to wine red. Titrate the sample with standard EDTA solution till wine red colour change in to blue. Note the reading ml of EDTA used.

RESULTS AND DISCUSSION

Data collected were subjected to statistical analysis based on mean values of five random samples taken from five different sites on twelve different dates. The relevant analysis of variance has been given in appendix. The salient features various parameters studied, are presented below:

pH :- From *table 1* showed that Average pH is decreases with following order $D_5 > D_2 > D_8 > D_3 > D_9 > D_4 > D_{10} > D_6 > D_{12} > D_7 >$ $D_{11} > D_1$ and Maximum Average pH had been found in D_5 (10 feb. 2013) at G2 ghat (7.6) while minimum Average pH had been found in D1 at G5 ghat (6.5). The change in pH can be ascribed by the reasons that due to large gathering significant amount of pollutants were added in the river in the form of acid which decreases pH (fecal contamination), salt which increases pH and makes the river alkaline. Also while gathering the flora and fauna were disturbed which caused significant change in pH as the excretion by them act as buffer and resist to the change in pH. Also difference in area of sample collected can also be the reason as water flowing over limestone will be more alkaline than rest part of the river.

Similar results have been reported by **Vijay Sharma**, **Sushil Bhadula and B. D. Joshi (2010)** reported The pH values was recorded between 7.6- 8.2. The minimum pH value was noted 7.6 at bathing ghat of Rath Sapta misnam during third Royal bath, while maximum pH value was noted 8.2 at bathing ghat of Prem Nagar during fourth or main Royal bath.

Hardness:- From *table 2* showed that Average total hardness is decreases with following order $D_1 > D_8 > D_2 > D_7 > D_{11} > D_{12} > D_3 > D_6 > D_4 > D_{10} > D_5 > D_9$ and Maximum Average pH had been found in D_1 at G2 ghat (7.6) while minimum Average pH had been found in D9 at G5 ghat (6.5). Change in hardness may be ascribed by the fact that Hardness is measured as mg/L of CaCO₃ (calcium carbonate), although the hardness may not necessarily be due to CaCO₃. This measure is equivalent to alkalinity and is caused by the presence of multivalent ions such as calcium, magnesium, iron or manganese, released from minerals dissolved in water. Large human gathering actually disturbed the alkalinity of river hence disturbing the mineral balance in the river causing significant change in hardness

Table.2: Average total hardness of the water samples collection at different date from different areas of Ganga river during the Mahakumbh.

Date of	Bathing Day	Total hardness mg/lit				
water						
collection						
		G1	G2	G3	G4	G5
D1	Before mahakumbh	330	340	380	350	460
D2	Before mahakumbh	317	320	384	360	420
D3	Maker Sankarnti	260	260	300	380	380
D4	Paush Purnima	290	230	260	310	380
D5	Ekadashi Snan	210	218	370	300	310
D6	Mauni Amavasya	300	320	252	300	340
D7	Basant Panchami	280	320	310	380	360
D8	Rath Saptami snan	330	316	330	350	486
D9	Bhisma Ashtami	264	244	250	240	250
	Snan					
D10	Maghi Purnima	280	200	300	310	360
D11	Shivaratri Snan	300	310	330	340	350
D12	After Mahakubh	280	300	300	360	360
		F-test	$S.Ed(\pm)$	C.D. at 5%	ó	
Due to pl	ace	S	21.712	45.595		
Due to da	ays	S	14.015	29.431		

Table 3: Average conductivity of the water samples collection at different date from different areas of Ganga river during the Mahakumbh.

Date of	Bathing Day	Avera	ge condu	ctivity (uohm	-cm)
water						
sample		G1	G2	G3	G4	G5
D1	Before mahakumbh	370	375	520	540	580
D2	Before mahakumbh	350	340	450	480	490
D3	Maker Sankarnti	330	350	400	420	460
D4	Paush Purnima	320	300	320	310	330
D5	Ekadashi Snan	315	320	330	350	380
D6	Mauni Amavasya	300	310	315	330	340
D7	Basant Panchami	300	315	300	320	310
D8	Rath Saptami snan	330	325	350	380	400
D9	Bhisma Ashtami	325	330	345	370	390
	Snan					
D10	Maghi Purnima	350	330	350	390	410
D11	Shivaratri Snan	335	350	370	380	400
D12	After Mahakubh	420	415	420	460	470
		F-test	S.Ed(±)	C.D. at 59	%	
Due to pla	ce	S	18.322	38.477		
Due to day	rs	S	11.827	24.837		

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Conductivity :- From *table 3* showed that Average conductivity decreased with following order $D_{12}>D_3>D_2>D_1>D_{11}>D_{10}>D_8>D_9>D_5>D_4>D_6>D_7$ and Maximum Average conductivity has been found in D_{12} at G2 ghat while minimum Average conductivity has been found in D7 at G5 ghat. The change in conductivity of the river can be accounted by the reason conductivity in rivers is affected by the geology of the area through which the water flows, so change in area from which water sample was taken like river that run through granite bedrock will have lower conductivity, and those that flow through limestone and clay soils will have higher conductivity values. Due to mass bathing as alkalinity was changed hence resulting into free ion change in river creating a significance change in conductivity.

 Table 4: Average COD of the water samples collection at

 different date from different areas of Ganga river

 during the Mahakumbh.

Date of	Bathing Day	Ave	erage C	OD mg	g/lit	
water						
collection		G1	G2	G3	G4	G5
D1	Before mahakumbh	31	30	18	17.5	17
D2	Before mahakumbh	33	32.8	23	21	23
D3	Maker Sankarnti	30	30.6	14.6	14	14.2
D4	Paush Purnima	33.8	33	23	22	22.8
D5	Ekadashi Snan	19	18.6	21	20.8	20
D6	Mauni Amavasya	27.7	25	19.5	21	19.8
D7	Basant Panchami	24.9	24.8	21	22	22.2
D8	Rath Saptami snan	23.6	26	20.8	20	18.6
D9	Bhisma Ashtami	22.87	24	21	22	21
	Snan					
D10	Maghi Purnima	27	27.8	24	22.5	22
D11	Shivaratri Snan	25	23.5	22	23	23.5
D12	After Mahakubh	28	25	21	20	20.2
		F-test	$S.Ed(\pm)$	C.D. at 59	6	
Due to place	2	S	1.873	3.933		
Due to days		S	1.209	2.538		

COD :- From *table 4* showed that Average COD is decreased with following order $D_4 > D_2 > D_{10} > D_{11} > D_7 > D_1 > D_1 > D_3 > D_6 > D_9 > D_8 > D_5$ and Maximum Average COD has been found in D_4 at G2 ghat while minimum Average COD has been found in D5 at G5 ghat. The reason for higher COD might be due to the presence of huge amount of accumulated organic matter and its incomplete oxidation. Due to increase in pollution large amount of organic waste was added in river hence changing the organic deposit in river causing change of COD.

Date of	Bathing Day	Average BOD mg/lit				
sample				-		
collection		G1	G2	G3	G4	G5
D1	Before mahakumbh	4.8	4.6	4.4	4.4	4.8
D2	Before mahakumbh	5	5.4	5.2	4.6	4.2
D3	Maker Sankarnti	6	5.4	5.4	4.8	4.6
D4	Paush Purnima	8	4	1.6	7.2	4
D5	Ekadashi Snan	4	3.5	6	4	7.2
D6	Mauni Amavasya	6.4	5.2	7.6	4.8	5.6
D7	Basant Panchami	7.6	7.2	6.8	6.4	6
D8	Rath Saptami snan	7.2	7.6	6.8	6.4	6
D9	Bhisma Ashtami	7.6	2.8	3.2	5.6	7.2
	Snan					
D10	Maghi Purnima	5.4	4.5	4.8	3.8	4.2
D11	Shivaratri Snan	5	4.8	4.2	4	4.8
D12	After Mahakubh	4.8	5	5.2	4.6	4.4
		F-test	$S.Ed(\pm)$	C.D. at 59	6	
Due to place			NS	0.752	1.580	
Due to day	8	S	0.486	1.020		

Table 5: Average BOD of the water samples collection at different date from different areas of Ganga river during the Mahakumbh.

BOD :- From *table 5* showed that Average BOD is decreases with following order $D_8 > D_7 > D_6 > D_9 > D_3 > D_4 > D_5 > D_2 > D_3 > D_1 > D_1 1 > D_{10}$ and Maximum Average BOD has been found in D_8 while minimum Average BOD has been found in D_{10} . The present study clearly indicated that the BOD was comparatively higher after the dip. As compared to before and after the dip as the pollution due to mass bathing increased the amount of biodegradable substance in river hence increasing the BOD. Sample collection area changed the BOD as the change of deposition in the area from where the sample was taken.Similar results have been reported by **G. Annalakshmi and. A. Amsath (2011)** reported that the BOD of water samples collected from various station was between 4.46 to 10.42 mg/l on river Cauvery.

DO :- From *table 6* showed that Average DO is decreased with following order $D_5 > D_{10} > D_{11} > D_7 > D_8 > D_6 >$ $D_3 > D_2 > D_1 > D_{12} > D_4 > D_9$ and Maximum Average DO has been found in D5 while minimum Average DO has been found in D9. The decomposition of leaf litter, grass clippings, sewage, and runoff from feedlots decreases DO readings and increased gathering caused more flora near ghats to be destroyed and enter river hence affecting DO of river. Also other sources of contamination due to huge gathering also aided in change of DO change. Similar results have been reported by **Vijay Sharma**, **Sushil Bhadula and B. D. Joshi (2010)** reported Dissolved Oxygen (DO) ranged between 7.0-9.8 ppm. The Maximum DO (9.8) was found at bathing ghat of the Sapt rishi during first Royal bath, while the minimum DO (7.0) was found at the Bathing ghat of Prem nagar during Fourth Royal Bath. Similar results have been reported by **H. Kulshrestha and S. Sharmare (2006)** reported that the DO of water samples collected from various ghats was between 9.7 to 15.2 mg/l before dip and 9.7 to 14 mg/l after the dip.

 Table 6: Average dissolved oxygen of the water samples

 at different date collection from different areas
 of Ganga river during the Mahakumbh.

Date of	Date of Bathing Day		erage di	ssolved	l oxyg	gen
water				mg/lit	,	
sample collection		G1	G2	G3	G4	G5
D1	Before mahakumbh	8.8	8.6	8	8.2	8.4
D2	Before mahakumbh	9.0	8.7	8.2	8.4	8.0
D3	Maker Sankarnti	10.2	8.8	8.4	7.6	8.0
D4	Paush Purnima	9.2	7.6	8.4	6	9.2
D5	Ekadashi Snan	13.2	14.4	8.4	12	12.8
D6	Mauni Amavasya	10.4	10	9.2	8	9.6
D7	Basant Panchami	10	10.2	9.8	9.6	9.0
D8	Rath Saptami snan	12.8	10.4	8.4	8.8	8.0
D9	Bhisma Ashtami	6.8	6.0	8.4	6.0	8.0
	Snan					
D10	Maghi Purnima	9.6	10	9.6	10.2	11.6
D11	Shivaratri Snan	9.8	10.2	9.8	9.6	9.4
D12	After Mahakubh	8.0	8.4	8.2	8.4	8.3
		F-test	$S.Ed(\pm)$	C.D. at 59	6	
Due to place		S	0.662	1.391		
Due to day	s	S	0.427	0.898		

Chlorides:- From *table 7* showed that Average chloride is decreased with following order $D_8 > D_2 > D_1 > D_5 > D_{11} > D_6 > D_4 > D_{12} > D_3 > D_9 > D_{10} > D_7$ and Maximum Average chloride has been found in D_8 at while minimum Average chloride has been found in D7. The change in fluctuation in chloride level may be accounted by the reason that though tries were made to stop industrial waste water flow in river sometimes water was directed in river which changed chloride level significantly. Also salt from body of human gathering also was in significant amount hence altering the chloride level.Similar results have been reported by **Vijay Sharma, Sushil Bhadula and B. D. Joshi (2010)** reported that the Chlorides of the Ganga river water during Maha Kumbh ranged between 17.36-48.90 mg/l at the bathing ghat of Prem Nagar during Fourth Royal bath,

while the lowest value was found 17.36 mg/l at the bathing ghat of Sapt Rishi Ashram during First Royal bath.

Table 7: Average chloride of the water samples atdifferent date collection from different areas ofGanga river during the Mahakumbh.

Date of	Bathing Day	Average chloride mg/lit				
water						
sample collection		G1	G2	G3	G4	G5
D1	Before mahakumbh	21	19	37	52	53
D2	Before mahakumbh	24	26	36	49	48
D3	Maker Sankarnti	18	16.3	27	47	46
D4	Paush Purnima	25	25	20	43.9	48
D5	Ekadashi Snan	30	25	39	46	39
D6	Mauni Amavasya	14	21	22	52	56
D7	Basant Panchami	17	18	17.9	41	42
D8	Rath Saptami snan	23	19	21	67	61
D9	Bhisma Ashtami	17	14	36	45	34
	Snan					
D10	Maghi Purnima	18	19.5	25	41	40
D11	Shivaratri Snan	25	25	37	40	44
D12	After Mahakubh	21	19	36	38.5	41
		F-test	$S.Ed(\pm)$	C.D. at 5%	6	
Due to place	æ	S	3.975	8.348		
Due to days		NS	2.566	5.389		

Table 8: Average alkalinity of the water samplescollection at different date from different areasof Ganga river during the Mahakumbh

Date of	Bathing Day	Average alkalinity				/lit
water						
collection		G1	G2	G3	G4	G5
D1	Before mahakumbh	38	36	37	40	43
D2	Before mahakumbh	40	44	42	40	44
D3	Maker Sankarnti	48	45	60	54	58
D4	Paush Purnima	54	54	50	53	57
D5	Ekadashi Snan	58	56	53	54	57
D	Mauni Amavasya	45	49	48	54	58
D7	Basant Panchami	58	52	50	52	56
D8	Rath Saptami snan	47	53	45	30	36
D9	Bhisma Ashtami	50	50	57	52	48
	Snan					
D10	Maghi Purnima	52	58	52	57	58
D11	Shivaratri Snan	52	56	55	32	38
D12	After Mahakubh	48	47	45	50	50
		F-test	S.Ed(±)	C.D. at 59	6	
Due to place		NS	3.376	NS		
Due to day	8	S	2.179	S		

Alkalinity:- From *table 8* showed that Average alkalinity is decreases with following order $D_5 > D_2 > D_8 > D_3 > D_9 > D_4 > D_{10} > D_6 > D_{12} > D_7 > D_{11} > D_1$ and Maximum Average alkalinity had been found in D_5 (10 feb. 2013) at G2 ghat (7.6) while minimum Average alkalinity had been found in D1 at G5 ghat (6.5). The change in alkalinity can be ascribed by the reasons that due to large gathering significant amount of pollutants were added in the river in the form of acid which decreases alkalnity (fecal contamination),salt which increases alkalinity and makes the river alkaline. Also difference in area of sample collected can also be the reason as water flowing over limestone will be more alkaline than rest part of the river. Change in ion concentration is also a strong reason of change in alkalinity

CONCLUSION

From the present study, it is concluded that the results obtained, showed that there was a slight change, in the parameter analyzed during the mass bathing during Mahakhubh (2013). All the sampling and analysis carried out as per the guideline provide by WHO and the comparison of result between before, during and after the condition of river quality emphasize that the quality of water was of found being effective due to the mass bathing the parameter analysed i.e. pH, EC, COD, BOD, DO, Hardness alkalinity, Chloride total coli forms were found in this the permissible limit of WHO. The reason behind such is that during the Kumbh, all the industrial waste water that was earlier introduced in the water body was banned and fresh water was introduced in the river due to which it acted as a dilution factor, which resulted in less water pollution.

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Effect of Copper (Cu) and Zinc (Zn) on growth, physiological and biochemical parameters of *Azolla microphylla*

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ABSTRACT

The present experiment entitled Effect of Zinc (Zn) and Copper (Cu) on growth, physiological and biochemical parameters of *Azolla microphylla*. was conducted in year 2013. The experiment was carried out in CRD with three replications. Observations were recorded on three randomly selected samples for all the traits from each replications and the observations were recorded on sample basis. The result showed that the higher concentration of zinc and copper found detrimental to the fronds of *Azolla microphylla*. Higher concentration of zinc and copper effect the growth, physiological parameters of Azolla

INTRODUCTION

Heavy metal pollution is an important environmental problem in the world. Rapid industrialization and urbanization have resulted in elevated levels of heavy metals in the biosphere (**Lu** *et al.*, **2004**). Toxic levels of some heavy metals appear as a result of environmental pollution due to removal from mining, automobile traffic, smelting, manufacturing and agricultural wastes (**Oncel et al., 2000**).

Industries such as smelters, metal refineries and mining operations have been indicated as major sources of metal release into the environment (Gardea-Torresdey *et al.*, 1997; Srivastava *et al.*, 2007). Most of the heavy metals are toxic or carcinogenic in nature and pose a threat to human health and the environment (Shakibaie *et al.*, 2008; Vinodhini and Narayanan, 2009). Copper (Cu), nickel (Ni), cadmium (Cd) and zinc (Zn) are considered as toxic since they cause deleterious effect in plants, animals and humans.

In this sense, the aquatic fern Azolla has been reported to accumulate high concentration of heavy metals and metalloids (3-4mgL⁻¹) from aqueous media **Khosravi** *et al.* (2005); **Rai** *et al.* (2009). Biosorption using living aquatic plants (phytoremediation) is a relatively new technology to solve the problem of heavy metal pollution. In the process of phytoremediation pollutants are collected by plant roots and either decomposed to less harmful forms (for example CO₂ and H₂O) or accumulated in the plant tissues.

The genus Azolla belongs to the single genus family Azollaceae, the six recognized species within the genus are grouped under two subgenera- Eu Azolla includes A. filiCuloides, A. coroliana, A. mexicana & A. microphylla and Rhizosperma includes A. nicotica & A. pinnata. Azolla has a controlled ecological life support system for its strong photosynthetic oxygen (O_2) releasing capacity. Azolla provides macronutrient such as P, K, Ca and Mg and

micronutrient such as Fe, Mo and Co have been shown to be essential for the growth and nitrogen fixation of *Azolla*.

Heavy metal; zinc (Zn) and Copper (Cu) are the most dangerous substances in the environment, because of their high level of durability and harmfulness to live organism. zinc (Zn) and Copper (Cu) are widely distributed in the atmosphere, soil, ocean and ground water, it is observed and can be identified in most plant and animals tissue to far greater extent. Excessive accumulation of heavy metals is toxic to most plant. Heavy metals ions, when present at an elevated level in the environment, are excessively absorbed by roots and translocated to shoot leading to impaired metabolism and reduced growth. (Bingham et al., 1986). Heavy metal contamination to water poses a major environmental human health problem. Chemical methods, to effectively decrease heavy metals to acceptable levels require a large excess of chemicals, which increase the costs because of generating the voluminous sludge. Aquatic macrophytes play an important role in structural and functional aspects of aquatic ecosystems by various ways. The ability to take up heavy metals makes them interesting research candidates especially for the treatment of industrial effluents and sewage waters. Biosorption using living aquatic plants (phytoremediation) is a relatively new technology to solve the problem of heavy metal pollution. The use of aquatic macrophytes, such as Azolla with hyper accumulating ability is known to be a good nitrogen fixing agent and an environment friendly option to restore polluted aquatic resources.

MATERIALS AND METHODS

The present work entitled Effect of Zinc (Zn) and Copper (Cu) on growth, physiological and biochemical parameters of Azolla microphylla was conducted in the Laboratory of Department of Biological Sciences, Sam Higginbottom Institute of Agriculture, Technology and sciences Allahabad, U. P., India. Allahabad is located in South Eastern part of Uttar Pradesh state of India. The experimental site (lab) is located at 25.57° N latitude, 81.56° N longitude and 98 meters above mean sea level. Azolla microphylla was procured from Center of Conservation and Utilization of Blue Green Algae (CCUBGA), Indian Agriculture Research Institute, Pusa, New Delhi. (Kanha se Li thin app)

CULTURING

Azolla Culture was maintained in the plastic tube of 35 cm. diameter and 12 cm. depth. Each tube was filled with 3 - 4 Kg sterilized paddy field soil and mixed with single super phosphate (SSP) of about 300 mg and water is allowed to stand up to 4cm. above the soil in the tube were put in open air in the field of biological sciences. Each tube was inoculated with 3-4 gm Azolla fronds. After 10-15 days a thick mass of Azolla covered the entire water surface of the tube from these tubes Azolla fronds were taken out to conduct the lab studies. Azolla plant were collected, washed and cleaned by running water then dried, weight and transfered into petridishes containing Nitrogen free Hoagland's nutrient solution. After bringing into laboratory the fronds were washed with tap water with the help of foreceps. Azolla fronds were dried from blotting paper and weight to required quantity and inoculated to petridishes containing suitable treatment solution and Hoagland's nutrient solutions. Then after petridishes were transferred to Culture room and allowed for the development of effect on Azolla.

COMPOSITION AND PREPARATION OF MEDIUM

As **Peters and Mayne (1980)** recommended Hoagland's medium for *Azolla* Cultivation includes 5 stock solution, the first four are Potassium nitrate, Calcium nitrate, Magnesium Sulphate and Ammoinium Nitrate and fifth stock is called micronutrient mixture which contain the six different compound bear different micronutrient are below.

LD₅₀ AND TREATMENT LEVEL :-

Treatments were decided on the lethal dose of Zinc and Copper to the *Azolla* microphylla. A series of concentration starting from 4ppm to 12ppm was given to find out the LD_{50} . The number of surviving frond was recorded. Therefore, these different concentration of Zinc and Copper was defined as the treatments for present study i.e. 4, 8,12ppm.

The method was Cumulated with **Robinson** *et al.* (1985). To get the fresh weight *Azolla* fronds were blotted on filter paper an immediately weight. Each measurement was done in two replications. To get the dry weight, fronds were placed in petridishes and dried in a hot air oven at 60°C for 24 hours. Again the dried sample were weight after deducting the plate weight, reading were recorded in grams. The Average root number of per frond's, the method of **Ge-shi-An** *et al.* (1980) was fallowed and is calculated as:-

Average root number =Total number of roots / Number of Fronds

Table 3.1. Composition of Hoagland's nutrient medium (Raja et al., 2012).

Component	Stock solution	Stock solution	ml Stock
	Solution	per 100ml	
Macronutrient			
2M KNO ₃ (Potassium nitrate) 1	202g/L	2.5	20.2g
$2M \text{ Ca} (\text{NO}_3)_2 4\text{H}_2\text{O} (\text{Calcium nitrate})$	236g/0.5L	15 g/L	47.g
Iron (Sprint 1387 iron chelate) (Iron EDTA or Iron Chelate, Fe-EDTA)			23.6gl
2M MgSO ₇ H ₂ O Magnessium sulphae heptahydrate	493 g/L	1	1.5g
1M NH ₄ NO ₃ Ammoinium Nitrate	80 g/L	1	49.3g
Mnicronutrients			8.09
M_3BO_3 (Boric Acid)	2.86g/L	1	0.28
Mn Cl ₂ .4H ₂ O (Manganese chloride)	1.81 g/L	1	0.18
$ZnSO_4.7H_2O$ (Zinc sulfate heptahydrate)	0.22 g/L	1	0.022
CuSO ₄ (Copper sulfate)	0.051 g/L	1	0.0051
H ₃ MoO4.H ₂ O or	0.09 g/L	1	0.009
$Na_2MoO_4.2H_2O$ (Sodium molybdate)	0.12g/L	1	0.012
1MKH ₂ PO ₄ (ph to 6.0) (potassium dihydrogen (Potassium phosphate monobasic)	136g/L	0.5	136

To find out average root length of *Azolla* microphylla fronds the procedure of **Kurth** *et al.* (1986) was followed. It is the average length of all roots hanged to *Azolla* fronds. It is calculated as fallows:-

Average root length=Total length of roots (cm) / Number of roots

Doubling time is the time in days needed for the production of next generation or needed for the doubling of *Azolla* biomass which is calculated as follows :-

doubling time = t/r

where,

t = Experimental period.

 $r = \log (w_1 - w_0) / 0.301$

 w_1 = weight after t days.

 $w_0 =$ weight initial sample.

The major photosynthetic pigment chlorophyll was determined according to **Lichtenthaler and Welburn (1983)** method. 0.1 gm *Azolla* was weight and grounded with 80% acetone made the volume to 10ml with 80% acetone. Then centrifuged at 800 rpm for 5 minutes. The supernant was read under 663 and 646 nanometer. The Chlorophyll content was calculated using the following formula:-

Chlorophyll- a mg/gm fresh weight= $12.21_{(A663)}$ - $2.81_{(A646)}$ Chlorophyll -b mg/gm fresh weight= $20.13_{(A646)}$ - $5.03_{(A663)}$ Total Chlorophyll (a & b) mg/g fresh weight=Chlorophyll (a) + Chlorophyll (b)

Where,

A=Absorbance of specific wavelength

The values obtain from the Chlorophyll a and Chlorophyll b are in mg/g fresh weight.

Carotenoid was determine according to method of **Lichtenthaler and Welburn (1983)**. 0.1 gm *Azolla* weight and crushed in 80% acetone, made the volume to 10ml. with 80% acetone. Then centrifuge at 800 rpm for 5 minutes. The supernant was read under 470 nanometer against 80% acetone blank . The carotenoid content was calCulated using the following formula :-

Carotenoid mg/g fresh weight=1000 $_{\scriptscriptstyle (A470)}$ - 3.27 (Chl-a) - 104 (Chl-b) / 227

The Anthocyanin were determined according to the method of **Mirecki and Teramura** (**1984**).

The Protein were determined according to the method of Lowry *et al.* (1951).

RESULTS AND DISCUSSION

The fresh weight of *Azolla microphylla* was severely inhibited at highest concentration i.e. T_6 12ppm Cu (0.367) concentration. While as gradual reduction was observed in other treatments (T_1 0.600, T_2 0.567, T_3 0.500, T_4 0.533 and T_5 0.400 mg/gm) as compared to control (1.033). Where as in

percentage decline in fresh weight of Azolla microphylla from T₁ to T₂ is 41.91, 45.11, 51.59, 51.59, 48.40, 61.27 and 64.47%. The dry weight of Azolla microphylla was severely inhibited at highest concentration i.e. T₆ 12ppm Cu (0.030) concentration. While as gradual reduction was observed in other treatments ($T_1 0.053$, $T_2 0.050$, $T_3 0.043$, $T_4 0.057$ and T_5 0.050 mg/gm) as compared to control (0.080) depicted in table number 4.2. Where as in percentage decline in dry weight of Azolla microphylla from T_1 to T_6 is 37.75, 37.5, 46.25, 28.75, 28.75, 37.5, 62.5%. The reduction in the growth in lemma polyrrhiza could be also due to suppression of the elongation growth rate of cells, because of an irreversible inhibition exerted by cadmium on the proton pump responsible for the process (Aidid and Okamoto, 1993). Fresh weight & dry weight of cowpea also decrease with an increasing cadmium level. These result are related with observation of Chen et al. (2003) in soyabean. Vallant et al. (2005) also showed that Zn induced and reduction in growth. Zn show reduction in biomass and growth rate on duck weed (Kehllaf and Zerdaoui, 2009).

The root length of Azolla microphylla increases when exposed to different concentration of zinc and Cupper from T_1 to T_6 (0.600, 0.533, 0.367, 0.700, 0.600, 0.400 cm) respectively from control (0.800). The average root length of Azolla microphylla was severely declined at highest concentration i.e. T, 12ppm Zn (0.367) concentration Where as in percentage loss in root length of Azolla microphylla is 25%, 33.37%, 54.12%, 12.5%, 25%, 50%. Visible symptoms like root length, and root number are also effected by heavy metal Zinc and Copper. In Azolla microphylla the root length are also decrease in the presence of heavy metal (John et al., **2008**). Inhibition of root length and root number of plant morphology associated with change in cell division, cell elongation and conversion of indol - 3 acetic acid into 2 various compound (Luscombe et al., 1995). The absolute decrease in average root number per frond was observed at T_1 to T_6 is 4.33, 3.66, 2.33, 4.66, 4.00, 3.66 compared to control (7.00). The average root number of Azolla microphylla was severely declined at highest concentration i.e. T₃ 12ppm Zn (2.33) concentration Where as in percentage loss in root length of Azolla microphylla is 38.1%, 47.61%, 66.67%, 33.32%, 42.85%, 52.38%. Further reduction is root length due to heavy metal may be explained on the basis of inhibition of the activity of 4- hydroxyl phenyl pyruvate deoxygenase (HPPD) and enzyme needed for meristmatic tissue as suggested by Luscombe et al., 1995). The doubling time increasing gradually with the increasing concentration from T₁ to T₆ (5.79, 11.83, 20.80, 5.83, 11.46 and 21.60 days) respectively from the control (2.89). The inhibition of any of the primary physiological process could lead to reduction in growth parameters seeds as fresh weight, dry weight and relative growth rates and this may lead to a lag to growth as evidenced by increasing in the doubling times. Heavy metal supplementation and inhibition of many metabolic process has been observed (**Bala and Setia**, 1990; **Barti and Singh** 1993).

The absolute decrease in chlorophyll-a was observed at T_1 to T_6 (0.41, 0.45, 0.31, .42, 0.32 and 0.30 mg/gm) fresh weight respectively from the control. The chlorophyll-a content of Azolla microphylla was severely reduced at highest concentration i.e. T_6 12ppm Cu (0.30) concentration. Where as reduction in percentage at T_1 to T_6 (19%, 11.76%, 39.21%) 17.6% 37.25% 41.17%) respectively from the control. The absolute decrease in chlorophyll-a was observed at T₁ to T₆ (0.60, 0.51, 0.57, 0.42, 0.52, 0.39, 0.36 mg/gm) fresh weight respectively from the control. Our result are also agreement with Cd causes significant reduction in chlorophyll content in pea (Padmaja et al., 1990). Reduced in chlorophyll biosynthesis is reported in terrestriual plants under heavy metal stress. This is due to reduced S- aminolevulinic acid dehydrogenase (ALA dehydratese) activity (Stobort et al., 1985; Prasad Prasad, 1987). The chlorophyll-b content of Azolla microphylla was severely reduced at highest concentration i.e. T_{6} 12ppm Cu (0.36) concentration. Where as reduction in percentage at T_1 to T_6 (15%, 5%, 30%, 13.33%, 35.32% and 40.29%) respectively from the control. The absolute decrease in total chlorophyll was observed at T, to T₆ (1.023, 0.930, 0.733, 0.947, 0.713, 0.703 mg/gm) fresh weight respectively from the control. Decrease is chlorophyll content under heavy metals stress was reported in the gymnosperm such as Picea baies in Angiosperm such as Zea mays, QuerCus plaustrus and Acer rubrum (Siedlecka and Krupa, **1996**). The decrease in chlorophyll content under heavy metal stress was also reported in sunflower (Zengin and Munzuroglu, 2006) and also in almond (Elloumi et al., 2007). Loss of chlorphylls content can consequently lead to disruption of photosynthetic machinery. Wheat plant which

is treated with Cd and Pb total chlorophyll decreased (**Oncel** *et al.*, **2000**). The total chlorophyll content of *Azolla microphylla* was severely reduced at highest concentration i.e. T_6 12ppm Cu (0.703) concentration. Where as reduction in percentage at T_1 to T_6 (8%, 16.21%, 34.14%, 15.31%, 35.93, 36.83%) respectively from the control. Under stress condition carotennoid pigment are also affected by heavy metal Zn and Cu. Carotenoid is non enzymatic antioxidant, it is a part of photosynthetic pigment playing an important role in protection of chlorophyll pigment under stress condition. **Sinha** *et al.* (2003) reported an increase in carotenoid content in submerged plant of Najas indica but an higher concentration of heavy metal decrease the carotenoid content. In case of heavy metal cadmium treatment the carotenoid content decreased (John *et al.*, 2008).

The absolute loss in Anthocyanin content of Azolla microphylla due to concentration of Zinc and copper from T_1 to T_6 was observed as (1.260, 1.227, 1.137, 1.297, 1.223, 1.173 mg/gm) fresh weight respectively from the control. The Anthocyanin content of Azolla microphylla was severely reduced at highest concentration i.e. T₆ 12ppm Cu (1.137) concentration. Where as reduction in percentage at T_1 to T_6 (11.26%, 13.59%, 20.42%, 13.87% 14.08%, 17.39%) respectively from the control. Stress of heavy metal may inhibit a synthesis of protein and promote other (Erisson and Affinito, 1984) with general trend of decline in the overall content. Our studies could be supported with the result of Costa and Spitz, (1997) decrease in protein content also reported under heavy metals stress in Lupinus albus. Mohan and Hosettis (1997) found more decrease in protein content with heavy metal treatment. T₁ 4.0ppm (Zinc), T₂ 8.0ppm (Zinc), T_3 12.0ppm (Zinc), T_4 4.0 ppm (Copper), T_5 8.0 ppm (Copper) and T_{6} 12.0 ppm (Copper) ppm the absolute decline in protein content was (0.52, 0.50, 0.43, 0.49, 0.45, 0.34 mg/gm) fresh weight while in percentage it was (16.05%, 19.27%, 45.42%, 20.22%, 27.27, 29.85%) respectively from the control. The

Table 1.Effect of Zinc (Zn) and Copper	r (Cu) on physiologic	cal parameters of Azolla microphylla
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Treatments Combination	Fresh weight	Dry weight	Average root	Average root	Doubling times
	(gm)	(gm)	length (cm)	no.	(number of days)
T0(control) 0.0 ppm	1.033	0.080	0.800	7.000	2.89
T1 4.0ppm (Zinc)	0.600	0.053	0.600	4.333	5.79
T2 8.0ppm (Zinc)	0.567	0.050	0.533	3.667	11.83
T3 12.0ppm (Zinc)	0.500	0.043	0.367	2.333	20.80
T4 4.0 ppm (Copper)	0.533	0.057	0.700	4.667	5.83
T5 8.0 ppm (Copper)	0.400	0.050	0.600	4.000	11.46
T6 12.0 ppm (Copper)	0.367	0.030	0.400	3.333	21.60
S.Ed.	0.15	0.010	0.073	1.230	0.18
CD at 5%	0.33	0.022	0.156	2.622	0.38
F-test	S	S	S	S	S

Treatments Combination	Chlorophyll A	Chlorophyll B	Total Chlorophyll	Carotenoids	Anthocyanin	Protein
	(mg/g)	(mg/g)	(mg/g)	(mg/gm)	(mg/gm)	(mg/gm)
T0 (control) 0.0 ppm	0.510	0.603	1.113	0.500	1.420	0.623
T1 4.0ppm (Zinc)	0.450	0.573	1.023	0.447	1.260	0.523
T2 8.0ppm (Zinc)	0.413	0.517	0.930	0.360	1.227	0.500
T3 12.0ppm (Zinc)	0.313	0.420	0.733	0.290	1.137	0.340
T4 4.0 ppm (Copper)	0.423	0.523	0.947	0.483	1.297	0.497
T5 8.0 ppm (Copper)	0.323	0.390	0.713	0.363	1.223	0.450
T6 12.0 ppm (Copper)	0.307	0.363	0.703	0.320	1.173	0.437
S.Ed.	0.06431	0.06957	0.14351	0.06957	0.0351	0.08058
CD at 5%	0.13704	0.14826	0.30582	0.14826	0.07479	0.17171
F-test	S	S	S	S	S	S

Table 2. Effect of Zinc (Zn) and Copper (Cu) on biochemical parameters of Azolla microphylla

drastic reduction observed at T_3 0.43 ppm (Zinc) level as compared to other treatments. Decrease in Anthocyanin content could provide protection in plant against oxidative damage like chlorophyll, carotenoid, Anthocynin content was also inhibited by Zn and Cu stress. **Knen and Heinone**, (2003) reported that Anthocynin directly reduces ROS through scavenging and possible metal chelatation acting in conjuction with other antioxidant **Olah ref** *et al.*, (2008) observe that accelerated Anthocyanin was acCumulated on the lower surface of heavy metal treated plant.

CONCLUSION

Based on the results of the present study it may be concluded that high concentration of Zinc (Zn) and Copper (Cu) 12 ppm were found more detrimental to the fronds of *Azolla microphylla*.

Since these results are based on one year trial, further trial need to be done in order to confirm the consistency of effects over the species and time.

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Effect of Lead (Pb) and Cadmium (Cd) on growth, photosynthetic pigments, anthocyanin and protein content of *Azolla microphylla*

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ABSTRACT

The present experiment "Effect of Lead (Pb) and Cadmium (Cd) on growth, photosynthetic pigments, anthocyanin and protein content of *Azolla microphylla*" was conducted in year 2013 at Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad. The experiment was carried out in CRD with three replications. The result showed that 2, 4 and 6 ppm concentration of Cadmium was more detrimental as compared to 2, 4 and 6 ppm concentration of lead for growth (Fresh weight, dry weight (gm), average root length (cm), Average root number, photosynthetic pigments (chl a, b, carotenoids) and protein content of *Azolla microphylla* while an increase was noticed in doubling time and anthocyanin content of azolla due to the treatment of lead and cadmium.

INTRODUCTION

Heavy metals have high mobility in aquatic systems and in general may produce high toxicity (**Zouboulis** *et al.*, **2004**). Heavy metals ions, when present at an elevated level in the environment, are excessively absorbed by roots and translocated to shoot leading to impaired metabolism and reduced growth. (**Bingham** *et al.*, **1986**).

Lead is a common heavy metal found in industrial effluents. Over 40 million children worldwide are threatened by lead poisoning and 97% of them are living in developing countries (CEJ 2012). Excess lead in plants causes growth reduction, chlorosis, inhibition of photosynthesis, alteration of the mineral nutrition and water balance (**Sharma and Dubey**, **2005**). The limits for lead in water as stipulated by the US-Environmental Protection Agency (EPA) are 0.015 mg L-1 and 0.20 mg L-1 for drinking water and effluent, respectively.

The presence of excessive amounts of Cd in soil commonly elicits many stress symptoms in plants, such as reduction of growth, especially root growth, disturbances in mineral nutrition and carbohydrate metabolism (**Moya** *et al.* **1993**), and may thus strongly reduce biomass production.

The aquatic fern *Azolla* has been reported to accumulate high concentration of heavy metals and metalloids (3-4mg L-1) from aqueous media (**Khosravi** *et al.* **2005**). *Azolla* is one of the world's fastest growing aquatic macrophytes, with a doubling time of only 2-5 days (**Taghi-Ganji** *et al.*, **2005**).

Azolla has many uses such as use as human food, animal feed, medicine, production of biogas, hydrogen fuel, water purifier, weed control, reduction of ammonia volatilization and because of the multifaceted uses it has been aptly

referred to as "green gold mine" (Wagner, 1997). The potential of *Azolla* as meal for chicken was also reported (Alalade and Iyayi, 2006). *Azolla* is used to feed pigs and is a good source of minerals and essential amino acids (Leterme *et al.*, 2009).

In the recent times *Azolla* is gaining tremendous importance in phytoremediation of polluted waters. *A.microphylla* biomass was successfully cultivated in secondary treated Municipal waters of Delhi (**Arora and Saxena, 2005**). Phytoremediation potential of three different species of *Azolla* to chromium has also been carried out (**Arora** *et al.* **2006**). These results show that *Azolla* may be successfully employed in phytoremediation of polluted water bodies.

MATERIALS AND METHODS

The present work entitled "Effect of Lead (Pb) and Cadmium (Cd) on growth, photosynthetic pigments, anthocyanin and protein content of *Azolla microphylla*" was conducted in the laboratory of Department of Biological Sciences, SHIATS Allahabad.

Culturing:-

Azolla culture was maintained in the plastic tub of 35 c.m diameter and 12 c.m depth. Each tub was filled with 3-4 Kg sterilized paddy field soil and mixed with single super phosphate (SSP) of about 300 mg and water is allowed to stand upto 4cm above the soil. The tub were put in open air in the field of biological sciences.

Azolla plant were collected, washed and cleaned by running water then dried, weighed and transfered into petridishes containing Nitrogen free Hoagland's nutrient solution and were transferred to culture room and allowed for the development of effect on *Azolla*.

Growth Medium :-

For the growth, heavy metal treatment solution of *Azolla microphylla* under laboratory condition modified nitrogen free nutrient medium has been used and it was prepared according to **Peters and Mayne (1980)**.

Observation Recorded :-

Estimation of fresh weight and dry weight (gm) : The method of Robinson *et al.* (1985) was followed.

Estimation of average root length (cm) : The procedure of Kurth *et al.* (1986) was followed to find out average root length of *Azolla microphylla* fronds.

Estimation of Average root number : The method of **Ge-shi-An** *et al.* (1980) was followed to find the average root number of per frond of *Azolla microphylla*.

Estimation of Doubling time : Doubling time is the time in days needed for the production of next generation or needed for the doubling of *Azolla* biomass which is calculated as follows :-

Doubling time = $t / \log (w1 - w0) / 0.301$

Biochemical measurements :-

Estimation of Chlorophyll a & b: The major photosynthetic pigment chlorophyll was determined according to Lichtenthaler and Welburn (1983) method.

Estimation of Carotenoids : Carotenoid was determined according to method of Lichtenthaler and Welburn (1983).

Estimation of Anthocyanin : The anthocyanin were determined according to the method of Mirecki and Teramura (1984).

Estimation of Protein : The Protein were determined according to the method of **Lowry** *et al.* (1951).

The was data recorded during the course of investigation were subjected to statistical analysis of "Analysis of variance" technique **Panse and Sukhatame (1967)** for drawing conclusion. The experiment was carried out in CRD with three replications. Observations were recorded on three randomly selected samples for all the traits from each replications and the observations were recorded on sample basis.

RESULTS AND DISCUSSION

Effect of lead and cadmium on growth of *Azolla* are depicted in *table 1*.

The heavy metals introduced into the aquatic system are known to pose high level of toxicities to the aquatic organisms and human beings. The effect of these toxic metals results in alterations at morphological, physiological/biochemical, and ultrastructural level in aquatic organisms. With the increase in concentration of lead (Pb) and cadmium (Cd) from 2ppm to 6ppm a gradual reduction in fresh weight of Azolla microphylla was noticed. The reduction in biomass from 2, 4, 6ppm cadmium and lead is 1.337 gm, 1.233 gm, 1.140 gm, 1.323 gm, 1.200 gm and 1.063 gm from the control (1.833gm) respectively. As compared to Pb the biomass of Azolla microphylla was severely inhibited in Cd and it was recorded highest at 6 ppm Cd concentration. The decrease in dry weight of Azolla microphylla due to concentration of Pb and Cd at 2, 4 and 6 ppm is 0.097gm, 0.073gm, 0.063gm, 0.070gm, 0.060gm and 0.053 as compared to the control (0.222gm). Again the reduction was highest at 6ppm Cd. Heavy metal supplementation and inhibition of many metabolic processes has also been observed by Bharti and Singh, (1993).

The root length of *Azolla* exposed to lead and cadmium at 2, 4 and 6 ppm concentration reduced to 1.73 cm, 1.100 cm, 1.00 cm, 1.00 cm, 0.800 cm and 0.400 cm as compared to control (2.93 cm). Cd (6ppm) showed more effect than Pb.

The absolute decrease in average root number per frond at 2, 4 and 6 ppm is 1.867, 1.400, 1.007, 1.633, 1.367 and 0.800

Table 1: Effect of Lead and cadmium on growth of Azolla microphylla

Treatment	Fresh weight	Dry weight	Average root	Average Root	Doubling time
Combination	(gm)	(gm)	length (cm)	no.	(number of days)
T0 (Control) 0.0ppm	1.833	0.222	2.93	2.63	2.700
T1 2.0 ppm (Lead)	1.337	0.097	1.73	1.867	5.727
T2 4.0 ppm (Lead)	1.233	0.073	1.10	1.400	10.500
T3 6.0 ppm (Lead)	1.140	0.063	1.00	1.007	11.800
T4 2.0 ppm (Cadmium)	1.323	0.070	1.00	1.633	8.867
T5 4.0 ppm (Cadmium)	1.200	0.060	0.80	1.367	12.800
T6 6.0 ppm (Cadmium)	1.063	0.053	0.40	0.800	16.000
S.Ed.	0.01898	0.0012	0.43	0.2076	0.14476
CD at 5%	0.04044	0.0027	0.91	0.4424	0.30847
F-test	S	S	S	S	S

Treatment Combination	Chlorophyll a	Chlorophyll b Total Chlorophyll		Carotenoids	Anthocyanin	Protein
	(mg/gm	(mg/gm	(mg/gm	(mg/ gm	(mg/gm	(mg/gm
	fresh weight)	fresh weight)	fresh weight)	fresh weight)	fresh weight)	fresh weight)
T0 (Control) 0.0ppm	6.97	1.96	8.93	1.47	6.2	4.25
T1 2.0 ppm (Lead)	4.81	1.63	6.44	1.109	8.1	3.8
T2 4.0 ppm (Lead)	4.68	1.60	6.28	1.04	8.3	3.3
T3 6.0 ppm (Lead)	4.55	1.50	6.05	0.97	8.5	3.1
T42.0 ppm (Cadmium)	4.60	1.60	6.2	1.103	8.2	3.4
T5 4.0 ppm (Cadmium)	4.40	1.40	5.8	1.08	8.5	3.2
T6 6.0\ppm (Cadmium)	4.20	1.30	5.5	1.02	8.7	3.0
S.Ed.	0.0359	0.0326	0.0048	0.003	0.03409	0.0037
CD at 5%	0.0765	0.0694	0.1024	0.0639	0.07264	0.0788
F-test	S	S	S	S	S	S

 Table 2: Effect of Lead (Pb) and Cadmium (Cd) photosynthetic pigments, anthocyanin and protein content of Azolla microphylla

roots per frond from that of control (2.63). As per the results Cd showed more effect than Pb and decrease recorded was highest at 6ppm Cd concentration. Significant inhibition was noticed in case of growth of *Azolla microphylla* with increase in concentration of heavy metals Pb and Cd. The inhibition was invariably maximum at the highest concentration of heavy metals employed. (**Bennicelli** *et al.* **2004**) Same results were found for growth parameters in present study.

The doubling time increasing gradually at 2, 4 and 6 ppm lead and cadmium concentration is 5.727, 10.500, 11.800, 8.867, 12.800 and 16.00 days respectively from the control 2.700. Effect of cadmium was more as compared to lead and 6ppm Cd concentration showed significant increase in doubling time. Present results are supported with the findings of **Arora and Singh (2003)** who have shown less biomass and more doubling time in *Azolla sp.* treated with different concentration of sodium chloride. **Arora and Saxena (2005)** got same result in *Azolla microphylla* treated by municipal effluents of Delhi.

Biochemical parameters

Effect of lead and cadmium on Biochemical parameters of *Azolla* are depicted in *table 2*.

The absolute decrease in chlorophyll-a at 2, 4 and 6 ppm concentration of Pb and Cd is 4.81(mg/gm), 4.68 (mg/gm), 4.55(mg/gm), 4.60, (mg/gm), 4.40 (mg/gm), 4.20(mg/gm) fresh weight respectively from the control 6.97 (mg/gm). Chlorophyll-b observed in the present investigation at 2, 4 and 6 ppm lead and cadmium concentration is 1.63 (mg/gm), 1.60 (mg/gm), 1.50 (mg/gm), 1.60 (mg/gm) and 1.40(mg/gm) and 1.30 (mg/gm), fresh weight respectively as of control 1.96 (mg/gm). The effect of Cd was more as compared to Pb and the effect being highest at 6 ppm concentration on

Chlorophyll- a/b content. The harmful effects of metals for growth in present work was in order Cd>Pb. Same reults were found by **Shi** *et al.* (2003) who showed that increase in concentration of Hg and Cd resulted in a drop in the chlorophyll content, mainly chlorophyll a and/b.

The Pb and Cd concentration at 2, 4 and 6 ppm show absolute decrease of 6.44 (mg/gm), 6.28 (mg/gm), 6.05 (mg/ gm), 6.20 (mg/gm), 5.8 (mg/gm) and 5.50 (mg/gm) fresh weight of chlorophyll content respectively from the control 8.93(mg/gm). Decline in total chlorophyll content was more in Cd (6ppm) as compared to Pb. Chlorophyll is a major pigment participating in photosynthesis process, whose content and a/b value are indication of the activity of photosynthesis. It was commonly believed that leaves etiolated due to heavy metals poisoning (**Shi et al., 2000**).

The reduction in carotenoid content at 2, 4 and 6 ppm Pb and Cd concentration 1.109mg/gm, 1.04mg/gm, 0.97mg/gm, 1.103mg/gm, 1.08mg/gm and 1.02mg/gm fresh weight respectively from the control 1.47mg/gm. It was observed that the decrease in carotenoid rate was slightly more in lead (6ppm) as compared to Cadmium. Like cholophyll, carotenoides of the Azolla microphylla was also inhibited by enhanced doses of heavy metal. The most important function of carotenoides seems to be protecting the plant from free radicals formed from ultraviolet or other radiation. Sandalio et al. (2011) reported that cadmium (Cd) exposure significantly decreased carotenoids in Brassica napus and pea plant Which is in agreement with our findings. Carotenoid protect chlorophyll from photooxidative destruction (Middletion and Teramura, 1993) and therefore a reduction in carotenoid could have a serious consequence on chlorophyll pigment.

The result for anthocyanin content observed from the

present investigation revealed absolute increase in anthocyanin content of *Azolla microphylla* due to concentration of lead and cadmium at 2, 4 and 6 ppm which is 8.1 mg/gm, 8.3 mg/gm, 8.5 mg/gm, 8.2 mg/gm, 8.5 mg/gm and 8.7 mg/gm fresh weight respectively from the control 6.2 (mg/gm). The increase recorded was more in Cd (6ppm) as compared to Pb. Increase in anthocyanin content could provide protection in plants against oxidative damage. Like chlorophyll and carotenoides, anthocyanin content was not inhibited by lead (Pb) and cadmium (Cd) stress. **Dai** *et al.* (**2006**), reported an increase in content of anthocyanin total phenolics and phenylalanine ammonia-lyase (PAL) activity during Cd treatment.

At different levels of lead and cadmium concentrations, i.e. 2, 4 and 6 ppm the absolute decline in protein content was 3.8mg/gm,3.3mg/gm,3.1mg/gm,3.4mg/gm, 3.2mg/gm and 3.0mg/gm from the control 4.25 (mg/gm) fresh weight. The drastic reduction in protein was more in Cd as compared to Pb. Decline was highest at 6 ppm cadmium level as compared to other treatments. It seems that the reduction in protein content is a response to the heavy metal stress. It is probable that the heavy metals may inactivate and denature protein by interacting with (-SH) groups (**Shekaraiah** *et al.*, **1992**).

CONCLUSION

Based on the results of the present study it is concluded that 2, 4 and 6 ppm concentration of cadmium was found more detrimental as compared to 2, 4 and 6 ppm concentration of lead for growth, photosynthetic pigments, and protein content of *Azolla microphylla* while an increase was noticed in anthocyanin content and doubling time due to the treatment of lead and cadmium.

Since these results are based on one year trial, further trials are needed in order to confirm the consistency of effects over the species and time.

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Genetic variability studies by both qualitative and quantitative traits in dolichos bean (*Lablab Purpureus* L.)

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ABSTRACT

An experiment was conducted to examine the genetic variability, heritability and genetic advance among 16 genotypes of *Lablab purpureus* for 13 quantitative and qualitative traits. Significant differences were observed among the genotypes for all the characters studied. High estimates of GCV and PCV were observed for pod yield per plant followed by number of pods per plant and lowest in leaflet length. The characters *viz.*, pod length followed by pod weight and days to 50% flowering exhibited high heritability coupled with high genetic advance, indicating that simple selection could be effective for improving these characters. Among the qualitative traits, stem pigmentation and pod color showed prominent difference.

Key words: Indian bean, qualitative, quantitative traits, genetic variability, heritability

INTRODUCTION

Lablab purpureus (L.), 2n=22 is an important legume crop cultivated in the tropical regions of Asia, Africa and America. It is commonly called as Dolichos bean, Indian bean. The crop has multipurpose uses. The green pods are popular vegetables. The dried seeds are consumed as a pulse. A thorough understanding of the genetic variation for different traits and their heritability is important for successful crop improvement programme, Savitha et al. (2012). So an attempt was given with both qualitative and quantitative characters for the study of genetic variability. The traits with high heritability coupled with high genetic advance were given preference as these traits were governed by additive genetic variance so a simple selection will help in developing the strains. The morphological traits were also considered as these traits can be characterized and used in the hybridization programmes to identify the progeny with both the parents' characters with the naked eye.

MATERIALS AND METHODS

The work was conducted during kharif 2012-13 at Field Experimentation Centre, Department of Genetics and Plant Breeding, Allahabad School of Agriculture. Sixteen genotypes were grown under RBD with 3 replications. The experimental field was divided into 48 blocks of equal size and each block possesses one genotype. The plot size and spacing were 6.0 sq. m and 1.0×1.0 sq. m, respectively. Three plants were taken for recording observation and for 13 quantitative traits *viz.* days to 50% flowering, days to first picking, number of primary branches, leaflet length (cm), inflorescence length

(cm), number of flowers per inflorescence, pod length (cm), pod width (cm), pod weight (g), number of pods per plant, number of seeds per pod, seed index (g), pod yield per plant (kg). The data was statistically analyzed for computation of analysis of variance by the formula of **Panse and Sukhatme** (**1967**), coefficient of variation (GCV, PCV) by **Burton (1952**), broad sense heritability and the expected genetic advance was estimated as per the formula suggested by **Lush (1949**). Among the qualitative traits, stem pigmentation, vein colour, flower colour, leaf anthocyanin, pod attachment (un- ripen), leaf colour, leaf shape, pod colour pod constriction, seed color, seed shape, growth habit and branch orientation were recorded at different stages of the crop even after harvest.

RESULTS AND DISCUSSION

Analysis of variance showing that there is significant difference among the genotypes for 13 characters used under the study at 1% level of significance. This indicates that there is ample scope for selection of genotypes for yield and its components, which is indicated in the *Table-1*.

High genotypic and phenotypic coefficient of variation was observed for pod yield per plant (57.42% and 54.11%) followed by number of pods per plant (38.67% and 38.06%), pod weight (30.02% and 29.95%), seed index (29.45% and 27.07%), number of branches per plant (27.28% and 26.41%) and pod width (26.91% and 26.73%), whereas, rest of the traits exhibited moderate to low coefficient of variation.

Hence, the traits exhibiting high genotypic and phenotypic coefficient of variation indicated, the existence of considerable variability for the traits among the genotypes. These findings

Characters	Mean sum of squares					
	Replications	Treatments	Error			
	(df=2)	(df=15)	(df=30)			
Days to 50% flowering	0.33	801.00**	2.02			
Days to first picking	7.14	585.63**	2.50			
Branches/plant	0.09	4.69**	0.10			
Leaflet length	1.44	3.13**	1.04			
Raceme length	0.98	147.89**	0.86			
Flowers/raceme	0.89	32.54**	1.01			
Pod length	0.01	13.13**	0.007			
Pod width	0.01	0.94**	0.004			
Pod weight	0.004	8.83**	0.01			
Pods/plant	155.43	18391.95**	195.17			
Seeds/pod	0.11	1.16**	0.10			
Seed index	9.40	300.89**	17.31			
Pod yield/plant	5.00	1.18**	0.004			

Table 1: Analysis of variance for different quantitativecharacters in Dolichos bean

** Significant at 1% level of significance

are in agreement with the findings of Rao (1979) and Rajasekharaiah (1979), Shivashankar *et al.* (1993), Uddin and Newaz (1997), Gnanesh *et al.* (2006), Upadhyay (2010) and Savitha *et al.* (2012) who also reported differential environment effects on the expression of different characters in Dolichos bean.

GVC and PCV do not indicate the amount of heritable variation of the proportion of the total genetic variation. High heritability estimate was observed for pod length (99.83%)

followed by pod weight (99.53%), days to 50% flowering (99.25%), pod yield per plant (98.93%), days to first picking (98.75%), pod width (98.66%), raceme length (98.27%), number of pods per plant (96.88%), number of branches per plant (93.70%), number of flowers per raceme (91.21%), seed index (84.52%) and number of seeds per pods (77.77%). High heritability estimates indicating the least influence of environment on these characters. The high heritability for yield and its components were obtained probably due to confining to single season as by **Savitha** *et al.* (2012).

On the other hand, high genetic advance as percent of mean was observed for pod yield per plant (117.01%) followed by number of pods per plant (77.17%), pod width (61.54%), pod weight (54.70%), number of branches per plant (52.66%), seed index (51.27%), raceme length (38.11%), pod length (37.68%), days to 50% flowering (36.49%), number of flowers per raceme (34.44%), days to first picking (23.53%) and number of seeds per pod (22.41%).

High heritability coupled with high genetic advance was observed for pod length followed by pod weight, days to 50% flowering, pod yield per plant, days to first picking, pod width, raceme length, number of pods per plant, number of branches per plant, number of flowers per raceme, seed index and number of seeds per pod has been reported. High heritability in conjunction with high genetic advance as percent of mean was observed for all traits, which indicates the preponderance of additive gene action governing the inheritance of this character and offers the best possibility of improvement through simple selection procedures. These results are in accordance with the findings of **Gnanesh** *et al.*

Parameters	Mean	Ran	ige	Coefficient of variation (%)		Heritability (bs)%	Genetic advance
Characters		Minimum	Maximum	Genotypic	Phenotypic		as % of mean
Days to 50% flowering	91.77	68.66	125.00	17.78	17.85	99.25	36.49
Days to first picking	121.29	101.66	151.66	11.49	11.57	98.75	23.53
Branches/plant	4.68	2.55	6.66	26.41	27.28	93.70	52.66
Leaflet length	9.32	7.83	11.93	8.94	14.15	39.94	11.64
Raceme length	37.51	22.88	46.44	18.66	18.83	98.27	38.11
Flowers/raceme	18.52	13.22	22.99	17.50	18.33	91.21	34.44
Pod length	11.42	7.05	14.46	18.31	18.32	99.83	37.68
Pod width	2.09	1.24	3.58	26.73	26.91	98.66	54.70
Pod weight	5.72	3.20	10.13	29.95	30.02	99.53	61.54
Pods/plant	204.62	74.66	371.00	38.06	38.67	96.88	77.17
Seeds/pod	4.81	3.77	5.99	12.34	13.99	77.77	22.41
Seed index	35.91	17.06	57.10	27.07	29.45	84.52	51.27
Pod yield/plant	1.09	0.32	2.49	57.11	57.42	98.93	117.01

Table 2: Genetic parameters for green pod yield and its components characters in Dolichos bean (Dolichos lablab L.)

Genotypes	Stem pigmentation	Vein colour Flower		Leaf	Pod attachment	Leaf	Leaf
	colour	anthocyanin	(un- ripen)	colour	shape		
SWARNA UTATE	Extensive	Purple	Purple	Absent	Erect	Green	Oval
IIHRPD-101	No pigmentation	Green	White	Absent	Intermediate	Green	Oval
ЛВР-03-3	Localized at nodes	Green	Purple	Absent	Erect	Green	Oval
IS-2010-5	Almost solid	Purple	Purple	Present	Intermediate	Purple	Oval
AHDB-03	Localized at nodes	Green	Purple	Absent	Erect	Green	Oval
VRSEM-6	Almost solid	Purple	White	Present	Intermediate	Purple	Oval
VRSEM-8	No pigmentation	Green	White	Absent	Intermediate	Green	Oval
VRSEM-11	Almost solid	Purple	Purple	Present	Intermediate	Green	Oval
VRSEM-30	No pigmentation	Green	Purple	Absent	Erect	Pale green	Oval
VRSEM-76	Solid	Purple	purple	Present	Erect	Dark purple	Oval
VRSEM 186	No pigmentation	Green	White	Absent	Intermediate	Green	Oval
VRSEM-501	Extensive	Purple	Purple	Present	Intermediate	Pale green	Oval
VRSEM-1000	Almost solid	Purple	Purple	Present	Erect	Purple	Oval
PUSA SEM -2	No pigmentation	Green	White	Absent	Intermediate	Green	Oval
PUSA SEM -3	No pigmentation	Green	White	Absent	Intermediate	Green	Oval
AP-CHIKKUDU-1	No pigmentation	Green	white	Absent	Intermediate	Pale green	Oval

Table 3.1 Qualitative characters of different Dolichos bean genotypes

Table 3.2 Qualitative characters of different Dolichos bean genotypes

Genotypes	Pod colour	Pod constriction	Seed color	Seed	Growth habit	Branch
				shape		orientation
SWARNA UTATE	Green	Moderate	Brown color	Round	Semi determinate	Spreading
IIHRPD-101	Green	Moderate	Blackish brown	Oval	Indeterminate	Spreading
JIBP-03-3	Light green	No constriction	Cream	Round	Indeterminate	Spreading
IS-2010-5	Green with purple suture	Moderate	Blackish brown	Long	Semi determinate	Perpendicular
AHDB-03	Pale green	Moderate	Brown cream mix	Long	Indeterminate	Perpendicular
VRSEM-6	Light purple	No constriction	Black	Oval	Semi determinate	Perpendicular
VRSEM-8	Dark green	Constriction	Brown	Oval	Indeterminate	Perpendicular
VRSEM-11	Green with purple suture	Constriction	Black	Oval	Semi determinate	Spreading
VRSEM-30	Green	Moderate	Brown	Oval	Indeterminate	Perpendicular
VRSEM-76	Dark purple	No constriction	Brown	Round	Indeterminate	Perpendicular
VRSEM 186	Light green	Moderate	Brown	Oval	Indeterminate	Spreading
VRSEM-501	Light purple	Moderate	Blackish brown	Round	Indeterminate	Perpendicular
VRSEM-1000	Dark purple	Constriction	Brown	Oval	Semi determinate	Perpendicular
PUSA SEM -2	Dark green	Moderate	Brown	Round	Semi determinate	Spreading
PUSA SEM -3	Dark green	Moderate	Brown	Round	Semi determinate	Spreading
AP-CHIKKUDU-1	Green	Moderate	Brown	Round	Indeterminate	Perpendicular

(2006), Chattopadhyay, and Dutta (2010), Upadhyay and Mehta (2010) and Savitha *et al.* (2012).

The study on qualitative traits showed the prominent differences among the genotypes. These traits can be used as morphological markers in the hybridization programme, which will help to identify the specific genotypes in the early generations itself. Among the qualitative traits the stem pigmentation, pod colour showed remarkable variation followed by seed colour, leaf colour, growth habit and branch orientation. The traits like leaf shape, leaf anthocyanin and vein colour showed narrow spectrum of variation. So study on these traits help the breeder to have an idea about the genotypes.

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Assessment of contributions of yield contributing characters on yield in advance breedings lines of Wheat (*Triticum Aestivum* L.) under timely sown irrigated conditions of the Terai Region

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ABSTRACT

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The present investigation was carried out at the Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarkhand, INDIA. The 150 genotypes included in the experiment were planted in an augmented design along with 3 checks (UP 2338, UP 2382 and PBW 343) and fourteen plant and grain characters were studied. The nature and magnitude of association among the yield and yield contributing character were estimated by correlation coefficient and the direct and indirect effects of these characters on grain yield was estimated through path coefficient analysis. It was found that the grain yield exhibited a highly significant positive correlation with biological yield followed by harvest index, hectolitre weight, number of tillers per running metre, sedimentation value, plant height, 1000-grain weight, ear length. However, it was found to be negatively and significantly correlated with grains per ear. Based on the results of the path coefficient analysis it may be inferred that the maximum emphasis during selection should be given to biological yield and harvest index.

Keywords: Wheat, Yield, yield correlated characters, correlation coefficient, path coefficient

INTRODUCTION

Wheat occupies a prominent place in the cereal economy of the world, consumed by 36 per cent of the global population in as many as 43 per cent of the countries and providing as high as 20 per cent of the total food calories (**Nagarajan and Singh, 1998**). India is the second largest producer of wheat in the world where itconstitutes the staple food of the people. However, the population of the country is increasing at a rapid pace, which is likely to double by the year 2020, whereas the area under cultivation is constantly declining due to this population pressure also a constant plateau in the yield of the crop has been observed. So, the only alternative left would be to increase the yield potential of the crop through effective plant breeding programmes.

Grain yield is a sum total of the several component characters that together pool in to give the overall yield in a crop. **Grafius (1964)** suggested that the selection for yield *per se* may not be effective as it is a function of various component plant characters. Moreover, genes for yield per se may be absent but genes may be present for its components. Also, since all the characters are correlated, the change in one character brings about a series of changes in the other characters also. Therefore, direct selection of characters correlated to yield may enable an indirect selection for higher yield. Thus to bring about a desirable change in yield or other character, a proper understanding of the associations among the yield and yield contributing characters is a must. This will helpin selection of traits associated with highest expression of yield and simultaneously in improvement of one character without sacrificing much on the other character. If the association is positive, it will accelerate the rate of genetic progress, while if the correlation is negative it will retard the genetic progress. The observed correlation is a function of linkage of genes determining the two characters. However, it may also arise as a result of plieotropy. And therefore, it is the multiplicative interaction of yield and yield contributing characters that result in the ultimate yield. Hence, it becomes mandatory to have information on the association between different characters, and their relative contribution to the yield for developing a high yielding variety.

The degree of association as revealed by correlation coefficient is incomplete if the relative influence of the other characters to the calculated correlation coefficient is not evaluated. As sometimes even a significant correlation gives a more shadow of the influence of other correlated characters.The theory of path-coefficient as proposed by **Sewall Wright (1921)** provides a critical examination of specific forces that produce a given correlation. It thus becomes possible to study both direct and indirect effects of yield components on grain yield via other components.

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The study was conducted with the objectives of accessing the nature and magnitude of association among the yield and yield contributing characters and estimating the direct and indirect effects of grain yield components and quality parameters on grain yield through correlation coefficient analysis and path coefficient analysis.

MATERIALS AND METHODS

The present investigation was carried out during rabi 2002-03 at Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar, District Udham Singh Nagar, Uttarakhand, India. The experimental material used in the present study comprised of 150 advanced breeding lines of bread and durum wheat along with three checks (UP2338, UP2382 and PBW343).

Data were recorded both on the plot basis and single plant basis. Observations on plot basis were recorded for days to heading, days to maturity, biological yield, grain yield and harvest index. Quality traits *viz*. hectolitre weight (kg/hl), sedimentation value (cc) and protein content(%) were considered from the sample of the bulk harvest obtained from the plot. For single plant observations five competitive plants from each plot were randomly selected and theiraverage was taken for statistical analysis, the following observations were recorded on plant basis- plant height (cm), ear length (cm), spikelets per ear, number of tillers per running metre, grains per ear, 1000-grain weight. All the 150 genotypes along with 3 checks (UP2338, UP2382 and PBW343) were planted in augmented design during rabi 2002 - 03 under, timely sown irrigated conditions. There were ten blocks each consisting of 15 genotypes and three checks each. Each plot comprised of 2 rows, 3 meter long and 23 cm apart. All the recommended agronomic practices were followed during the conduct of experiment.

Simple correlation coefficient was computed to determine the association among all the yield contributing characters. The significance of correlation coefficient (r) was tested by comparing with 't' value at (n-2) degree of freedom (**Snedecor and Cochran, 1967**). The relative influence of the yield contributing characters on yield can be evaluated by usingthe path coefficient analysis (**Wright, 1921; Dewey and Lu, 1959**). It is defined as the ratio of the standard deviation of the effect due to a given cause to the total standard deviation of the effect. In the present study the grain yield was assumed to be the dependent variable (effect) which was assumed to be influenced by 13 plant and plot characters or independent variables (causes) contributing directly or indirectly to the yield.

RESULTS

The correlation coefficients between different characters obtained in the present study have been summarised in *Table I*. It was found that the grain yield exhibited a highly significant positive correlation with biological yield (0.67)

	Days to	Plant	Ear	No. of	No. of	No. of	1000	Harvest	Hectolitre	Protein	Sedimentation	Biological	Grain
	maturity	height	length	tillers per	spikelets	grains	-grain	index	weight	content	value	yield	yield
		(cm)	(cm)	running	per ear	per ear	weight		(%)	(kg/hl)	(%)	(cc)	(kg)
				metre			(g)						
Days to heading	0.44**	0.08	-0.38**	-0.04	0.02	0.05	-0.12	-0.22**	-0.05	-0.11	-0.06	-0.16	-0.12
Days to maturity		0.19*	-0.02	0.19*	0.08	0.002	0.02	-0.10	0.09	0.08	0.05	0.18*	0.08
Plant height (cm)			0.32**	0.23**	0.20*	0.05	0.15	-0.01	0.12	0.09	0.18	0.40**	0.25**
Ear length (cm)				0.21*	0.27**	-0.07	-0.07	-0.08	-0.08	0.23**	0.27**	0.33**	0.18*
No. of tillers per					0.09	-0.06	-0.09	-0.01	-0.19*	0.19*	0.24**	0.34**	0.32**
running metre													
No. of spikelets						0.24**	-0.19*	-0.11	-0.21*	0.15	0.001	0.15	0.05
per ear													
No. of grains per ear							-0.15	-0.14	-0.33**	-0.03	-0.17	-0.18*	-0.22**
1000-grain								0.29**	0.43**	-0.17*	-0.09	0.11	0.23**
weight (g)													
Harvest index (%)									0.46**	-0.31**	-0.01	-0.15*	0.61**
Hectolitre weight										-0.25**	0.01	0.23**	0.39**
(kg/hl)													
Protein content (%)											0.18*	0.10	-0.05
Sedimentation												0.32**	0.28**
value (cc)													
Biological yield													0.67*
(kg)													

Table I: Correlation coefficient for different yield contributing and quality characters on yield in wheat genotypes

* Significant at 1 % level of probability, * * Significant at 5 % level of probability

followed by harvest index (0.61), hectolitre weight (0.39), number of tillers per running metre (0.32), sedimentation value (0.28), plant height (0.25), 1000-grain weight (0.23) and ear length (0.18). However, it was found to be negatively and significantly correlated with grains per ear (-0.22). A non significant relationship was established between grain yield and days to heading and also between grain yield and days to maturity. A negative non-significant relation was observed between grain yield and protein content. (*Table I*)

The biological yield was found to have a positive and significant correlation with plant height (0.40) followed by the number of tillers per running metre (0.34), ear length (0.33), sedimentation value (0.32), hectolitre weight (0.23), days to maturity (0.18). However, it was found to be negatively and significantly correlated to number of grains per ear (-0.18) and harvest index (-0.15). Sedimentation value was found to have a significant positive correlation with ear length (0.27), number of tillers per running metre (0.24) and protein content (0.18). Therefore, it can be inferred that selection for sedimentation value might be useful in improving the protein quality and grain yield simultaneously as grain yield and biological yield are positively correlated.Protein content in turn revealed a significant positive correlation with ear length (0.23) and number of tillers per running metre (0.19). On the other hand, this character exhibited a negative and significant correlation with harvest index (-0.31) followed by hectolitre weight (-0.25) and 1000-grain weight (-0.17). This kind of association may be helpful in selection for genotypes with high protein content.

The correlation coefficient for hectolitre weight was found to be highly negatively and significantly correlated withnumber of grains per ear (-0.33) followed by number of spikelets per ear (-0.21) and number of tillers per running metre (-0.19). Also, a significant positive correlation was observed for harvest index (0.46) and 1000-grain weight (0.43). Harvest index exhibited a significant positive correlation with 1000-grain weight (0.29) and a significant negative correlation was found to exist for days to heading (-0.22).1000-grain weight was found to be significantly negatively correlated to number of spikelets per ear (-0.19) whilenumber of grains per ear showed a significant positive correlation with number of spikelets per ear (0.24), which was found to have a significant positive correlation with ear length (0.27) and plant height (0.20). Therefore, it can be inferred that a longer earlength will have larger number of spikelets per ear. The study of number of tillers per running metre revealed its positive significant correlation with plant height (0.23) followed by ear length (0.21) and days to maturity (0.19). The ear length in turn was found to exhibit a significant positive correlation with days to heading (0.38) and plant height (0.32). A

Table II: Path c	oefficient showing	direct and indirect	effects of	f different vield	contributing a	nd auality	characters	in wheat
						···· · · · · · · · · · · · · · · · · ·		

	Days to	Days	Plant	Ear	No. of	No. of	No. of	1000-	Harvest	Hectolitre	Protein	Sedimentation	Biological
	heading	to	height	length	tillers per	spikelets	grains	grain	index	weight	content	value	yield
		maturity	(cm)	(cm)	running	per ear	per ear	weight	(%)	(kg/hl)	(%)	(cc)	(kg)
					metre			(g)					
Days to heading	<u>0.0617</u>	-0.0040	-0.0038	0.0030	-0.0029	0.0001	0.0001	-0.0018	-0.1542	0.0034	-0.0078	-0.0036	-0.0107
Days to maturity	0.0271	<u>-0.0092</u>	-0.0087	0.0002	0.0131	0.0004	0.0000	0.0003	-0.0709	0.0056	0.0057	0.0026	0.1226
Plant height (cm)	0.0052	-0.0017	<u>-0.0445</u>	0.0026	0.0163	0.0011	0.0001	0.0023	-0.0088	-0.0076	-0.0062	0.0100	0.2750
Ear length (cm)	-0.0237	0.0002	-0.0142	-0.0079	0.0147	0.0015	-0.0001	-0.0010	-0.0539	0.0048	0.0166	0.0144	0.2293
Number of tillers	-0.0026	-0.0017	-0.0103	-0.0017	<u>0.0702</u>	0.0005	-0.0001	-0.0014	-0.0086	0.0124	0.0134	0.0130	0.2373
per running metre													
Number of spikelets	0.0011	-0.0007	-0.0088	-0.0021	0.0062	<u>0.0057</u>	0.0006	-0.0029	-0.0790	0.0135	0.0111	0.0000	0.1030
per ear													
Number of grains	0.0030	-0.0001	-0.0021	0.0005	-0.0041	0.0013	0.0024	-0.0023	-0.1011	0.0214	-0.0022	0.0095	-0.1264
per ear													
1000-grain	-0.0073	-0.0002	-0.0069	0.0005	-0.0062	-0.0011	-0.0004	<u>0.0154</u>	0.2048	-0.0274	-0.0121	-0.0052	0.0774
weight (g)													
Harvest index (%)	-0.0135	0.0009	0.0005	0.0006	-0.0008	-0.0006	-0.0003	0.0044	<u>0.7043</u>	-0.0298	-0.0226	-0.0006	-0.0314
Hectolitre weight	-0.0032	-0.0008	-0.0052	0.0006	-0.0135	-0.0012	-0.0008	0.0066	0.3259	<u>-0.0643</u>	-0.0184	0.0004	0.1612
(kg/hl)													
Protein content (%)	-0.0067	-0.0007	-0.0038	-0.0018	0.0130	0.0008	-0.0000	-0.0026	-0.2201	0.0164	0.0722	0.0097	0.0712
Sedimentation	-0.0040	-0.0004	-0.0081	-0.0021	0.0168	0.0000	-0.0004	-0.0015	-0.0079	-0.0005	0.0128	<u>0.0547</u>	0.2206
value (cc)													
Biological yield	-0.0009	-0.0016	-0.0177	-0.0026	0.0241	0.0008	-0.0004	0.0017	-0.0320	-0.0150	0.0074	0.0175	0.6906
(kg)													

Residual factor : 0.1140 Figures underlined show direct effect

Four digit have been retained after decimal so as to presence the validity of data as same values are very less.

significant positive correlation was found to exist between plant height and days to maturity (0.19) and between days to maturity and days to heading (0.44). This positive relationship between the components reflects promise of improvement in yield in the new selections as a result of appropriate nicking of component genes of desired value.

The path coefficient analysis of the direct and the indirect effects towards yield have been presented in *table 2*. A perusal of *table 2* reveals that the harvest index (0.704) exerted a high order of positive direct effects towards grain yield followed by biological yield (0.690), protein content (0.072), number of tillers per running metre (0.070), days to heading (0.062), sedimentation value (0.055), 1000 grain weight (0.015), number of spikelets per ear (0.006) and number of grains per ear (0.002).

Indirect effects to grain yield were also observed as presented in table 2. The major positive indirect contributors to grain yield via harvest index was revealed to be mainly 1000 grain weight (0.004), while negative indirect effects in this class were observed for biological yield (-0.031), hectolitre weight (-0.03) and protein content (-0.023). The biological yield may be partitioned into the positive indirect effects by number of tillers per running metre (0.024) and sedimentation value (0.017) and the negative indirect effects attributable to harvest index (-0.032), plant height (-0.018) and hectolitre weight (-0.015) mainly. Protein content was found to be partitioned into the positive direct effects by mainly biological yield (0.071), hectoliter weight (0.016) and number of tillers per running metre (0.013) and the negative indirect effects by mainly harvest index (-0.220) and days to heading (-0.007). The highest negative direct effects to grain yield were observed for hectoliter weight (-0.064) and plant height (-0.044). These were found to be a function of several indirect positive and negative effects as can be clearly inferred from the table II. Based on the results of the path coefficient analysis it may be inferred that the maximum emphasis during selection should be given on biological yield and harvest index. (Table II)

DISCUSSION

From the study it can be inferred that the grain yield exhibits a highly significant positive correlation with biological yield followed by harvest index, hectolitre weight, number of tillers per running metre, sedimentation value, plant height, 1000grain weight and ear length. Therefore, these characters may be used as an index to selection for higher yield in wheat genotypes. However the yield was found to be negatively and significantly correlated with grains per ear.

The negative significant relationship correlation between yields and number of grains per ear may be attributable to the reduction in size of the grains with increment in their number.

Yield also shows a non-significant relation with days to heading and days to maturity which implies that yield is independent of these two characters and yield is indeed a function of the number of days given for grain development i.e. the difference between the days to maturity and days to heading depending on the environment it is exposed to. Also, a negative non-significant relation was observed between grain yield and protein content. The similar unfavourable association was also observed by previous workers **Getachew** *et al.* (1993), Feil, B. (1997), Acreche and **Slafer** (2009). This was reasoned to be due to the competition of energy between nitrate (reduced) and CO₂ (fixed to produce photosynthates and yield) at the level of ferridoxin (Munier-Jolain and Salon, 2005) and a N dilution effect by carbon-based compounds (Acreche and Slafer, 2009).

Also, selection for sedimentation value may be beneficial for improving both the protein quality as well as the grain yield simultaneously. Based, on the results of the path coefficient analysis it may be inferred that the maximum emphasis during selection should be given to biological yield and harvest index.

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Efficacy of insecticides and botanicals against rice gundhi bug (Leptocorisa acuta)

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ABSTRACT

An experiment was conducted to determine the comparative efficacy of selected insecticides and botanicals against rice gundhi bug (*Leptocorisa acuta* L.) on paddy. All the insecticides resulted in significant reduction in the population of insect and increased the grain yield (q/ha) in comparison with control. However, 25 EC proved to be significantly superior insecticide followed by other treatments.

Key word: - Botanicals, Insecticides, Rice gundhi bug, Oryza sativa

INTRODUCTION

Rice (*Oryza sativa* L.) is the world's most important food and a primary food source for more than a third of the world's population. India produces 99.15 million tons of rice. Rice, the staple food of more than half of human population is grown in 153.9 million hectares in the world with a production of 618 million tones and a productivity of 4.02 tones/ha. China ranks first in rice production in the world. In India, the area under rice cultivation is 41.90 million hectares with production of 132.02 million tons.

Gundhi bug is the major pest of rice: There are mainly two species, *viz., Leptocorisa acuta* (Thunberg) and *L. oratorius.* Rice gundhi bug causes an average loss of 10-30% yield because of its infestation during milky stage which leads to partial filling of grains/chaffy grains. The nymphs as well as adults emit a characteristic offensive odour in infested fields, which can be very easily recognized as a signal of presence of gundhi bug in rice fields. (**Prasad and Prasad, 2006**) IPM is an ecofriendly approach for managing pest problems utilizing all possible available methods and techniques of pest control such as cultural, mechanical, biological and chemical methods in a compatible and scientific manner to suppress the pest population below economic injury level.

MATERIALS AND METHODS

A field trial was conducted during *kharif* season of 2011 with Pusa basmati-1 variety in research field of department of Plant Protection, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad. The experiment was laid out in randomized block design, with three replications and nine treatments including untreated check with a plot size of $2x1m^2$ each. Twenty one days old seedlings were planted with a spacing of 30 x10cm². The treatments comprised of foliar sprays of insecticides and botanicals, *viz.*,

monocrotophos 36 WSC @ 500g a.i. /ha, Dichlorvos 76% @ 500g a.i. /ha, Quinalphos 25 EC @ 0.4kg a.i. /ha, chlorpyriphos 20 EC @ 2.5ml/l, Cypermethrin 25EC @ 30g a.i. / ha, Malathian 50 EC 1.0 kg a.i. /ha, NSKE @ 5%/l and Neem oil 3%/l. Ambthgar (1996), Mishra (2003), Seetha Ramu *et.al.*, (2005), Samanta (2006). The treatments were given at 90 days after transplanting and the observations were recorded one day before and at 1, 5, 10 and 15 days after spray from 5 randomly selected plants of each plot. The data collected were statistically analyzed.

RESULTS AND DISCUSSION

The pooled data presented in *Table 1* indicates that all insecticides and botanicals were significantly superior over control in reducing the population of gundhi bug recorded at 1, 5, 10 and 15 days after insecticidal and botanical applications. Quinalphos was found significantly superior (1.466, 1.000, 0.533, 0.333) followed by chloropyriphos (1.733, 1.466, 0.933, 0.933), dichlorvos (1.400, 1.066, 0.866, 0.733), monocrotophos (1.600, 1.400, 0.866, 0.800), melathion (1.666, 1.533, 0.933, 0.866), cypermethrin (1.733, 1.466, 0.933, 0.933), neem oil (2.066, 1.800, 1.266, 1.333) and NSKE (2.066, 1.866, 1.466, 1.533) as compared to control (2.466, 2.533, 2.600, 2.533) at 1st, 5th, 10th and 15th days, respectively.

The data for the efficacy of different treatments were evaluated on the basis of percentage population reduction. All the treatments were significant. Percentage population reduction of gundhi bug recorded at 1, 5, 10 and 15 days after insecticidal and botanical applications of quinalphos was found significantly superior (39.106, 59.693 79.830 86.786) followed by chloropyriphos (33.786, 39.146, 63.146, 75.53) as compared to other treatments, dichlorvos (40.890, 47.913, 60.156, 70.273), monocrotophos (33.760, 41.940, 65.743, 67.940), melathion (28.216, 34.743, 61.653, 64.566), cypermethrin (25.113, 41.286, 61.876, 62.130), neem oil (18.816, 32.733, 55.680,

Treatments	In	sect Populat	Percentage Population Reduction					Yield		
	Before		After Spray			A	fter Spr	ay		(q/ha)
	Spray	1 st Day	5 th Day	10 th Day	15 th Day	1 st Day	5 th Day	10 th Day	15 th Day	
Monocrotophos	2.066	1.600	1.400	0.866	0.800	33.760	41.940	65.743	67.940	39.00
Dichlorvos	2.000	1.400	1.066	0.866	0.733	40.890	47.913	60.156	70.273	40.516
Quanalphos	2.133	1.466	1.000	0.533	0.333	39.106	59.693	79.830	86.786	44.200
Chslorpyriphos	2.133	1.600	1.466	0.933	0.600	33.786	39.143	63.146	75.953	40.550
Cypermethrin	2.066	1.733	1.466	0.933	0.933	25.113	41.286	61.876	62.130	38.66
Malathian	2.066	1.666	1.533	0.933	0.866	28.216	34.743	61.653	64.566	38.78
Neem oil	2.266	2.066	1.800	1.266	1.333	18.816	32.733	55.680	49.986	37.43
NSKE	2.266	2.066	1.866	1.466	1.533	18.796	27.573	45.096	42.676	37.03
Control	2.200	2.466	2.533	2.600	2.533	-	-	-	-	28.83
CD(5%)	-	0.285	0.242	0.257	0.229	10.510	11.294	13.961	7.598	-
S.Ed (±)	2.707	0.126	2.828	4.163	2.581	4.902	5.265	6.509	3.538	-
CV%	5.948	9.309	8.832	12.731	12.154	20.146	15.877	12.935	6.669	-

Table 1: Per cent reduction of rice gundhi bug population due to insecticides and botanicals:

NSKE = Neem seed kernel extract

49.986) and NSKE (18.796, 27.573, 45.096, 42.676) respectively. Siminar findings have been reported by **Ramudu and Misra** (2005), Singh (2006) and Singh *et.al.*, (2009).

Treatments were found significant among each other in yield comparison. Maximum yield (q/ha) was recorded in Quinalphos (44.200) followed by Chlorpyriphos (40.550), Dichlorvos (40.516), Monocrotophos (39.000), Cypermethrin (38.783), Malathian (38.666), Neem Oil (37.433) and NSKE (37.033) as compared to control (28.833).

The probable reason for such findings may be that the insecticides after penetrating inside the body of insect may have reached the synoptic sites and may have mimicked the acetyl choline and reacted with enzyme acetyl choline esterase and inhibited it by blocking its active sites which are responsible for hydrolysis of natural substrate acetyl choline. This enzyme inhibition may have lead to the accumulation of acetyl choline at the nerve endings which may have ultimately resulted in restlessness, tremors, paralysis and death of the target insect. In case of botanicals, neem oil was found superior over others. The probable reason for this may be break down of the exoskeleton, disruption of the normal membrane functions, causing the early nymphs of rice bugs to dry out and die (**Ma et al., 2005**).

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Studies on Physical properties of Soybean seed and Splits as Influenced by Moisture content

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ABSTRACT

The physical property of soybean seed and split were determined as a function of moisture content in the range of 13% to 25.9 % and 12 % to 34.4 % (d.b.), respectively. The principal dimension increased linearly in length, width, thickness, arithmetic mean diameter, geometric mean diameter, square mean diameter, equivalent diameter, unit volume and surface area with the increase in moisture content for soybean seed and splits, respectively. While sphericity, aspect ratio and shape factor were decreased linearly with the increase in moisture content range studied for soybean seed and splits, respectively.

Keywords: Soybean, length, width, moisture content

INTRODUCTION

Soybean [Glycine max (L.) Merr.] is the 'golden bean' or 'miracle bean'. Soybean has come to be recognized as one of the premier agricultural crops today for various reasons. In brief, soybean is a major source of vegetable oil, protein and animal feed (Bisaliah, 1994). It contains about 43% of good quality protein, 20% fat, 21% carbohydrates, 5% minerals, 8% moisture, 4% fibre and reasonable amounts of vitamins. Soy based food products are also suitable to diabetic patients as they contain less carbohydrates and low cholesterol. Soy protein is also good to people who are allergic to animal protein. Therefore, it is one of the most economical protein source in the world (Ali, 2003). The current global production of soybean is around 176.64 million MT with USA being the largest producer (Jain and Kumar, 2011). In traditional soaking uses water at room temperature and takes 1 to 2 days. Modern methods use hot water, and soaking can be completed in a shorter time depending on the temperature of the soak water. Long-duration cold water soaking leads to microbial growth and off-flavor development, whereas hot water soaking requires high energy inputs and produces unsatisfactory coloration of the grains (Igathinathane et al., 2005). The water absorption of soybeans during soaking mainly depends as upon soaking time and temperature. As the soaking time increases, the amount of water absorbed increases with an increase in temperature (Chopra et al., **1994**). The kinetics of water absorption has been extensively studied for traditional food products such as cereal grains and legumes (Sopade et al., 1992, Turhan et al., 2002). In order to design equipment used in plantation, harvesting, storage, processing, oil extraction and transportation, of soybean, there is need to know various physical and mechanical properties as function of moisture content. The size, shape and mechanical behavior of soybean are important in designing of harvesting, separating, sizing, grinding and oil extraction machines (**Tavakoli** *et al.*, 2009). The present work was carried out to understand the physical and mechanical properties of soybean seeds and splits at different moisture content.

MATERIALS AND METHODS

Sample preparation

For this present study, the soybean seeds (JS- 335 var.) harvested in the year 2012 were obtained from Central Institute of Agriculture Engineering, Bhopal (India). The seeds were subjected to dehulling and splits were obtained. The initial moisture content of samples was determined (Ranganna, 1986) and the initial moisture content of soybean seeds and splits were 13% and 12% (d.b.), respectively. Only sound grains were used in the experiments. The samples were cleaned manually to remove foreign materials and broken, cracked and damaged grains, then sealed in polyethylene bags, the bags sealed tightly and stored at room temperature $(30\pm2^{\circ}C)$. To determine the different physical properties of soybean seed and splits, about 2 g (screened for uniformity of size) of sample was weighted using an digital electronic balance (least count of 0.001g) and soaked in 10 ml tap water in a measuring cylinder for 4 h.

Determination of physical properties

The physical properties such as size, shape, surface area, volume, density and many more properties are important in

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 CIAE-Regional Centre, Coimbatore-641 003, *Karunya University, Coimbatore-641 114 Department of Food Process Engineering, SHIATS, Allahabad – 211007 (U.P.) designing particular equipment or determining the behavior of the product for its handling.

Determination of geometrical properties

In order to determine the different physical properties, one hundred grain were randomly picked from each sample. The length (L), width (W) and thickness (L) were measured using an electronic digital vernier caliper (GENERAL ULTRATECH, Gurgaon, New Delhi having a resolution of 0.01 mm). The arithmetic mean diameter (AMD), geometric mean diameter (GMD), square mean diameter (SMD), equivalent diameter (EQD), degree of sphericity (Sp), aspect ratio (AR), shape factor (?) and unit volume of seed and split were calculated using the following equation (**Mohsenin**, **1996**).

$$AMD = \frac{L+W+T}{3}$$

$$GMD = \sqrt[3]{LWT}$$

$$SMD = \sqrt{LW+WT+TL}$$

$$EQD = \frac{AMD+GMD+SMD}{3}$$

$$Sp = \frac{GMD}{L}$$

$$AR = \frac{B}{L}$$

Major dimension was used to calculate the surface area (S) of single grain (**Jain and Bal, 1997**) as details below.

$$S = \frac{\pi GMD L^2}{2L - GMD}$$

Shape factor (?) based on unit volume and surface area of grain was determined (**McCabe and Smith, 1984**) as

$$\lambda = \frac{b}{a}$$

Where, $a = \frac{Vt}{W^2}$ and $b = \frac{S}{6W^2}$

The unit volume of single grain (Jain, 1997) was calculated as

$$Vt = \frac{\pi GMD^2 L^2}{6 (2L - GMD)}$$

Where, AMD: arithmetic mean diameter, GMD: geometric mean diameter, SMD: square mean diameter, EQD: equivalent diameter, Sp: degree of sphericity, AR: aspect ratio, S: surface area, λ : shape factor, Vt : unit volume.

Statistical analysis

The mathematical calculations and regression equation were carried out using MS Excel 2007.

RESULTS AND DISCUSSION

Geometrical properties of seed and split

The average value of three principal dimensions of soybean seed and splits determined at different moisture contents was increased linearly in length (7.63-10.81 and 5.98-11.42 mm), width (6.72-7.77 and 4.28-6.30 mm), thickness (5.09-6.47 and 2.36-3.62 mm), arithmetic mean diameter (6.48-8.35 and 4.20-7.11), geometric mean diameter (6.39-8.16 and 3.92-6.38 mm), square mean diameter (11.14-14.29 and 7.05-11.66 mm), equivalent diameter (8.00-10.26 and 5.06-8.38 mm), unit volume (140.35-302.72 and 35.86-169.25 mm³) and surface area (131.77-222.58 and 54.85-159.02 mm²), where in sphericity (0.83-0.75 and 0.65-0.55 %), aspect ratio (0.88-0.71 and 0. 71-0.52) and shape factor (1.05-0.95 and 1.09-0.98) were decreased linearly with the increase in moisture content from 13 % to 25.9% and 12% to 34.4% (d.b.) for soybean seed and splits, respectively. Changes occurring in dimensional geometrical properties during soaking are presented in Table-1. The axial dimensions increased with increase in moisture content due to absorption of moisture, which resulted in swelling of capillaries, stretching of longitudinal ridges on the soybean seed and splits surface and, finally, expansion in medium and minor axes. Similar trends were showed for coriander seeds. It was found that the geometric mean diameter was lower than the major axis and sphericity of soybean seed and splits were much lower than the reported values of spherical shaped black pepper and okra seeds, and higher than for locust and faba bean seeds (Murthy and Bhattacharya, 1998). SMD and EQD showed a maximum R² for soy bean seeds where as thickness showed a maximum R² for soybean splits.

Moisture	Axial Dimension (mm)		AMD	GMD	SMD	EQD	Sp	AR	$SF(\lambda)$	SA	Unit	
content	Length	Width	Thickness	(mm)	(mm)	(mm)	(mm)	(%)			(mm ²)	Volume
(% db)	(mm)	(mm)	(mm)									(mm ³)
					Se	ed		-				
13.00	7.63	6.72	5.09	6.48	6.39	11.14	8.00	0.83	0.88	1.05	131.77	140.35
19.88	7.72	6.83	5.13	6.56	6.46	11.28	8.10	0.83	0.88	1.05	134.95	145.46
21.60	7.81	6.94	5.18	6.64	6.54	11.42	8.20	0.83	0.88	1.05	138.31	150.94
22.46	8.06	7.08	5.28	6.80	6.70	11.70	8.40	0.83	0.87	1.05	145.30	162.35
22.46	8.31	7.23	5.39	6.97	6.86	11.99	8.61	0.82	0.87	1.05	152.75	174.83
22.46	8.61	7.36	5.46	7.14	7.02	12.27	8.81	0.81	0.85	1.04	160.29	187.55
22.46	8.95	7.46	5.50	7.30	7.16	12.53	8.99	0.80	0.83	1.04	167.80	200.27
22.46	9.03	7.46	5.83	7.44	7.32	12.78	9.18	0.81	0.82	1.01	174.72	213.25
23.32	9.09	7.46	6.17	7.57	7.47	13.03	9.36	0.82	0.82	0.99	181.42	226.17
23.32	9.10	7.57	6.33	7.66	7.58	13.20	9.48	0.83	0.83	0.99	185.81	234.84
23.32	9.14	7.65	6.47	7.75	7.67	13.36	9.59	0.83	0.83	0.99	190.00	243.10
23.32	9.66	7.65	6.47	7.92	7.81	13.63	9.79	0.80	0.79	0.97	199.32	259.77
24.18	10.23	7.65	6.47	8.11	7.97	13.92	10.00	0.77	0.74	0.95	209.81	278.71
24.18	10.49	7.68	6.47	8.21	8.04	14.07	10.11	0.76	0.73	0.95	215.13	288.56
25.90	10.78	7.71	6.47	8.32	8.13	14.23	10.23	0.75	0.71	0.94	221.08	299.64
25.90	10.80	7.74	6.47	8.33	8.14	14.26	10.25	0.75	0.71	0.94	221.93	301.36
25.90	10.81	7.77	6.47	8.35	8.16	14.29	10.26	0.75	0.71	0.95	222.58	302.72
		•			Sp	lit						
12.00	5.98	4.28	2.36	4.20	3.92	7.05	5.06	0.65	0.71	1.09	54.85	35.86
18.27	6.65	4.77	2.59	4.67	4.34	7.82	5.61	0.65	0.71	1.09	67.46	48.87
20.96	7.39	5.18	2.77	5.11	4.73	8.54	6.13	0.64	0.70	1.09	80.82	63.76
22.75	7.93	5.40	2.85	5.39	4.96	8.98	6.44	0.62	0.68	1.08	89.90	74.32
25.44	8.36	5.66	2.90	5.64	5.15	9.37	6.72	0.61	0.67	1.08	97.94	84.20
27.23	9.88	5.73	2.96	6.19	5.51	10.13	7.28	0.53	0.57	1.03	118.67	109.04
29.92	10.34	5.79	3.10	6.41	5.70	10.48	7.53	0.53	0.55	1.03	127.93	121.62
31.71	10.63	5.99	3.10	6.57	5.82	10.73	7.70	0.53	0.56	1.02	133.88	129.92
31.71	11.01	6.07	3.10	6.72	5.91	10.94	7.86	0.53	0.55	1.02	139.93	138.00
32.61	11.27	6.13	3.38	6.92	6.15	11.30	8.13	0.54	0.55	0.99	149.99	153.93
32.61	11.36	6.18	3.44	6.99	6.22	11.42	8.21	0.54	0.55	0.99	153.08	158.88
33.50	11.37	6.25	3.51	7.04	6.29	11.52	8.28	0.55	0.54	0.99	155.45	163.09
33.50	11.41	6.28	3.56	7.08	6.34	11.60	8.34	0.55	0.54	0.99	157.41	166.39
34.40	11.41	6.30	3.62	7.11	6.38	11.66	8.38	0.55	0.54	0.98	158.87	169.04
34.40	11.41	6.30	3.62	7.11	6.38	11.66	8.38	0.55	0.53	0.98	158.87	169.04
34.40	11.42	6.30	3.62	7.11	6.38	11.66	8.38	0.55	0.53	0.98	159.02	169.25
34.40	11.42	6.30	3.62	7.11	6.38	11.66	8.38	0.55	0.52	0.98	159.02	169.25

 Table 1. Some physical properties of soybean seed and split at different moisture content.

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Properties		Soybean seed	_	Soybean splits								
	Range	mx+c	R ²	Range	mx+c	R ²						
Geometric property												
Length (mm)	07.63-10.81	0.0117x+7.5727	0.9637	5.98-11.42	0.0598x + 5.8264	0.9838						
Width (mm)	06.72-07.77	0.009 x + 6.7261	0.9829	4.28-06.30	0.0199x + 4.4460	0.9672						
Thickness (mm)	05.09-06.47	0.0117x + 4.9105	0.9142	2.36-03.62	0.0088x + 2.4185	0.9710						
AMD (mm)	06.48-08.35	0.0109x+6.3891	0.9934	4.20-07.11	0.03x + 4.2409	0.9951						
GMD(mm)	06.39-08.16	0.0112x + 6.2831	0.9929	3.92-06.38	0.0235x + 4.0038	0.9965						
SMD(mm)	11.14 - 14.29	0.0192x + 10.979	0.9935	7.05-11.66	0.0459x + 7.1698	0.9963						
EQD(mm)	08.00-10.26	0.0138x+7.8837	0.9935	5.06-08.36	0.0331x + 5.1382	0.9963						
Sphericity	00.83-00.75	-0.0001x + 0.8320	0.7863	0.65-00.55	-0.0016x+0.6709	0.8956						
Aspect ratio	00.88-00.71	-0.0002x + 0.8890	0.9367	0.71-00.52	-0.0023x + 0.7454	0.9120						
Shape factor	01.05-00.95	-0.0004x + 1.0678	0.9380	1.09-00.98	-0.0011x + 1.1152	0.8983						
Surface area (mm ²)	131.77 -227.58	0.4671x+127.27	0.9915	54.85-159.02	1.0361x+51.968	0.9946						
Unit volume(mm ³)	140.35-302.72	0.7862x + 131.91	0.9908	35.86-169.25	1.2553x + 29.309	0.9926						

Table 2. Regression equations for physical properties of soybean seed and splits at different moisture contents.

 R^2 -correlation determination.

CONCLUSION

The moisture dependent physical properties of soybean seeds and splits showed an increasing trend for length, width, thickness, arithmetic mean diameter, geometric mean diameter, square mean diameter, equivalent diameter, unit volume and surface area showed a decreasing trend for sphericity, aspect ratio, and shape factor with the increase in moisture content from 13 % to 25.9% and 12% to 34.4% (d.b.).

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Effect of different levels of bavistin, waxol application on shelf life and quality on guava fruit (Psidium guajava) cv. Apple colour in Room temperature

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ABSTRACT

Guava cv. (Apple colour) is a Commercial fruit crop for the grower in Indian. Its is very economically fruit for Fruit industry and many home bases products prepared by farmers its also used in table purpose, But we know its self life is poor. Due to its waste causes many economic problems. The aim of this study is to improve the self life of the fruit by different chemicals composition, Waxol Percentages and packaging materials. The present investigation entitled "Effect of shelf life and quality on guava fruit (Psidium guajava) cv. Apple colour in Room temperature. There were ten post harvest treatment and one storage condition i.e (Room temperature). Name of chemical use - Bavistin (0%), (0.1%) and (2%) and Wax (0%), (6%) and (8%). Their effects were accessed by complete randomized design with three replication. The treated fruit of Guava were stored at room temperature. There was decrease in vitamin C (mg) and acidity during storage period of guava fruit under room temperature. There was increase in TSS and juice pH. Physiological loss in weight of fruit increased in storage period Irrespective of post harvest treatment and room temperature. All the treatments were found better in respect of TSS & ascorbic acid content over Control. On the basis of results obtained the treatment combination T_4 (Waxol (6%) + Bavistin (0.2%) proved to be the best in terms of fruit quality and better shelf life at room temperature. Since these finding are based on one year trial.

Key Words: Guava, Waxol, polythene bags, Carbendazim and LDPE.

INTRODUCTION

Guava (Psidium guajava) is an evergreen sub tropical fruit crop and belongs to the family Myrtaceae. It is one of the common and major fruit crops of India and considered fourth most important in area and fifth in production. In India, it occupies an area of 1.62 million hectors with an annual production of 16.85 million tones accounting for 5.26 percent and 3.73 percent of area and production respectively. It is rich in vitamin 'C' (300mg\100g.) and good sources of calcium, phosphorous, pantothenic acid, riboflavin, thiamine and niacin. It can be canned with sugar or used for making fruit like mango, apple etc, are not available in the market. It is also known as the "apple of tropics." It is a climatic fruit and highly perishable in nature and should be marketed immediately after harvest. The short post- harvest life of horticultural crop is due to their highly perishable nature and physiological break down during handling, transport, storage and these losses are further enhanced by infection of post harvest disease. Various viable technologies for improving shelf-life and storage of horticulture commodities have evolved during the post decades; antitranspirants, wax coating, growth retardants and different type of packing material etc. increase the shelf-life of harvested fruits. The technology holds considerable promise because in many cases it has an edge over the conventional methods. It could be applied judiciously where conventional methods are

inadequate, uneconomical or pose potential health risks. It can also be used as a complementary process with many new and emerging technologies. The process helps in reducing chemical burden on the commodities and also increases the packaging possibilities. But in spite of these available techniques the percentage of post harvest losses of fruit is still high. Therefore, there has to be a standardization of techniques for reducing this post harvests losses in the produce thereby, maintaining the quality of the product. The techniques should be feasible, economically viable and easily affordable to the average growers. It should also be feasible from the health point of view of human beings, Hussain, et al. (1991). Irradiated foods are wholesome and nutrition. All known methods of foods processing and even storing even storing foods at room temperature for a few hours after harvesting can lower the content of some nutrients, such as vitamins, Aradhita, et al. (1995). At low doses of radiation, nutrient losses are either not measurable or, if they can be measured, are not significant. Sometimes higher doses are used to extend shelf life or control harmful bacteria, nutrition losses are less than or about the some as cooking and freezing.

MATERIALAND METHODS

The present investigation entitled "Effect of post harvest treatment on shelf life and quality of Guava fruit (*Psidium guajava*) cv. Apple colour ." was conducted at post Harvest

Laboratory. Department of Horticulture, Allahabad Agricultural Institute-Deemed University, Allahabad during the year 2008-09. The experiment was laid out in a C.R.D. with ten treatment, each replication thrice, keeping unit per treatments. The treated fruit of Guava were stored at room temperature.

Bavistin and waxol was applied on a guava fruits and packed in a polythene bags to extend the shelf life. Regular observation were taken at 4 days interval on physiological loss in diameter of fruit, specific gravity of fruit, T.S.S., acidity and vitamin C.

S.No.	Symbol	Treatment combination
1	T ₀	Control
2	T ₁	Bavistin (0.1%) + Waxol (0%)
3	T ₂	Bavistin (0.2%) + Waxol (0%)
4	T ₃	Bavistin (0%) + Waxol (6%)
5	T ₄	Bavistin (1%) + Waxol (6%)
6	T ₅	Bavistin (2%) + Waxol (8%)
7	T ₆	Bavistin $(0.\%)$ + Waxol (6%)
8	T ₇	Bavistin (0.1%) + Waxol (8%)
9	T ₈	Bavistin (0.2%) + Waxol (8%)

Table 1. Treatment combination

RESULT AND DISCUSSION

The results of the experiment conducted on the effect of post harvest treatment on shelf life and quality of Guava fruit (*Psidium guajava*) cv. Apple colour., have been presented in detail.

Diameter of fruit (%).

It is clear from *table 1* that the effect of different levels of Waxol, and interaction (waxol + Bavistin) was significant right from 0, 4, 8 & 12 days of storage. Minimum physiological loss in weight was recorded with the treatment combination T_0 (Bavistin (0.%) + Waxol (0%) i.e. 6.60, 5.90, 5.65 and 5.20 at 0, 4, 8 and 12 days of storage respectively which is followed by T_1 (Bavistin (0.1%) + Waxol (0%) i.e. 6.63, 6.23, 5.78 and 5.31. Maximum physiological loss in weight was recorded with the treatment combination T_5 (Bavistin 0.2% + Waxol 6%).

Similar results were recorded by **Teaotia**, *et al.* (1968) and **Jagdeesh**, S.L. (1994).

Specific gravity :

It is clear that *table 2* that the effect of different levels of Waxol, and interaction (waxol+Bavistin) was significant right from 0, 4, 8 and 12 days of storage. Whereas the interaction

 Table 1 : Effect of different levels of bavistin, waxol and their interaction on diameter (cm) of guava fruit cv. Apple

 Colour at different days of storage at ambient temperature

Bavistin (B)			0 Day				4th Day	
		Waxol (W)		Mean (B)		Waxol (W)		Mean (B)
	W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.)		W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.)	
B ₀ (0.0%)	6.60	6.83	6.93	6.79	5.90	6.37	6.43	6.23
B ₁ (0.1%)	6.63	7.71	7.10	7.15	6.23	6.77	6.58	6.53
B ₂ (0.2%)	6.67	7.60	7.07	7.11	6.23	6.73	6.57	6.51
Mean (W)	6.63	7.38	7.03	-	6.12	6.62	6.53	-
		F - Test	S. Ed. (±)	C. D. at 5%		F - Test	S. Ed. (±)	C. D. at 5%
Bavistin (H	3)	NS	-	-		S	0.010	0.022
Waxol (W)	NS	-	-		S	0.010	0.022
Interaction (B	x W)	NS	-	-		S	0.018	0.038
Bavistin (B)			8th Day				12th Day	
		Waxol (W)		Mean (B)		Waxol (W)		Mean (B)
	W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.)		W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.)	
B ₀ (0.0%)	5.65	5.99	6.00	5.88	5.20	5.35	5.38	5.31
B ₁ (0.1%)	5.78	6.35	6.30	6.14	5.31	5.95	5.50	5.59
B ₂ (0.2%)	5.98	6.30	6.15	6.14	5.35	5.85	5.50	5.57
Mean (W)	5.80	6.21	6.15	-	5.29	5.72	5.46	-
		F - Test	S. Ed. (±)	C. D. at 5%		F - Test	S. Ed. (±)	C. D. at 5%
Temperature	(TE)	S	0.005	0.011		S	0.019	0.040
Time (T)		S	0.005	0.011		S	0.019	0.040
Interaction (TE	E x T)	S	0.009	0.019		S	0.033	0.070

Bavistin (B)			0 Day			4th Day			
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)	
	W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.)		W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.))	
$B_0(0.0\%)$	1.01	1.11	1.12	1.08	0.91	1.02	1.02	0.98	
$B_1(0.1\%)$	1.03	1.34	1.16	1.18	0.95	1.15	1.05	1.05	
$B_2(0.2\%)$	1.10	1.27	1.13	1.17	0.96	1.12	1.04	1.04	
Mean (W)	1.05	1.24	1.14	-	0.94	1.10	1.04	-	
		F - Test	S. Ed. (±)	C. D. at 5%		F - Test	S. Ed. (±)	C. D. at 5%	
Bavistin	(B)	NS	-	-		S	0.005	0.010	
Waxol (W)	NS	-	-		S	0.005	0.010	
Interaction (B x W)	NS	-	-		S	0.008	0.017	
Bavistin (B)			8th Day				12th Day		
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)	
	W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.))	W ₀ (0.0%.)	W ₁ (6.0%.)	W ₂ (8.0%.))	
$B_0(0.0\%)$	0.81	0.92	0.94	0.89	0.62	0.78	0.82	0.74	
$B_1(0.1\%)$	0.86	1.08	0.95	0.96	0.71	1.01	0.90	0.87	
$B_2(0.2\%)$	0.88	1.06	0.94	0.96	0.75	0.98	0.89	0.87	
Mean (W)	0.85	1.02	0.94	-	0.69	0.92	0.87	-	
		F - Test	S. Ed. (±)	C. D. at 5%		F - Test	S. Ed. (±)	C. D. at 5%	
Temperatur	e (TE)	S	0.004	0.009		S	0.004	0.008	
Time (7	Г)	S	0.004	0.009		S	0.004	0.008	
Interaction (ΓE x T)	S	0.007	0.015		S	0.006	0.013	

 Table 2 : Effect of different levels of bavistin, waxol and their interaction on specific gravity of guava fruit cv. Apple

 Colour at different days of storage at ambient temperature

of different levels of (Waxol + Bavistin) was non-significant at 0, 4, 8 and 12 days of storage. Maximum specific gravity was recorded with the treatment combination T_4 (Waxol (6%) + Bavistin (0.1%) i.e. 1.34, 1.15, 1.04 and 1.01 at 0, 4, 8 and 12 days of storage which is followed by T_5 (Waxol (6%) + Bavistin (0.2%) and minimum specific gravity was recorded with the treatment combination T_1 (Waxel 0%) + Bavistin (0.0%). Similar results were recorded by **Shanker** *et al.* (1967b).

Total soluble solids (%) :

It is clear that *table 4* the effect of different levels of waxol, bavistin and interaction (Waxol + Bavistin) was significant fifth from 0, 4, 8 & 12 day of storage.

Maximum total soluble solid was recorded with the treatment combination T_4 (Waxol (6%) + Bavistin (0.1%) i.e. 12.49, 11.65, 10.16 and 8.86 at 0, 4, 8 and 12 days of storage which is followed by T_7 (Waxol (1%) + Bavistin (0%) and minimum total soluble solid was recorded with the treatment combination T_0 (Waxol (0%) + Bavistin (0.0%). This result was also in agreement with the work of **Singh et al. (1976**).

Acidity:

It is clear that table no. 6 that the effect of different levels of waxol Bavistin and interaction (waxol + Bavistin) was significant right from 0, 4, 8 and 12 days of storage. All the treatment showed significant different for different interval of storage periods. Maximum acidity (0.72) was recorded with the treatment combination T_0 (waxol 0.1% + Bavistin 0%) followed by other treatment and minimum acidity (0.12%) was recorded with the treatment combination T_4 (waxol 6% + Bavistin 0%). This finding was supported by **Singh** *et al.* (1985) and Chen *et al.* (2001).

Ascorbic acid (Vitamin C) content (mg/100g) :

It is clear that *table 7* that the effect of different levels of waxol, Bavistin and interaction (Waxol + Bavistin) was significant right from 0, 4, 8 & 12 days during storage. All the treatment showed significant difference for different interval of storage periods. Maximum vitamin C was recorded with the treatment combination T_4 (Waxol (6%) + Bavistin (0.1%) i.e. 205.17, 199.46, 173.25 and 153.92 at 0, 4, 8 and 12 days which is followed by T_5 (Waxol (6%) + Bavistin (0.2%) and minimum vitamin C was recorded with the treatment combination T_0 (Waxol (0%) + Bavistin (0.0%). This finding was supported by **Ylagan, M.M. (1961)**, **Singh** *et al.* (1989)

On the basis of results obtained the treatment combination T_4 (Waxol (6%) + Bavistin (0.2%) proved to be the best in terms of fruit quality and better shelf life at room temperature.

Bavistin (B)			0 Day				4th Day	
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)
	$W_{_0}$ (0.0%)	W ₁ (6.0%)	W ₂ (8.0%)		$W_{_0}(0.0\%)$	W_1 (6.0%)	W ₂ (8.0%).)
$B_0(0.0\%)$	10.46	11.77	11.80	11.34	10.02	11.33	11.35	10.90
$B_1(0.1\%)$	11.70	12.49	12.27	12.15	11.31	11.65	11.43	11.46
$B_2(0.2\%)$	11.70	12.49	11.85	12.01	11.32	11.65	11.37	11.45
Mean (W)	11.29	12.25	11.97	-	10.88	11.54	11.38	-
		F - Test	S. Ed. (±)	C. D. at 5%	, D	F - Test	S. Ed. (±)	C. D. at 5%
Bavistin (B)	NS	-	-		S	0.02	0.04
Waxol (W)		NS	-	-		S	0.02	0.04
Interaction (B >	κW)	NS	-	-		S	0.03	0.06
Bavistin (B)			8th Day				12th Day	
	Waxol (W)			Mean(B)		Waxol (W)		Mean(B)
	$W_{_0}(0.0\%)$	W ₁ (6.0%)	W ₂ (8.0%)		$W_{_0}(0.0\%)$	$W_1(6.0\%)$	W ₂ (8.0%)	
$B_0(0.0\%)$	8.26	9.76	9.83	9.28	6.70	7.17	7.66	7.18
$B_1(0.1\%)$	9.23	10.16	10.16	9.85	6.95	8.86	8.39	8.07
$B_2(0.2\%)$	9.65	10.16	9.90	9.90	6.95	8.86	8.12	7.98
Mean (W)	9.05	10.03	9.96	-	6.87	8.30	8.06	-
		F - Test	S. Ed. (±)	C. D. at 5%	, D	F - Test	S. Ed. (±)	C. D. at 5%
Temperature (ГЕ)	S	0.02	0.04		S	0.03	0.07
Time(T)		S	0.02	0.04		S	0.03	0.07
Interaction (TE	x T)	S	0.04	0.07		S	0.06	0.12

 Table 3 : Effect of different levels of bavistin, waxol and their interaction on total soluble solids (%) of guava fruit cv.

 Apple Colour at different days of storage at ambient temperature

 Table 4 : Effect of different levels of bavistin, waxol and their interaction on acidity (%) of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Bavistin (B)			0 Day				4th Day	
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)
	$W_{0}^{}(0.0\%)$	$W_1 (6.0\%)$	$W_{2}(8.0\%)$		$W_{_0}(0.0\%)$	$W_1(6.0\%)$	W ₂ (8.0%)	
$B_0 (0.0\%)$	0.89	0.60	0.57	0.69	0.86	0.56	0.53	0.65
$B_1(0.1\%)$	0.80	0.32	0.33	0.48	0.75	0.28	0.29	0.44
$B_2 (0.2\%)$	0.75	0.33	0.56	0.55	0.72	0.29	0.52	0.51
Mean (W)	0.81	0.42	0.49	-	0.78	0.38	0.45	-
		F - Test	S. Ed. (±)	C. D. at 5%	, D	F - Test	S. Ed. (±)	C. D. at 5%
Bavistin (B)	S	0.077	0.163		S	0.003	0.007
Waxol (W)	1	S	0.077	0.163		S	0.003	0.007
Interaction (B >	x W)	NS	-	-		S	0.005	0.011
Bavistin (B)			8th Day				12th Day	
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)
	$W_{_0}(0.0\%)$	W ₁ (6.0%)	W ₂ (8.0%)		$W_{_0}(0.0\%)$	W ₁ (6.0%)	W ₂ (8.0%))
$B_0(0.0\%)$	0.91	0.75	0.67	0.78	0.72	0.35	0.26	0.44
$B_{1}(0.1\%)$	0.82	0.34	0.48	0.55	0.48	0.12	0.24	0.28
$B_{2}(0.2\%)$	0.81	0.35	0.60	0.59	0.46	0.24	0.26	0.32
Mean (W)	0.85	0.48	0.58	-	0.55	0.24	0.25	-
		F - Test	S. Ed. (±)	C. D. at 5%	, D	F - Test	S. Ed. (±)	C. D. at 5%
Temperature (ΓE)	S	0.004	0.008		S	0.002	0.005
Time(T)		S	0.004	0.008		S	0.002	0.005
Interaction (TE	x T)	S	0.006	0.013		S	0.004	0.009

Bavistin (B)			0 Day				4th Day	
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)
	$W_{_0}(0.0\%)$	W ₁ (6.0%)	W ₂ (8.0%)		$W_{_0}(0.0\%)$	$W_1(6.0\%)$	W ₂ (8.0%)	1
$B_0(0.0\%)$	181.38	191.66	191.80	188.28	176.66	184.49	187.59	182.91
B ₁ (0.1%)	183.83	205.17	199.68	196.23	178.83	199.46	193.33	190.54
B ₂ (0.2%)	190.22	200.10	198.27	196.20	183.83	193.75	191.25	189.61
Mean (W)	185.14	198.98	196.58	-	179.77	192.57	190.72	-
		F - Test	S. Ed. (±)	C. D. at 5%	, D	F - Test	S. Ed. (±)	C. D. at 5%
Bavistin (B	8)	NS	-	-		S	0.86	1.81
Waxol (W)	NS	-	-		S	0.86	1.81
Interaction (B	xW)	NS	-	-		S	1.49	3.13
Bavistin (B)			8th Day				12th Day	
		Waxol (W)		Mean(B)		Waxol (W)		Mean(B)
	$W_{_0}(0.0\%)$	$W_1(6.0\%)$	$W_{2}(8.0\%)$		$W_{_0}(0.0\%)$	W ₁ (6.0%)	W ₂ (8.0%)	1
$B_0(0.0\%)$	146.08	161.69	163.08	156.95	122.02	129.52	134.63	128.72
B ₁ (0.1%)	153.95	173.25	170.19	165.80	124.79	153.92	147.53	142.08
B ₂ (0.2%)	157.73	171.84	164.26	164.61	129.06	152.53	138.56	140.05
Mean (W)	152.59	168.93	165.84	-	125.29	145.32	140.24	-
		F - Test	S. Ed. (±)	C. D. at 5%	, D	F - Test	S. Ed. (±)	C. D. at 5%
Temperature (TE)	S	0.74	1.55		S	0.61	1.29
Time(T)		S	0.74	1.55		S	0.61	1.29
Interaction (TE	E x T)	S	1.28	2.69		S	1.06	2.23

Table 5 Effect of different levels of bavistin, waxol and their interaction on vitamin C (ascorbic acid) (mg/100 g pulp) of guava fruit cv. Apple Colour at different days of storage at ambient temperature

Since these finding are based on one year trial and therefore, further experiment may be done to substantiate the results.

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Biometric Assessment of Selected Multipurpose Tree Species for Carbon Assimilation pattern at Seedling Stage

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ABSTRACT

Investigations were carried out in *Casuarina equisetifolia, Leucaena leucocephala, Azadirachta indica, Gmelina arborea and Eucalyptus tereticornis* seedlings to study the effect of ambient CO_2 in the atmosphere in carbon assimilation pattern at Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam. The observations on the biometric parameters revealed the carbon assimilation pattern in the selected multipurpose tree species. Studies on biometric attributes revealed that leaf area, specific leaf area, specific leaf weight and total dry matter accumulation were highly significant in *Eucalyptus tereticornis and Leucaena leucocephala*. The results showed that increasing carbon dioxide concentration of the atmosphere significantly improved the growth traits in the species studied. On analysing the biometric attributes *Eucalyptus tereticornis and Leucaena leucocephala* found superior among other multipurpose tree species. The results of the present study revealed that *Eucalyptus tereticornis and Leucaena leucocephala* were the best performers among the other multipurpose tree species. These species can be recommended for plantation forestry which could help to achieve a faster and efficient carbon assimilation and carbon gain through higher biomass and yield.

Keywords: leaf area, dry matter production, carbon assimilation, plantation

INTRODUCTION

The problem of climate change is one of the most serious impact on environment the humanity has ever faced, and one that humans themselves have generated, placing all planetary life in jeopardy. Reducing the emission of contaminating gases that heat up the atmosphere and destroy the ozone layer through the use of clean technologies and taking many of these gases off the market is a part of the solution. Forest plantations are important part of these global "cleaners," but the region's potential also lies in land where more trees can be planted or where forests can regenerate naturally wherein the efficient species can sequester more for enhancing their capacity to mitigate greenhouse gases. But this needs identification of ecosystems with high C sink capacity.

Brown *et al.* (1996) estimated that, by 2050, plantations in tropical countries have the potential to capture as much as 16.4 Gt C whereas agroforestry has the potential to capture 6.3 Gt C. This privileged position is derived from the net potential of carbon from future plantations, implementation of agroforestry systems and induced regeneration of forests, making it possible to produce around 243 million tons of carbon (24.3 million tons a year) in the next decade. However, a methodology for evaluating the biological components of carbon flux remains a significant research issue. This concern may lead to international negotiations on carbon emissions, which will require in depth understanding of national-level

carbon budgets. In addition to the scientific importance of understanding the C balance of trees, it is also of economic interest to known how trees will respond to further increases in atmospheric CO₂.

Differences in % C among different tree species and among wood types within a single tree (Lamlom and Savidge, 2003) indicated the need to estimate biomass and C content for each species and each tree component. Among various agricultural land-use and management strategies, bioenergy crops have the largest potential for C storage (Smith *et al.*, 2000). Fast growing multipurpose tree species such as *Eucalyptus tereticornis, Leucaena leucocephala, Casuarina equisetifolia, Azadirachta indica, Gmelina arborea* and *Bambusa bambos* are important components of tropical forest ecosystem and are especially well suited for plantation culture.

Environmental stresses such as drought can cause temporary change in shoot: root ratio that may have important effects on seedling quality and survival (**Cannel** *et al.*, **1978**). They concluded that allocation of biomass and morphology of the leaves has an important impact on plant's carbon economy and are major determinants of interspecific variation in RGR. Although a number of papers have been published on these multipurpose tree species, however, research regarding the effects of elevated CO_2 on its growth in seedling stage is rather few. The present study, therefore, were to

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determine the effects of the present CO_2 level upon growth and dry matter partitioning in the selected multipurpose tree species, viz., *Azadirachta indica, Bambusa bambos, Casuarina equisetifolia, Eucalyptus tereticornis, Gmelina arborea* and *Leucaena leucocephala* during the seedling stage and to investigate, through growth analysis, the relationship between source and sink, dry matter partitioning and its components under the present stress conditions. Such analytical tools as local Carbon budgets are needed to improve our preventive and mitigative strategies for dealing with global climate change. With this background, the current study is designed to assess the carbon assimilation pattern and estimate the carbon stock available in the selected multipurpose tree species in seedling stages.

MATERIALS AND METHODS

The laboratory and the nursery studies were carried out in order to study the carbon assimilation pattern and carbon gain in the selected multipurpose tree species in the seedling stage at Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam. The species under study includes Casuarina equisetifolia (T1), Leucaena leucocephala (T2), Bambusa bambos (T3), Azadirachta indica (T4), Gmelina arborea (T5) and Eucalyptus tereticornis (T6). The Institute is located in the western zone of Tamil Nadu. Geographically it is located at 110 19' N latitude and 770 56' E longitude and an altitude of 300m above msl. The soil used was non-calcareous, red loam (Typic Ustropept), having pH 7.24 and Organic Carbon 0.426 %. The status of available nitrogen, phosphorus and potassium of the experimental site were 187.6, 51.4 and 64 kg ha⁻¹. Fresh seeds of all the selected multipurpose tree species were collected from single identified trees at Forest College and Research Institute, Mettupalayam. The same seeds were used for raising the seedlings in the nursery under study. The experiment was laid out in a Complete Randomized Design (CRD) with six treatments, each replicated four times.

The observations on biometric parameters were recorded at 30, 60, 90 and 120 days after transplanting (DAT) @ four seedlings per replication. The leaf area was estimated by graphic method as suggested by **Ashley** *et al.* (1963). To estimate the leaf area, the outline of the leaf is drawn on a graph paper and the number of full squares, half squares and quarter squares are counted and added. The leaf area was expressed as cm2 leaf-1. Estimation of carbon assimilatory efficiency of leaves or to estimate the leafiness of plants, **Radford** (1967) suggested leaf area ratio as a measure of leaf area to the weight of the whole plant. It was expressed as cm² g⁻¹. SLA is the ratio of assimilating surface to its dry weight. **Kvet** *et al.* (1971) suggested Specific leaf area as a measure of leaf area per plant to the leaf dry weight per plant. It was expressed as cm² g⁻¹. Specific leaf weight (SLW) is the ratio of leaf dry weight to its area of assimilating surface. The formula was suggested by **Pearce** *et al.* (1968) and expressed as mg cm⁻². The shoot and root length is expressed in cm. Dry weight of shoot and root in g seedling⁻¹.

The estimation of biomass carbon stock is based on biomass and carbon content (%) in different components of tree species. The total biomass carbon was calculated by using below given formulae.

- i) AGB carbon (g C plant⁻¹) = Above ground biomass (g plant⁻¹) × Carbon content (%)
- BGB carbon (g C plant⁻¹) = Below ground biomass (g plant⁻¹) × Carbon content (%)
- iii) Total biomass carbon stock (g C plant⁻¹) = AGB carbon
 + BGB carbon

The data were analyzed by standard statistical procedure described by **Snedecor and Cochran (1967)**. The stage wise data were analyzed separately using AGRES software.

RESULT AND DISCUSSION

Towards realizing the objectives enumerated in introduction, experiments were carried out in *Casuarina equisetifolia, Leucaena leucocephala, Bambusa bambos, Azadirachta indica, Gmelina arborea* and *Eucalyptus tereticornis* seedlings, to study the carbon gain among the selected multipurpose tree species. The observations on the biometric attribute in the ambient CO_2 condition revealed the carbon assimilation pattern in the selected multipurpose tree species. The data obtained from these experiments were statistically analyzed and the results are presented and discussed thoroughly in this chapter.

1. Biometric attributes

1.1. Leaf area

The leaf area per plant was maximum (567 cm^2) in *Eucalyptus tereticornis*, followed by *Leucaena leucocephala* (475 cm^2) , while the lowest leaf area (94 cm^2) was recorded in *Bambusa bambos (Table 1)*. The representation of actual photosynthesizing apparatus which fixes the carbon for the build up of dry matter production can be primarily assigned to the leaf area of any terrestrially grown plant or tree species. The growth analysis revealed that leaf area of all the treatments increased exponentially with time.

The leaf area expansion was significant in the present study which could be significantly observed in *Eucalyptus tereticornis* which was in confirmative with the findings of **Ilango (1997)** who reported a three fold increase in leaf area in *Albizia lebbeck* with increase in age of seedlings. The increase in the leaf area due to enhanced carbon dioxide levels can be assigned to the effective assimilatory pattern of C_3

plants. The majority of the tree crops fall under the category of C_3 assimilatory pattern of photosynthesis.

This is supported by the findings of **Elkohen** *et al.* (1993) that a greater effect of elevated CO_2 in beech was the result of a significant increase of net photosynthesis of the seedlings occurring during the whole season in which total leaf area per plant increased, owing to a greater number of growth flushes, of progressively larger leaves.

1.2. Leaf area ratio

The highest leaf area ratio $(85.26 \text{ cm}^2 \text{ g}^{-1})$ was observed in *Leucaena leucocephala*, followed by *Azadirachta indica* which recorded 66.58 cm² g⁻¹ whereas the lowest leaf area ratio $(26.35 \text{ cm}^2 \text{ g}^{-1})$ was observed in *Bambusa bambos (Table 1)*. Significant variation was observed at different stages of growth. The leaf area ratio which symbolizes the leaf area to total plant weight is also dependent on rate of leaf expansion, net assimilation rate, leaf area and leaf weight. The main dependent variable in this parameter is the leaf area. The enhanced carbon dioxide had significantly improved the leaf area expansion during the seedling growth stage.

In the present study, the leaf area ratio values increased from 30 to 60 days after transplanting and showed a marginal increase till 90 days after transplanting and then declined. The reason that could be attributed to decline in the leaf area ratio is due to the senescence of the leaves and partitioning and translocation of dry matter or carbon source to the stem and branches which is in the form of consolidated plant dry biomass. This was in conformity with the findings of **Reich** *et al.* (1992) who reported the leaf area ratio of seedlings decreased with increasing leaf life span results from the impact of decreasing leaf N mass due to translocation.

1.3. Specific leaf area

The specific leaf area indirectly measures the leaf expansion rate in relation to leaf weight. Significant variation in specific leaf area was found at different stages of growth in the study. Specific Leaf Area was found to be higher (1.03 cm² mg⁻¹) in *Leucaena leucocephala*, followed by *Casuarina equisetifolia*, which was on par with *Azadirachta indica* recording 0.25 cm² mg⁻¹. *Eucalyptus tereticornis* recorded the lowest specific leaf area of 0.16 cm² mg⁻¹ (*Table 1*).

The reduction in specific leaf area was noted from 30 to 60 DAT and showed a marginal increase till 120 DAT. *Eucalyptus tereticornis* recorded lower specific leaf area, which is an indirect measure of carbon gain or dry matter accumulation. This finding is highly supported by the findings of **Ostman and Weaver (1982)** who reported that the decrease in specific leaf area at the initial stage followed by an increase near the end presumably indicates retranslocation of organic matter in and out of leaves during senescence. The results were also in conformity with the findings of **Paramaguru and Thamburaj (1991)** in Cassava who found the decreased specific leaf area with ageing of plants.

Reich *et al.* (1992) also confirmed the specific leaf area of seedlings decreased with increase in leaf life span. **Peneulas and Matamala (1990)** indicated that parallel to the increase in atmospheric carbon dioxide from 278 μ mol mol⁻¹ in 1750 AD to the current ambient 348 μ mol mol⁻¹, there have been

	LA (cm ²)				LAR (cm2 g-1)			SLA (cm ² mg ⁻²)			S	SLW (mg cm ⁻²)				
Species	30	60	90	120	30	60	90	120	30	60	90	120	30	60	90	120
	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT
Casuarina	23	40	68	100	30.59	23.25	25.69	28.78	0.31	0.26	0.21	0.20	3.34	4.02	4.89	5.21
equisetifolia																
Leucaena	56	155	286	475	61.49	93.99	90.90	85.26	0.43	0.66	0.45	1.03	4.49	5.44	7.35	5.09
leucocephala																
Bambusa	20	42	59	94	23.89	22.52	21.54	26.35	0.24	0.21	0.19	0.18	4.31	5.09	5.34	5.82
bambos																
Azadirachta	12	48	131	206	33.41	71.36	74.39	66.58	0.26	0.21	0.24	0.27	4.02	5.02	4.29	3.73
indica																
Gmelina	23	79	215	448	16.67	25.98	44.06	65.46	0.14	0.17	0.20	0.17	7.35	5.91	5.03	6.09
arborea																
Eucalyptus	32	87	256	567	30.03	45.62	79.44	64.03	0.13	0.11	0.15	0.16	8.19	9.11	7.12	6.39
tereticornis																
SEd	27	75	169	315	32.68	47.12	56.00	56.08	0.25	0.27	0.24	0.34	5.28	5.76	5.67	5.39
CD																
(P = 0.05)	2.00	3.07	2.27	5.82	1.52	1.06	1.37	0.96	0.005	0.005	0.003	0.003	0.004	0.003	0.003	0.014

Table 1. Biometric attributes (LA, LAR, SLA & SLW) in the selected multipurpose tree species at seedling stage

overall decrease in specific leaf area from 184% to 100% today.

1.4. Specific leaf weight

The specific leaf weight of trees indirectly reveals the thickness of the leaf. The ratio of assimilating surface to its dry weight is represented as specific leaf weight. Measure of specific leaf weight also gives the assimilatory efficiency of the leaf which decreased towards crop maturity, since proteins and metabolites are translocated from the leaf to the developing sink (**Pearce** *et al.*, **1968**). *Eucalyptus tereticornis* has recorded the highest specific leaf weight of 6.39 mg cm⁻², followed by *Gmelina arborea* which recorded 6.09 mg cm⁻². The lowest specific leaf weight of 3.73 mg cm⁻² was recorded in Azadirachta indica (*Table 1*).

In the present study, the increase in specific leaf weight was noted in all species. This could be because of the present elevated CO_2 concentration in the atmosphere. This is supported by the earlier findings of **Rao** *et al.* (1999) who reported that greater specific leaf weight was achieved when seedlings raised with CO_2 enrichment treatment. *Eucalyptus tereticornis* seedlings showed higher specific leaf weight. The increase in specific leaf weight was noted from 30 to 60 DAT, whereas it declined at the end of the growth stage. The reason could be the translocation of proteins and metabolites from the leaf to the developing since and this finding is highly supported by the findings of **Pearce** *et al.* (1968).

1.5. Shoot length and Root length

Growth is one of the most fundamental and conspicuous characteristics of living organism. The growth in length of the plant is due to the meristematic activity of the apical meristems that takes place in the root and shoots apices. Among the tree species, *Eucalyptus tereticornis* recorded the maximum shoot length (65.6 cm), followed by *Leucaena leucocephala* which measured 55.1 cm. The lowest shoot length of 21.8 cm was recorded in *Azadirachta indica* (*Table* 2). The shoot length varied significantly at all the stages of growth. **Bertomeu and Sungkit** (**1998**) also reported an increasing growth rate in *Eucalyptus deglupta* Blume. in the seedling stage.

Similarly the root length also varied significantly at all the stages of the growth. The maximum root length of (55.5 cm) was recorded in Casuarina equisetifolia, followed by Leucaena leucocephala which measured 47.7 cm. The lowest root length of 30.0 cm was recorded in Azadirachta indica (Table 2). The increase in the root length was noted in all the species with increase in age of the seedlings which was in conformity with the findings of Saravanan (2000) who reported an increasing root length trend with increase in age of the seedlings. Casuarina equisetifolia showed maximum root length. This is in conformity with the findings of Adalarasan (2002) who reported a similar trend of root length values in Casuarina equisetifolia when grown as control. The reason could be the roots of Casuarina seedlings possess nodules capable of fixing atmospheric nitrogen which enhances the root growth.

1.6. Shoot and root dry weight

The increase in the shoot dry weight was found significant in all the species. Among the tree species, *Eucalyptus tereticornis* recorded the maximum shoot dry weight (6.44 g seedling⁻¹), followed by *Leucaena leucocephala* which

Species		SL (cm)			RL(cm)		SD SD	W (g s	eedling	g ⁻¹)	RDW (g seedling ⁻¹)			
	30	60	90	120	30	60	90	120	30	60	90	120	30	60	90	120
	DAT	DAT	DAT	DAT	DAT	DAT	DAT	DAT								
Casuarina equisetifolia	16.5	22.8	38.0	48.1	15.4	28.1	39.9	55.5	0.35	0.66	1.21	3.21	0.41	0.98	1.23	3.28
Leucaena leucocephala	18.1	25.3	41.0	55.1	16.3	21.0	31.3	47.7	0.51	0.94	1.91	4.81	0.40	0.72	1.21	3.12
Bambusa bambos	8.2	14.3	21.1	25.9	13.5	19.4	25.0	38.0	0.47	0.88	1.45	1.98	0.41	0.85	1.41	1.81
Azadirachta indica	6.9	10.8	18.5	21.8	9.8	14.9	20.5	30.0	0.18	0.33	0.86	1.80	0.20	0.35	0.87	1.29
Gmelina arborea	15.2	22.3	32.1	40.7	12.4	17.3	27.4	35.9	0.62	0.78	1.63	4.27	0.23	0.48	1.10	2.63
Eucalyptus tereticornis	19.2	29.5	48.3	65.6	12.4	17.3	21.5	31.0	0.82	1.46	2.25	6.44	0.28	0.45	0.96	2.42
SEd	14.0	20.8	33.2	42.9	13.3	19.7	27.6	39.7	0.49	0.84	1.55	3.75	0.32	0.64	1.13	2.43
CD(P=0.05)	0.33	0.48	0.78	0.92	0.21	0.40	0.76	0.77	0.01	0.01	0.02	0.03	0.01	0.01	0.02	0.05

Table 2. Biometric attributes (SL, RL, SDW & RDW) in the selected multipurpose tree species at seedling stage

measured 4.81 g seedling⁻¹ (*Table 2*). This could be because of faster growth rate, longer growth period and better photosynthetic efficiency of the leaves which supply abundant energy for biomass production. This finding is supported by the findings of Jarvis and Jarvis (1964) who revealed that long growth period had a significant effect on annual production of dry matter by the trees which coincide with high yielding species of Eucalyptus and Populus have long growth period. In contrast, Casuarina equisetifolia recorded the maximum root dry weight (3.28 g seedling⁻¹), followed by Leucaena leucocephala which recorded 3.12 g seedling⁻¹. Casuarina seedlings had maximum root dry weight among all the treatments. The reason that could be attributed to greater 'N' transfer rate which is in conformity with the findings of Srivastava and Ambasht (1995) who concluded that in Casuarina stands, root nodules contribute significantly to below ground production.

1.7. Total dry matter production

The key components of the carbon balance of trees are photosynthesis, respiration and biomass production. The primary factors determining plant productivity are photosynthetic efficiency and light interception, the latter depending on leaf area and tree architecture (Monteith, 1977). The highest total dry matter production (8.86 g) was found in Eucalyptus tereticornis, followed by Leucaena leucocephala which recorded 7.93 g. The lowest total dry matter production was found in Azadirachta indica (3.09 g) (Table 3). Similarly the highest biomass carbon was found in Eucalyptus tereticornis (3.22 g C plant⁻¹) followed by Leucaena leucocephala (2.64 g C plant⁻¹). In the present study the increase in total dry matter production was significant which could be significantly observed in Eucalyptus seedling. The increase in growth and biomass could be due to higher leaf area which enabled the plants to intercept a large amount of light and also photosynthesize more. This is in conformity with the findings of Hideaki (2004) who revealed

that increase in the rate of photosynthesis is accompanied by an increase in leaf area, both having a significant effect on biomass production. **Zhang** *et al.* (2006) on the other hand, reported that nutrient and carbon dioxide elevation had synergistic effects on biomass production but not on biomass allocation in white birch seedlings. **Tandom** *et al.* (1993) while studying the dry matter production of *Eucalyptus* stands revealed that total standing biomass of the stand increases with increasing age.

The result of this study is supported by the findings of **Damesin** *et al.* (1996) who stated that elevated carbon dioxide affected total biomass production, the average increase being 76 per cent and 97 per cent at 3 and 4 months, respectively. Shoot biomass, root biomass, stem height and total leaf area were increased by elevated carbon dioxide which corresponds to increased total biomass of Quercus suber seedlings. **Devakumar** *et al.* (1998) stated that there was higher biomass accumulation, leaf area and better growth when compared to ambient air grown Hevea brasiliensis seedlings. **Dhakhwa** *et al.* (1997) documented that the inclusion of carbon dioxide fertilization effects with those due to climate change resulted in higher biomass and yield.

The present study aimed to understand the carbon assimilation rate from the elevated CO_2 levels in the atmosphere by studying the various biometric parameters that are unique in the carbon dioxide assimilation existing in the various multipurpose tree species. The study also brought out the efficient tree species that could assimilate more carbon and fix it up in the biomass. The carbon isotope discrimination has given a significant evidence of carbon signature of the *Eucalyptus tereticornis* and *Leucaena leucocephala* which could form a promising multipurpose tree species for carbon assimilation and gain. These species can be recommended for plantation forestry which could help to achieve a faster and efficient carbon assimilation and carbon gain through higher biomass and yield.

Species		120) Days after transpla	nting
	TDP	AGB carbon	BGB carbon	Total biomass carbon
Casuarina equisetifolia	6.49	1.01	1.09	2.10
Leucaena leucocephala	7.93	1.57	1.07	2.64
Bambusa bambos	3.79	0.54	0.51	1.05
Azadirachta indica	3.09	0.42	0.33	0.75
Gmelina arborea	6.89	1.24	0.81	2.05
Eucalyptus tereticornis	8.86	2.29	0.93	3.22
Mean	6.18	1.18	0.79	1.97
SEd	0.06	0.028	0.031	0.05
CD(P=0.05)	0.11	0.06	0.06	0.11

Table 3. Total dry matter production (g seedling-1) and biomass carbon stock (g C plant-1) in the selected multipurpose tree species at seedling stages.

CONCLUSION

Total biomass carbon stock is a measure of quantity of carbon contained in a "pool", meaning a reservoir or system which has the unique capacity to accumulate or release carbon.

In the present study the increment in the total biomass carbon stock was significant and observed in Eucalyptus seedlings. Higher photosynthesizing area of eucalyptus relatively helps to assimilate more carbon which in turn promotes faster rate of growth compared to other species studied. The other reason could be the rise in carbon dioxide concentration in the atmosphere which favoured the net carbon assimilation.

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Effect of different nutrient management practices on growth and yield of pearlmillet (*Pennisetum glaucum* L.)

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ABSTRACT

The experiment consisted of 12 treatments comprising of Nitrogen at 30, 40, and 60 kg ha⁻¹ with Phosphorus and Potash each at 20, 30 and 40 kg ha⁻¹ applied alone or in combination with Farm yard manure, Poultry manure and Vermicompost at different levels. Higher length of spike plant⁻¹, more number of grains spike⁻¹ and grain yield was obtained with N at 60, P_2O_5 and K_2O at 40 each and highest benefit cost ratio was also recorded in the same treatment.

Key words:- Farm yard manure, Poultry manure, Vermicompst and Nitrogen.

INTRODUCTION

Pearlmillet [Pennisetum glaucum (L.) Br. Emend stuntz.] popularly known as Bajra ranks sixth following rice, wheat, corn, barley and sorghum. (Anonymous, 2010) However, in India, it is fourth most important cereal crop after rice, wheat and sorghum. It has the greatest potential among all the millets. India is the largest producer of pearlmillet with an annual production of 9.13 million tonnes from an area of 9.53 million ha and productivity of 10.44 g ha⁻¹ (AICPMIP, 2010). India is the largest producer of pearlmillet in the world. The nutrient content of pearlmillet compares very well with other cereals and millets. It has high protein content with slightly superior amino acid profile. Pearlmillet grain contains 13-14 per cent protein, 5-6 per cent fat, 74 per cent carbohydrate and 1-2 per cent minerals. It also contains higher amount of carotene, riboflavin (Vit B_2) and niacin Vit B_4 . (Singh et al., 2009). With this in view, present experiment was conducted to study the effect of different nutrient management nitrogen, phosphorus and potassium along with farm yard manure, poultry manure and vermicompost.

MATERIALS AND METHODS

A field experiment was conducted in Kharif Season of 2011 at the Crop Research Farm, Department of Agronomy, Sam Higginbottom Institute of Agriculture, Technology and Science (Deemed-to-be-University) Allahabad. The soil was sandy loam in texture having pH 7.5, low in organic carbon (0.27%) and available nitrogen (337.50 kg ha⁻¹) and medium available phosphorus (14.0 kg ha⁻¹) and potassium (100 kg ha⁻¹) The experiment was laid out in Randomized Block Design with 12 treatments and replicated thrice. The treatment consisted of Nitrogen levels of 30, 40 and 60 kg ha⁻¹ along with phosphorus and potash each at 20, 30 and 40 kg ha⁻¹, Farm yard manure 1.5, 3.0 and 6.0 tons ha⁻¹, Poultry Manure

0.25, 0.5 and 1.0 tonnes ha⁻¹ and Vermicompost 0.5, 1.0 and 2.0 tons ha⁻¹. Pearlmillet variety MHB - 2240 was sown at 45cm x 15cm spacing by dibbling method Seed rate used was 4 kg ha⁻¹.

RESULTS AND DISCUSSION

Yield attributes

Grain yield was found to be significant when compared with different nutrient management treatments Application of 60 kg ha⁻¹ N, 40 kg ha⁻¹ P₂O₅, 40 kg ha⁻¹ K₂O in combination with 0.5 t ha⁻¹ vermicompost (Treatment 12) recorded maximum length of spike (21.4) grains per spike (1750.68), grain yield (20.87 q/ha⁻¹) and straw yield (118.53q/ha⁻¹) which was closely followed by 60 kg ha⁻¹ Nitrogen , 40 kg ha⁻¹ P₂O₅, 40 kg ha⁻¹ K₂O with 0.25 t ha⁻¹ Poultry Manure (Treatment 11).

Maximum yield of pearl millet and yield attributes was recorded with application of vermicompost which was due to greater availability of nutrient in soil, improved soil physical conditions and higher total uptake of nutrients because of better root penetration leading to better absorption of nitrogen the relay dose favourably influencing plant growth and development characters with ultimately resulted in higher yield. (Gautam and Kaushik 1987).

Economics

Economic evaluation in terms of monetary returns showed that maximum benefit cost ratio was obtained when crop were fertilized with 60 kg ha⁻¹ N, 40 kg ha⁻¹ P₂O₅, 40 kg ha⁻¹ K₂O in combination with 0.5 t ha⁻¹ vermicompost applied This was closely followed by 60 kg ha⁻¹ N, 40 kg ha⁻¹ P₂O₅, 40 kg ha⁻¹ K₂O with 0.25 t ha⁻¹ poultry manure Findings show that integrated use of inorganic manure with organic manure resulted in maximum returns per rupee invested on production inputs. Application of recommended dose of NPK

Tre	atment	Length of	Grains	Grain	Straw	Benefit
		spike	spike ⁻¹	yield	yield	Cost
		(cm)	(No.)	(q ha -1)	(q ha ⁻¹)	ratio
1.	$30 \text{ kg ha}^{-1} \text{ N}_2 + 20 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 20 \text{ kg ha}^{-1} \text{ K}_2 \text{ O}$	20.56	1350.5	13.38	94.13	1.56
2.	$45 \text{ kg ha}^{-1} \text{ N}_2 + 30 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 30 \text{ kg ha}^{-1} \text{ K}_2 \text{ O}$	21.4	1321.83	13.92	100.20	1.58
3.	$60 \text{ kg ha}^{-1} \text{ N}_2 + 40 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 40 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} \text{ (control)}$	20.63	1478.05	19.52	101.23	1.80
4.	$30 \text{ kg ha}^{-1} \text{ N}_2 + 20 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 20 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 6 \text{ t ha}^{-1} \text{ FYM}$	20.47	1537.78	17.98	104.60	1.37
5.	$30 \text{ kg ha}^{-1} \text{ N}_2 + 20 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 20 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 1 \text{ t ha}^{-1} \text{ PM}$	21.07	1630.28	18.65	99.13	1.57
6.	$30 \text{ kg ha}^{-1} \text{ N}_2 + 20 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 20 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 2 \text{ t ha}^{-1} \text{ VC}$	20.41	1542.39	18.13	109.17	1.29
7.	$45 \text{ kg ha}^{-1} \text{ N}_2 + 30 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 30 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 3 \text{ t ha}^{-1} \text{ FYM}$	21.16	1559.99	17.72	103.50	1.52
8.	$45 \text{ kg ha}^{-1} \text{ N}_2 + 30 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 30 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 0.5 \text{ t ha}^{-1} \text{ PM}$	20.27	1632.61	18.32	111.10	1.74
9.	$45 \text{ kg ha}^{-1} \text{ N}_2 + 30 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 30 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 1 \text{ t ha}^{-1} \text{ VC}$	20.46	1544.17	18.47	106.83	1.50
10.	$60 \text{ kg ha}^{-1} \text{ N}_2 + 40 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 40 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 1.5 \text{ t ha}^{-1} \text{ FYM}$	21.31	1703.94	19.78	115.23	1.78
11.	$60 \text{ kg ha}^{-1} \text{ N}_2 + 40 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 40 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 0.25 \text{ t ha}^{-1} \text{ PM}$	20.12	1658.50	19.88	107.07	1.79
12.	$60 \text{ kg ha}^{-1} \text{ N}_2 + 40 \text{ kg ha}^{-1} \text{ P}_2 \text{ O}_5 + 40 \text{ kg ha}^{-1} \text{ K}_2 \text{ O} + 0.5 \text{ t ha}^{-1} \text{ VM}$	21.4	1750.68	20.87	118.53	1.81
	S. Ed. (±)	0.916	72.44	0.390	8.736	
	CD(P = 0.05)	NS	149.517	0.804	NS	

 Table 1
 Effect of different nutrient management practices on yield attributes in Pearlmillet.

along with organic manure was important for improving grain production, quality and also the economics.

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Integrated Phosphorus management and its effect on growth and yield of groundnut (*Arachis hypogaea* L.)

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ABSTRACT

The experiment on Groundnut (*Arachis hypogaea* L.) consisted of 13 treatments in a Randomized Block Design (RBD) and replicated thrice. The treatments consisted of 3 level of Phosphorus at 40, 50 & 60 kg ha⁻¹ applied alone and in combination with VAM, PSB, VAM + PSB and VAM + PSB + FYM. Highest plant height, more No. of branches, Maximum plant dry weight, crop growth rate, was recorded in the treatment in which Phosphorus was applied at 40 kg ha⁻¹ along with seed treatment with VAM, PSB along with application of FYM at 10 t ha⁻¹. The yield attributes namely maximum No. of pods plant⁻¹, kernels pod⁻¹ and pod yield was also recorded in the aforesaid treatment.

Key words: Groundnut, organic manure, Phosphorus, PSB, VAM

INTRODUCTION

Groundnut (Arachis hypogaea L.) is a leading oil seed crop in India with an area of 4.19 million hectares and production of 5.62 million tonnes of pod at an average yield of 1,341 kg ha⁻¹ (GOI, 2011). Phosphorus is one of the nutrients, which is required in large quantity for optimum growth and yield in oil seeds. Groundnut responds well to higher levels of phosphorus fertilization, especially in acidic soil conditions of higher p-fixing capacity necessitating to lay emphasis on supplementing the use of chemical fertilizer with cheaper source of nutrient, viz. biofertilizer and organics. The biofertilizer are cost effective and eco-friendly, supplement the nutrients requirement of the plants and their use in association with inorganic and organic manures prove beneficial in improving yield and soil health. Therefore, integrated nutrient management is an important aspect in groundnut, as it does not only fetch promising yields but also maintain soil fertility.

MATERIALS AND METHODS

A field experiment was conducted during Kharif season of 2011 at the Central Research Farm of SHIATS, Department of Agronomy, Allahabad. Soil of the experimental site was sandy loam in texture with poor water holding capacity, analyzing low in organic carbon 0.69 percent and available nitrogen 0.28 percent as well as medium in available phosphorus 16.00 kg ha⁻¹ and potassium 150.66 kg ha⁻¹ and slightly alkaline in reaction ph 7.93.

The experiment was laid out in Randomized Block Design (RBD), with 13 treatments replicated thrice with 3 phosphorus levels (40, 50, and 60 kg P_2O_5 ha⁻¹) and 2 biofertilizers and

organics, viz. control, seed inoculation with VAM and PSB, and 2 levels of Farm Yard Manure (FYM) viz. 5 and 10 t ha⁻¹. Groundnut cultivar 'Kaushal' was sown 29 July 2011, with a spacing of 30 cm x10 cm. An applied dose of 20 kg N₂ ha⁻¹ and 40 kg K₂O ha⁻¹ as common dose to each plot and phosphorus applied basal treatment wise at the time of sowing. All the recommended agronomic practices were followed to raise the crop. Various growth parameters were recorded at different stages of growth, while yield attributes and yield were recorded at harvest.

RESULTS AND DISCUSSION

Yield components and yield

Application of 40 kg ha⁻¹ $P_2O_5 + VAM + PSB$ with 10 t ha⁻¹ FYM recorded maximum number of pods plant⁻¹ 23.93, number of grains pod-1 2.40, shelling percentage 69.13 and also recorded highest pod vield 26.07 g ha⁻¹. However, maximum seed index 48.96 percent was recorded in 50 kg ha- $^{1}P_{2}O_{5} + VAM + PSB$ with 5 t ha⁻¹ FYM application. The application of VAM + PSB combined with10 t ha⁻¹ FYM recorded highest pod yield 26.07 q ha-1 this was closely followed by 25.09 q ha⁻¹ 40 kg ha⁻¹ P_2O_5 + VAM + PSB with 5 t ha-1 FYM. The increase in pod yield owing to these treatments may be due to the fact that Phosphorus play an important role in the synthesis of chlorophyll and amino acids, VAM and PSB ensured continuous supply of these nutrients, while FYM besides supplying N, P and K also improved the soil condition. It was also observed that single inoculation of VAM or PSB marginally improved the pod yields but their combined use significantly improved the pod yield. It indicates that when both cultures and FYM are applied

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Tre	atments	Pods	Kernel	Shelling	Seed	Pod	Benefit
		Plant ⁻¹	pod ⁻¹	Percentage	Index	yield	Cost
		(NO.)	(NO.)	(%)	(g)	(q ha -1)	Ratio
1	$P_2O_5 40$ kg ha ⁻¹ (control)	16.33	1.73	67.06	42.65	21.12	2.06
2	$P_2O_5 50 \text{ kg ha}^{-1}$	16.93	1.60	67.74	42.30	18.92	1.82
3	$P_2O_5 60 \text{ kg ha}^{-1}$	17.00	1.87	66.48	43.91	20.40	1.91
4	$P_2O_5 40 \text{ kg ha}^{-1} + \text{VAM}$	16.73	1.67	66.57	47.22	21.32	2.07
5	$P_2O_5 40 \text{ kg ha}^{-1} + PSB$	19.93	1.87	68.88	44.23	22.46	2.18
6	$P_2O_5 40 \text{ kg ha}^{-1} + \text{VAM} + \text{PSB}$	17.13	1.80	66.1	41.79	18.15	1.76
7	P_2O_540 kg ha ⁻¹ +VAM+PSB+ 5 t ha ⁻¹ FYM	21.27	2.27	68.14	44.68	25.4	2.27
8	$P_2O_5 40 \text{ kg ha}^{-1} + \text{VAM} + \text{PSB} + 10 \text{ t ha}^{-1} \text{ FYM}$	23.93	2.40	69.13	47.39	26.07	2.16
9	$P_2O_5 50 \text{ kg ha}^{-1} + \text{VAM}$	19.40	1.93	67.13	42.07	21.41	2.04
10	$P_2O_5 50 \text{ kg ha}^{-1} + PSB$	20.13	1.80	68.16	43.76	21.12	2.01
11	P_2O_550 kg ha ⁻¹ +VAM+PSB	18.67	1.80	67.22	41.65	21.43	2.02
12	$P_2O_5 50 \text{ kg ha}^{-1} + \text{VAM} + \text{PSB} + 5 \text{ t ha}^{-1} \text{ FYM}$	20.80	2.07	68.56	48.96	25.09	2.19
13	P_2O_5 50 kg ha ⁻¹ +VAM+PSB+ 10 t ha ⁻¹ FYM	23.40	1.93	67.79	47.67	24.00	1.95
	F- test	S	S	S	NS	NS	•
	S. Ed. (±)	0.975	0.159	0.836	3.508	3.838	
	C D (P = 0.05)	2.012	0.328	1.725	-	-	

Table 1. Effect of Integrated Phosphorus management on yield attributes and yield in groundnut.

Nitrogen at 20 and Potash at 40 kg ha-1 was applied as blanket application

PSB - Phosphorus Solubilizing Bacteria, VAM - Vesicular Arbascular Mycorrhizae, FYM - Farm Yard Manure

together it has synergistic effect on each other and higher yields. Similar results were indicated by Agasimani and Hosmani (1989).

Economics

The highest net return Rs. (41,493.32) and benefit cost ratio (2.27) was registered in treatment in which phosphorus was applied at 40 kg ha⁻¹ in combination with seed treatment VAM + PSB + FYM at 5 t ha⁻¹ was found to the best for obtaining higher benefit cost ratio in groundnut. **Singh** *et.al.* (2011) also observed that application of biofertilizer recorded the highest net return and benefit cost ratio. This might be due to the highest pod yield.

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Effect of Phosphorus and Sulphur nutrients on Rapeseed (*Brassica compestris* L.) variety Toria

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ABSTRACT

The experiment on Toria (*Brassica compestris* L.) consisted of 4 level of phosphorus and 4 levels sulphur (0, 30, 60, and 90 kg ha⁻¹) laid out in 4 x 4 Factorial Design and replicated thrice. Application of phosphorus and sulphur at 90 kg ha⁻¹ recorded higher plant height, more No. of branches plant⁻¹, Crop growth Rate and Relative growth Rate. Among the yield attributes, more No. of sliqua plant⁻¹, seed sliqua⁻¹, test weight and seed yield was also recorded with the same treatment.

Key words: Toria, Phosphorus, Sulphur

INTRODUCTION

Oilseed crops constitute the second largest Agriculture production in India after food grains. Besides having immense value in our diet, Oils and fats are used in cosmetics soaps, lubricants and varnish industries and have medicinal and therapeutic value. India is endowed with a wealth of vegetable oil resources in the form of cultivated annuals and perennial and three species exist among the cultivation annuals. Toria (Brassica compestris L.) is important oilseed crop of family cruciferae and occupies a prominent place among oilseed crops being next to groundnut in important. It is responsive to chemical fertilizers, especially sulphur and phosphorus. Sulphur application is expressed on yield and oil content of the produce. It is involved in the synthesis of essential amino acid like cysteine, cystine and methionine, the SH sulphyldryl linkages provide the sources of pungency in the oil (Pradhan and Sarker, 1998) phosphorus stimulates pod setting, helps in improving the seed weight & peroxides and an extensive and vigorous root system. It also helps in better partitioning of photosynthates to reproductive parts which increase the seed stover ratio (Prasad et al 1991). The present investigation was therefore carried out to study the effect of phosphorus and sulphur levels on the performance of Indian mustard.

MATERIALS AND METHODS

A field experiment was conducted during Rabi season of 2011 at the Central Research Farm of SHIATS, Department of Agronomy, Allahabad. Soil of the experimental site was sandy loam in texture with poor water holding capacity, analyzing low in organic carbon 0.36 percent and available nitrogen 0.28 percent as well as medium in available phosphorus 13.05

kg ha⁻¹ and potassium 56.44 kg ha⁻¹ and slightly alkaline in reaction ph 8.33.

The experiment was laid out in 4 x 4 factorial design and replicated thrice with 16 treatment combinations with 4 phosphorus levels (0, 30, 60 and 90 kg ha⁻¹) and 4 sulphur levels (0, 30, 60 and 90 kg ha⁻¹). Rapeseed cultivar 'PT-303' was sown 1 October 2011, at a spacing of 30 cm x10 cm. An applied dose of 60 kg N₂ ha⁻¹ and 40 kg K₂O ha⁻¹ as common dose to each plot and phosphorus applied basal treatment wise at the time of sowing. All the recommended agronomic practices were followed to raise the crop. Various growth parameters were recorded at different stages of growth, while yield attributes and yield were recorded at harvest.

RESULTS AND DISCUSSION

Growth and yield

There was statistical significant differences between different treatments. Levels of phosphorus and sulphur significantly influenced the growth and yield attributes viz dry matter accumulatation, siliqua plant⁻¹, seed siliqua⁻¹ Viz. and test weight. The dry matter increased significantly with each increment in the dose of phosphorus and sulphur up to 90 kg phosphorus and 90 kg sulphur ha⁻¹. However the differences in plant height due to further increase in the dose of phosphorus was significant and sulphur was non significant. An increase in the level of phosphorus and sulphur significantly improved the dry matter accumulation resulting in higher plant hight and more number of branches per plant. Similar results was reported by Prasad et. al., (1991) and Pradhan and Sarkar (1998). The highest number of siliqua plant⁻¹ was recorded with 90 kg phosphorus and 60 kg sulphur ha⁻¹. However the differences in siliqua plant⁻¹ due

Treatment	Dry weight at	Siliqua/plant	Seed/sliqua	Seed/yield	Harvest index	Test weight
	60 DAS	(No.)	(No.)	(q)	(%)	(g)
Phosphorus Levels(kg/ha)						
0	8.37	161.28	13.65	12.16	68.08	3.04
30	8.98	162.50	12.46	12.83	63.42	3.29
60	8.78	163.53	13.51	13.04	63.57	3.22
90	9.18	169.94	14.03	13.24	61.86	3.37
F-test	S	NS	S	NS	NS	NS
S. Em. (±)	0.458	6.939	0.309	0.268	2.083	0.200
C.D. at 5%	0.536	-	0.632	-	-	-
Sulphur Levels (kg/ha)						
0	8.91	162.44	12.91	12.93	66.03	2.94
30	8.83	163.91	13.79	12.46	64.45	3.27
60	7.97	165.78	13.68	12.92	63.75	3.36
90	9.59	165.11	13.27	13.00	62.70	3.36
F-test	NS	NS	S	S	S	NS
S. Em. (±)	0.458	6.939	0.309	0.268	2.083	0.200
C.D. at 5%	-	-	0.632	0.547	1.279	-

Table 1: Effect of phosphorus and sulphur on yield attributes of rapeseed

to further increase in the dose of phosphorus and sulphur was non significant. The highest number of seed siliqua-1 significantly increased up to 90 kg phosphorus ha-1 and 30 kg sulphur ha⁻¹ which was found to be at par with 60 kg phosphorus and 60 kg sulphur ha⁻¹ and was significantly superior to the control. The maximum test weight of (3.37)and 3.36 g/1000 seed) was recorded with 90 kg phosphorus ha-1 and 90 kg sulphur ha⁻¹ and minimum in control (3.04 and 2.94 g/1000 seed). This may be due to large amount of phosphorus found in the seed and siliqua which is considered essential for seed formation and boldness of seeds (Prasad et. al., (1991). Sulphur in the presence of phosphorus stimulates more flowering and seed formation in siliqua. These results are also in accordance with those of Singh and Kumar (1996). The maximum seed yield was recorded with the application of 90 kg phosphorus ha⁻¹ and 90 kg sulphur ha⁻¹.

Economics

The highest net return Rs. (24969.72), gross return Rs. (45790.00) and benefit cost ratio (2.19) was recorded at 60 kg phosphorus ha-1 only. **Varun and Abidi (2008)** also reported that combined use of phosphorus and sulphur resulted in maximum returns per rupee invested on production inputs this might be due to the positive effect of sulphur along with phosphorus and other nutrient on yield and maximum gross return, net profit and benefit cost ratio.

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Studies on growth and yield of wheat (Triticum aestivum L.) as influenced by different planting methods and nitrogen management through organic and inorganic sources

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ABSTRACT

A field experiment was conducted during Rabi season of 2 010-11 in sandy loam soil, to find out the influence of different planting methods and nitrogen management through organic and inorganic sources on wheat, was carried out at the Crop Research Farm of Department of Agronomy. The treatments consisted of T,- 100% N (urea) conventional method of sowing, T,-75 % N (urea) + 25% (Poultry manure) conventional method of sowing, T₃-75% N (urea) + 25% (FYM) conventional method of sowing, T₄- 50% N (urea) + 50% (Poultry manure) conventional method of sowing, T₅- 50% N (urea) + 50% (FYM) conventional method of sowing, T_z- 50% N (urea) + 25% (Poultry manure) + 25% (FYM) conventional method of sowing, T_{s} - 100% N (urea) furrow irrigated raised bed system, T_{s} - 75% N (urea) + 25% (Poultry manure) furrow irrigated raised bed system, T₉-75% N (urea) + 25% (FYM) furrow irrigated raised bed system, T₁₀-50% N (urea) + 50% (Poultry manure) furrow irrigated raised bed system, T₁₁- 50% N (urea) + 50% (FYM) furrow irrigated raised bed system, T₁₂- 50% N (urea) + 25% (Poultry manure) + 25% (FYM) furrow irrigated raised bed system that were replicated thrice. During the course of experiment, observations were recorded as mean value of the data show that best result with the T,- (75% through urea and 25% through Poultry manure) conventional method of sowing and followed by T₁-100% N (urea) conventional method of sowing, respectively better than other treatments combination. Maximum plant height, plant dry weight, crop growth rate, relative growth rate and highest grain yield and its attributes namely No. of grain/spike and test weight. Conventional method of sowing wheat was found to be better as compared to furrow irrigated raised bed system as plant height, plant dry weight, crop growth rate, relative growth rate, grain yield and its attributes (grain/spike and test weight) was found to be the highest. Application of Nitrogen (75% through urea and 25% through Poultry manure) in conventional method of sowing recorded highest gross return, net return and benefit cost ratio.

Key words: Wheat, Planting methods, Nitrogen management, FYM, Poultry manure, Yield

INTRODUCTION

Wheat is staple food of approximately 23 per cent population of the world. 20 per cent energy is achieved through wheat at global level. Among food grains wheat is the richest source of protein and its stands at second place after pulses. In general wheat contains carbohydrate (70%), protein (12%), lipid (2%), vitamins & minerals (2%) and crude fiber (2%).

In India mainly three species of *Triticum* mainly *aestivum*, *durum* and dicoccum are cultivated in which area is approximately 95, 4 and 1 per cent, respectively. *Triticum aestivum* is cultivated in all the regions of the country while durum is cultivated in Punjab and Central India and dicoccum in Karnataka. Wheat is consumed as bread, biscuits (cookies), pastry, noodles, semolina, snack foods etc. in other countries. In India around 70 per cent wheat is consumed in the form chapatti and the rest 30 per cent is used for making bread, Bread, biscuits, pastry, sweet dishes etc. Wheat grains are rich in gluten protein. Gluten gives spongy characteristics to wheat flour which facilitates the chapatti making quality. In addition to house hold uses wheat is consumed in industrial uses in different forms viz., starch, gluten, bran, germ, vitamins, binders and filters, food thickeners, card board etc. In addition to protein, other nutrients are also found in wheat, which are essential for growth and development of human being (**Singh**, **2009**).

Poultry manure is an excellent organic fertilizer, as it contains high nitrogen, phosphorus, potassium and other essential nutrients. In contrast to mineral fertilizer, it adds organic matter to soil which improves soil structures, nutrient retention, aeration, soil moisture holding capacity, and water infiltration (**Deksissa** *et al.*, **2008**).

Farm yard manure occupies important position among organic manures. The FYM seems to Act directly by increasing crop yield either by acceleration of respiratory process or by cell permeability or by hormonal growth action. It supplies N, P and K in available from to the plant through biological decomposition, it contains 0.50, 0.17 and 0.55 per cent of N, P and K respectively (**Gaur** *et al.*, **1991**).

MATERIALS AND METHODS

The experiment was carried out during Rabi season 2010-11 at plot No.16-C Crop Research Farm, Department of Agronomy, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (U.P.), Which is located at 250 24' 42" N latitude, 810 50' 56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Allahabad Rewa Road 5 km away from Allahabad city. The soil of the experimental field was Sandy loam, Available nitrogen 0.028 (%), Available phosphorus 13.05 kg ha⁻¹, Available potassium 156.44 kg ha⁻¹ ¹, Organic carbon 0.36 (%), ph 8.34 and EC 0.13 (dS m⁻¹). The recommended dose of fertilizers NPK (120-60-40 kg/ha) were applied at the time of planting and first irrigation was applied at the 23rd DAS. Wheat 'PBW 502' was sown on 5 December in the respective years, and the planting methods were applied two types, which was Conventional and FIRBS and grains were sowing through the method of line sowing. There are 4 times irrigations were given according to the requirements of crop, and two times weeding were applied during the season of crop. The treatments comparisons were made using f-test at 5% levels of significance, which are: The economics was calculated on the basis of prevailing market price of durum grains and local cost of inputs.

RESULTS AND DISCUSSION

The results showed that Conventional method of sowing and Application of Nitrogen (75% through urea and 25% through Poultry manure) recorded maximum plant height, plant dry weight, crop growth rate, relative growth rate and highest grain yield and its attributes namely number of grain/ spike and test weight. Conventional method of sowing wheat was found to be better as compared to furrow irrigated raised bed system as (*Table. 1*) plant height, plant dry weight, crop growth rate, relative growth rate, grain yield and its attributes (grain/spike and test weight) found to was be the highest yield attributes, viz. spikes m⁻², grains/spike, 1000-grain weight, harvest index, yield, Stover yield (*Table-2*), were influence significantly due to different treatment combinations.

The maximum number of spike/m⁻² was recorded with application of nitrogen through with the treatment combination T_2 - (75% through urea and 25% through Poultry manure) conventional method of sowing which was statically significant to the other treatments combinations. This may be due to optimal supply of nutrients and space to the crop and recommended dose of fertilizers, thereby resulting in better growth and development of the crop.

The similar result is increasing fertility level from 75-100% of recommended fertilizer dose (100, 50 and 25 kg/ha of NPK) significantly increased the growth and yield of wheat during both the years, where as further increase in recommended dose to 125% did not show significant impact on growth and

Treatments	Plant height	Plant tillers	Plant dry	Effective	No. of
	(cm)	(No.)	weight (g)	tillers/m ² (No.)	Spikes/plant
T ₁	83.60	8.40	20.83	363.81	5.88
T ₂	83.73	8.87	22.50	368.15	6.63
T ₃	81.00	6.33	20.02	352.72	5.20
T_4	82.00	6.67	20.06	354.94	5.23
T ₅	74.87	4.33	15.53	313.91	3.76
T ₆	80.07	5.60	19.58	339.27	4.79
T ₇	82.87	7.13	20.36	357.08	5.31
T ₈	83.47	7.80	20.74	358.95	5.44
T ₉	80.27	5.67	19.74	350.31	4.85
T ₁₀	80.53	6.00	19.99	351.25	5.06
T ₁₁	79.67	5.07	19.04	321.74	4.28
T ₁₂	79.80	5.20	19.25	331.58	4.50
F- test	S	S	S	S	S
S. Ed (±)	0.30	0.13	0.08	1.36	0.06
CD (P=0.05)	0.62	0.27	0.17	2.82	0.13

Table 1.Studies on growth and yield of wheat as influenced by different planting methods and nitrogen management through organic and inorganic sources on 80 DAS.

Treatments	No. of	No. of	Test weight	Grain yield	Straw yield	Benefit
	Spikes/plant	Grain/spikes	(g)	(q/ha)	(q/ha)	cost ratio
T ₁	5.88	44.85	53.81	63.70	100.92	2.80
T ₂	6.63	46.90	55.87	65.82	102.28	2.90
T ₃	5.20	43.50	51.11	58.39	86.58	2.56
T ₄	5.23	43.75	52.38	58.75	88.67	2.59
T ₅	3.76	41.25	48.14	50.04	65.89	2.19
T ₆	4.79	42.70	49.85	55.87	77.26	2.45
T ₇	5.31	44.30	52.70	59.37	90.95	2.60
T ₈	5.44	44.16	53.05	60.35	96.58	2.66
T ₉	4.85	43.11	50.16	57.19	79.42	2.50
T ₁₀	5.06	43.24	50.55	57.80	81.85	2.53
T ₁₁	4.28	41.40	49.37	51.86	67.72	2.27
T ₁₂	4.50	41.77	49.62	55.09	76.18	2.41
F- test	S	S	S	S	S	-
S. Ed (±)	0.06	0.18	0.13	0.25	1.03	-
CD (P=0.05)	0.13	0.37	0.28	0.52	2.14	-

Table 2. Studies on growth and yield of wheat as influenced by different planting methods and nitrogen management through organic and inorganic sources

yield of wheat which are conformity with the findings of **Gupta** *et al.*, (2011).

Conventional method of sowing wheat was found to be better as compared to furrow irrigated raised bed system as plant height, plant dry weight, crop growth rate, relative growth rate, grain yield and its attributes (grain/spike and test weight) was found to be the highest. Application of Nitrogen (75% through urea and 25% through Poultry manure) in conventional method of sowing recorded highest gross return, net return and benefit cost ratio.

Recommended dose of Nitrogen (75% through urea and 25% through Poultry manure) in conventional method of sowing may be recommended for wheat crop.

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Response of Hybrid Bajra (*Pennisetum glaucum* L.) to Summer Planting at Allahabad

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ABSTRACT

An experiment entitled "Response of hybrid bajra (*Pennisetum glaucum* L.) to summer planting at Allahabad was laid out in Randomized Block Design, having eight treatments replicated thrice during summer 2012. The crop fertilized with 150 kg N h^{a-1} , 80 kg P_2O_5 ha⁻¹, 60 kg K₂O ha⁻¹ and variety Ganga kaveri 1136 sown at a spacing 60 cm (T₂) resulted into significantly higher grain yield, Stover yield, no. of grain/spike and also maximum net return

Key words: Hybrid bajra, NPK, Varieties

INTRODUCTION

Pearlmillet [Pennisetum glaucum (L.) Br. Emend stuntz.] Popularly known as Bajra ranks sixth following rice, wheat, corn, barley and sorghum. (Anonymous, 2010). India is the largest producer of pearlmillet with an annual production of 9.13 million tonnes from an area of 9.53 million ha and productivity of 1.044 tha-1 (AICPMIP, 2010). Pearl millet (Penisetum glaucum L.) is mostly grown in rajasthan (46%), Maharashtra (19%), Gujarat (11%), Uttar Pradesh (8%), and Haryana (6%) as its cultivation is mostly rainfed as a mono cropping to some extent in the pearl millet growing area but high intensity involving double cropping are followed to enhance the productivity per unit time. The genus Pennisetum is distributed throughout the tropics and subtropics of the world. It includes about 140 species. Pearl millet is the most droughts tolerant of all domesticated cereals, and soon after its domestication it became widely distributed across the semiarid tropics of Africa and Asia. If the water is available, it can be cultivated in summer because it gives very good response during this season due to less incidence of pest and diseases and better grain setting.

MATERIALS AND METHODS

The field experiment to study the "Response of hybrid bajra (*Penisetum glaucum* L.) to summer planting at Allahabad was conducted at the crop research farm, Allahabad School of Agriculture, SHIATS, Allahabad during summer, 2012. The experiment was laid out in randomized block design with two levels of N (150 and 120 kg ha⁻¹) in the form of urea and two level of P (80 and 60 kg ha⁻¹) in the form of DAP and two level of P (60and 40 kg ha⁻¹) in the form of MOP respectively. Two varieties i.e., Ganga kaveri 1136 and Ganga kaveri 1138 were sown with two spacing 50 and 60 cm. row to row. The crop was sown on 7th April 2012 by line sowing. The biometric observations were recorded on five randomly selected plants in a net plot area. After harvesting the post harvest observations were taken from 2 m 2 area. After the harvest of crop plant were dried threshed by hand and cleaned by winnowing. Weight of sun dried seed in kg/net plot was recorded and presented in tha-1. The data was statistically analyzed.

RESULT AND DISCUSSION

Growth and Growth Attributes

The application of nitrogen 150 kg ha⁻¹, phosphorus 80 kg ha⁻¹, potash 60 kg ha⁻¹, variety Ganga kaveri 1138 and spacing 60 cm showed best performance on plant height (cm) and number of tillers plant⁻¹ and crop growth rate (g day⁻¹ m⁻²) and relative growth rate (g g⁻¹day⁻¹) performed best with the application of $T_4 V_1 S_2 F_2$ (Ganga kaveri 1136, 50cm, 150:80:60) (*Table.1*). This treatment proved superior perhaps because doses and relatively superior varietal characters of higher fertilizer NPK. Similar result reported by **Jakhar** *et al.* (2011)

Yield and Yield Attributes

The application of nitrogen 150 kg ha⁻¹, phosphorus 80 kg ha⁻¹, potash 60 kg ha⁻¹, variety Ganga kaveri 1136 and spacing 60 cm showed best performance on all the yield contributing characters expect ear length (cm) (*Table.1*). This treatment proved superior perhaps because doses and relatively superior varietal characters of higher fertilizer NPK and higher availability of NO₃-N which resulted in significantly higher grain yield, Stover yield and grain spike⁻¹ increased significantly due to variation in fertilizer doses, varieties and spacing during the summer planting and also maximum net returns. These results are in close conformity with those of **Gautam and kaushik (1987)**.

Tre	eatments	Plant	Number	CGR	RGR	Ear	Grain	Grain	Stover	Net
		height	of tillers	(g day-1	(g g ⁻¹	length	/spike	yield	yield	return
		(cm.)	m ⁻²)	day-1)	(cm.)	(tha ⁻¹)	(tha ⁻¹)	(`/ha)		
Τ ₁	$V_1S_1F_1$ (Ganga Kaveri) 1136, 60 cm ,120:60:40)	181.520	2.933	81.17	0.022	19.720	1364.000	1.4716	7.4283	9641.04
T 2	$V_1S_1F_2$ (Ganga Kaveri 1136, 60 cm, 150:80:60)	180.146	2.933	96.47	0.030	19.933	1416.666	1.7633	8.6033	14293.04
Τ ₃	V ₁ S ₂ F ₁ (Ganga Kaveri 1136, 50 cm, 120:60:40)	169.040	2.666	115.53	0.027	19.400	1333.000	1.5933	7.8900	11690.00
T_4	$V_1S_2F_2$ (Ganga Kaveri 1136, 50 cm, 150:80:60)	178.746	4.733	172.85	0.031	19.400	1350.000	1.4900	8.3600	11122.01
Τ ₅	V ₂ S ₁ F ₁ (Ganga Kaveri 1138, 60 cm,120:60:40)	200.886	4.533	87.03	0.022	20.266	1280.000	1.5550	8.4283	12275.04
T ₆	$V_2S_1F_2$ (Ganga Kaveri 1138, 60 cm,150:80:60)	205.546	5.733	129.62	0.022	19.633	1306.666	1.7216	6.4936	10078.58
T 7	$V_1S_2F_1$ (Ganga Kaveri 1136, 50 cm, 120:60:40)	196.120	4.600	152.41	0.031	19.066	1406.666	1.6566	8.9100	12265.10
T ₈	$V_2S_2F_2$ (Ganga Kaveri 1138 50 cm,150:80:60)	183.226	2.866	149.05	0.026	19.600	1290.000	1.6916	7.8750	14158.10
C.I	D (P= 0.05 %)	NS	S	S	NS	NS	S	NS	S	

Table: 1 Effect of Growth and Yield Attributes of Hybrid Bajra in Summer Planting.

CONCLUSION

On the basis of above mentioned results it can be concluded that Ganga kaveri 1136 should preferably be sown at the application of nitrogen 150 kg ha⁻¹, phosphorus 80 kg ha⁻¹, potash 60 kg ha⁻¹ and spacing 60 cm. to get good yield under agro-ecological conditions of Allahabad. Hence, this treatment may be recommended for hybrid bajra in summer season.

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Response of sesame (*Sesamum indicum* L.) cv. Chaumukhi white and Gujrat 1 to integrated nutrient supply system during summer

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ABSTRACT

Field experiment was conducted during the summer seasons of 2012. To study the response of sesame (*Sesamum indicum* L.) varieties to integrated nutrient supply system during summer. The results revealed that chaumukhi white with the application of $T_3F_3V_1$ (INM 50% N through FYM + 50% N through urea) produced maximum yields of 0.975 t ha⁻¹ and Gujrat⁻¹ with the application of $T_5F_1V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) produce maximum yield 1.10 t ha⁻¹ respectively. Out of two varieties, Gujrat 1 produced more plant height, no. of branches, number of capsules per plant, no. of seeds capsules⁻¹ and 1000 seed weight, than chaumukhi white. Out of two varieties Gujrat 1 produced higher seed yield (0.80 t ha⁻¹) and oil yield (0.38 t ha⁻¹) than chaumukhi white.

Key words: Sesame, varieties, yield, nitrogen, phosphorus, FYM.

INTRODUCTION

Sesame (Sesamum indicum L.) is one of the important oilseed crops in Indian agriculture. Sesame seeds are rich source of food, nutrition, edible oil and bio-medicine. Sesame oil has excellent nutritional, medicinal, cosmetic and cooking qualities for which it is known as 'the queen of oils. Due to the presence of potent antioxidants, sesame seeds are called as 'the seeds of immortality. Sesame cake or meal obtained as a by-product of the oil milling industry is rich in protein, vitamin (Niacine) and minerals (Ca and P). India ranks first in area (29%), production (26%) and export (40%) of sesame in the world. In India, sesame is grown on an area of 13.85 lakh hectares with an annual production of 4.34 lakh tonnes. The average yield of sesame in India is very low that is 311 kg per ha (Anon., 2004). It is cultivated on a large area in the states of Maharashtra, Uttar Pradesh, Rajasthan, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, West Bengal, Gujarat and Karnataka. The present study was, therefore taken up to study the varietal response of sesame under different level on nutrients application.

MATERIALS AND METHODS

The field experiment to study the response of sesame (*Sesamum indicum* L.) varieties to integrated nutrient supply system during summer was conducted at the crop research farm, Allahabad School of Agriculture, SHIATS, Allahabad during summer, 2012 the soil had pH 7.3, organic carbon. 51%, available nitrogen 110.8 kg/ha, available phosphorus 52 kg/ha, and available potash 341.2 kg/ha. The experiment was laid out in randomized block design with two levels of N

(25 and 20 kg/ha) in the form of urea at the time of sowing and one level of P (20 kg/ha) in the form of DAP and one level of farmyard manure (20 t/ha) respectively. Two varieties i.e., Chaumukhi white and Gujrat-1 were sown in 3 X 3 plot sizes with a spacing of 30 cm row to row and 10 cm plant to plant. The crop was sown on 7th April 2012 by line sowing. The biometric observations were taken on five randomly selected plants in a net plot area. Thinning was done two weeks after sowing to maintain a uniform plant distance in respective treatments for uniform plant population. After harvesting the post harvest observations were taken from 2 m² area. The observations were recorded that plant height (cm), no of branches, no. of seed per capsules, no. of capsule per plants was recorded from each net plot of five randomly selected plants and observations viz. grain yield (t ha-1),oil yield (t ha⁻¹) were recorded from 2 m² area. After thorough drying, 1000 seed were counted from each net plot and weights were recorded in grams as test weight. After the harvest of crop plants were threshed by hand and cleaned by winnowing. Weight of sun dried seed in kg/net plot was recorded and presented in kg/ha. The percentage of oil content (%) in seed was determined by solvent extraction method.

RESULT AND DISCUSSION

Growth and Yield Parameters

Plant height (cm)

Plant height was significantly influenced by nutrient management practices and varieties at all the growth stages (*table 1*). The variety Gujrat-1 produced more plant height (81.27 cm) than Chaumukhi white (75.33cm). Application of

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 $T_7F_3V_2$ (INM 50% N through FYM + 50% N through urea) produced the maximum plant height (81.27 cm) compared to the application of $T_4F_3V_1$ (INM 50% N through FYM + 50% N through urea). This result is confirmedly with **Nahar** *et al.* (2008)

Dry weight (g)

Nutrient management practices did not show significant effect on number of branches plant⁻¹ at all the growth stages except at harvest. The variety Gujrat-1 produced more dry weight (13.70). Application of $T_5 F_1 V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) produced the maximum dry weight. Similar results were reported by **Subramanian** *et. al* (1979).

Number of capsules⁻¹ plant

Significant differences were found between the two varieties in the number of capsules plant⁻¹. The application of $T_5F_1V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) produced more number of capsules per plant (43.00). Similar results were reported by **Ghose and Sen (1980)**.

Number of seeds capsule⁻¹

Varieties were significantly affected by different levels on nutrient for the number of seeds per capsule. The application of $T_5 F_1 V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) produced more number of seeds capsule⁻¹ (50.00). Similar results were reported by **Shrivastava and Tripathi (1992)**.

Test weight (g)

Thousand seed weight was significantly affected by different level of fertilizer in both the varieties. Gujrat-1 gave higher 1000-seed weight of 3.20 g in $T_8 F_4 V_2$ (INM 75% N through FYM + 25% N through urea). Similar results were reported by **Jadhav** *et. al.* (1991).

Seed yield (t ha⁻¹)

Seed yield was also influenced significantly by different levels of fertilizer in both the varieties. Variety Gujrat-1 produced significantly higher seed yield (0.80 t ha⁻¹). The maximum seed yield (1.10 t ha⁻¹) was recorded in plot seeded with $T_5F_1V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) and minimum seed yield (0.357 t ha⁻¹) was recorded in $T_1F_1V_1$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P). Similar results were reported by **M.T. Katwate and J.D. Jadhav (2010)**.

Stover yield (t ha⁻¹)

Stover yield was also influenced significantly by different levels of fertilizer in both the varieties. Variety Gujrat-1 produced significantly higher Stover yield $(3.667 \text{ t ha}^{-1})$. The maximum Stover yield (4.22 t ha^{-1}) was recorded in $T_5F_1V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) and minimum Stover yield (2.82 t ha⁻¹) was recorded in $T_1F_1V_1$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P). Similar results were reported by (**Appavu 2004**).

Oil yield (t ha-1)

Oil yield was also influenced significantly by different level of fertilizer in both the varieties. Variety Gujrat-1 produced significantly higher oil yield (0.382 t ha⁻¹). The maximum oil yield (0.544 t ha⁻¹) was recorded in $T_5F_1V_2$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P) and minimum oil yield (0.181 t ha⁻¹) was recorded in $T_1F_1V_1$ (25 kg ha⁻¹ N + 20 kg ha⁻¹ P). Similar results were reported by **Patra (2001)**

CONCLUSION

From the above findings it may be concluded that amongst all the treatments, nitrogen 25 kg ha⁻¹ and phosphorus 20 kg ha⁻¹ applied with combination of variety Gujarat 1 was found to be the best for obtaining higher seed yield and benefit cost ratio in sesame.

Table 1: Effect of different	t levels of integrated n	utrient supply system on	growth and yield param	eters during summer
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Treatment	Plant	Dry	Number of	Number of	Seed	Oil	Stover	Harvest	Test
	height	weight	capsules ⁻¹	seeds	yield	yield	yield	index	weight
	(cm)	(g)	plant	capsule ⁻¹	(t ha ⁻¹)	(t ha ⁻¹)	(t ha ⁻¹)	(%)	(g)
$T_1F_1V_1$	67.86	10.00	12.40	43.83	0.357	0.181	2.82	11.24	2.96
$T_{2}F_{2}V_{1}$	70.47	10.67	18.40	45.00	0.570	0.278	3.20	16.15	2.95
$T_{3}F_{3}V_{1}$	72.86	11.67	29.04	48.99	0.975a	0.439	3.74 b	20.64b	3.17b
$T_4 F_4 V_1$	75.33	13.70	15.60	43.28	0.471	0.225	3.14	13.00	3.09
$T_5F_1V_2$	79.47	12.00	43.00	50.00	1.10	0.544	4.22	20.72	3.18a
$T_6F_2V_2$	76.54	12.33	24.13	47.84	0.756	0.339	3.75 a	16.77	3.13c
$T_{7}F_{3}V_{2}$	81.27	10.67	21.53	46.44	0.706	0.329	3.49c	16.67	3.04
$T_8F_4V_2$	80.01	13.33	19.53	46.72	0.649	0.319	3.21	21.28a	3.20
F- Test	NS	S	S	NS	S	S	S	S	S
S. Ed. (±)	5.32	0.98	4.43	4.24	0.062	0.032	0.290	1.41	0.04
CD(P=0.05)	-	2.10	9.50	-	0.133	0.069	0.812	3.03	0.10

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Effect of NAA and IBA on rooting and establishment of hard wood cutting in Phalsa (*Grewia subinaequalis* L.)

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ABSTRACT

Vegetative propagation of phalsa (*Grewia subinaequalis* L.) through cutting is the most convenient and the cheapest method to obtain true to the type fully developed plants in considerably lesser time and in order to improve the rooting and reduce the mortality of rooted cuttings. The use of growth regulators and appropriate time for establishment of cuttings has been standardized. Maximum rooting, root number and root length is observed that hard wood cutting treated with IBA 400 ppm + NAA 200 ppm by dipping in prepared solution for 24 hours. Field survival of the plants develop through hard wood cuttings treated with IBA 400 ppm + NAA 200 ppm, IBA 100 ppm and IBA 400 ppm was found the highest.

INTRODUCTION

Phalsa (*Grewia subinaequalis* L.), also known as "Star Apple" is an exotic bushy plant considered horticultural as a small fruit crop. It is native to the Indian sub-continent and South-East Asia. It is one of the important fruits arid and semi arid zones of North India and arid and semi arid tracts of north western and south central India. Phalsa belongs to family Tiliaceae and genus *Grewia*. Propagation by cutting is the easiest and widely employed method which is usually followed in easy-to-root species. In cuttings, growth substances applied exogenously are found beneficial to enhance early and good root formation. Now-a-days many of the difficult-to-root plants are made to root easily by applying plant growth substances.

Various classes of growth regulators such as auxins, cytokinins, gibberellin and ethylene influence root initiation in cuttings. Of these, auxins have greater effect on root formation in cuttings. In addition to these groups, various growth retardants and promoters may have less direct part in adventitious root formation (**Krul, 1968**). IBA is used for inducing the root formation in cuttings of woody plants. Roots induced by IBA showed a highly increased number of vascular strands in relation to its concentration. The use of NAA stimulated the development of more fertile branches.

MATERIALS AND METHODS

The Experimental work on "Effect of NAA and IBA on rooting of hard wood cuttings in Phalsa (*Ggrewia subinaequalis* L.)" was conducted in the Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed-to-be-University), Allahabad during the year 2012-2013 in the month of July to November.

Hard wood cuttings of phalsa were collected from Department of Horticulture, SHIATS, Allahabad. From the selected branches, 25 cm long having 4 to 5 nodes and 1.0-1.2 cm thick cuttings were taken from hardwood portion of the branches. Sieved sand was used as the rooting media. Before planting, the sand was thoroughly drenched with captan (0.2%). It was then filled in the Poly bag of 1 kg size, leaving gap of 2 cm from the top. The experiment was laid out in completely randomized block design. There were sixteen treatments comprising growth regulator formulations i.e. T₁-Control (dipped in distilled water), T₂-IBA 100ppm, T₃-IBA 200ppm, T₄-IBA, 400ppm T₅-NAA 100ppm, T₆-NAA 200ppm T₂-NAA, 400ppm, T₂-IBA, 100ppm + NAA, 100ppm, T₉ -IBA, 100ppm + NAA, 200ppm, T₁₀ -IBA, 100ppm + NAA, 400ppm, T₁₁ -IBA, 200ppm+ NAA, 100ppm, T₁₂ -IBA, 200ppm + NAA, 200ppm, T₁₃ - IBA, 200ppm + NAA, 400ppm, T₁₄-IBA, 400ppm + NAA, 100ppm, IBA, 400ppm + NAA, 200ppm, T₁₆ -IBA, 400ppm + NAA, 400ppm. Twenty cuttings kept for each treatment with 3 replicationw. The prepared cuttings were planted in pots under shade net, before planting cuttings are dipped in prepared solution of IBA and NAA as per treatments for 24 hours.

RESULTS AND DISCUSSION

The results clearly indicated that the treatment of IBA 400ppm + NAA 200 ppm take the minimum number of days (4) for first sprouting from cutting and after 40 DAP also showed the maximum percentage (75.00%) of rooted cuttings, shoot girth (2.67 mm), shoot length (22.67cm), root numbers (17.80), root length (7.81cm), shoot number (2.07), number of shoots (3.00/ plant), shoot length (9.57cm) and Cent percent survival percentage of the rooted cuttings under field

Treatment	Days to	Percentage	Shoot	Shoot	Number of	Root length	Number of	Number of	Shoot	Establishment
	first	of rooted	girth in	length in	roots per	in phalsa	shoots/plant	shoots/plant	length/plant	of rooted
	sprouting of	cuttings at	phalsa at	phalsa at	cutting at	cuttings at	at 60 DAP	after 40	after 40	plant after
	cuttings	60 DAP	60 DAP	60 DAP	60 DAP	60 DAP		DAT	DAT	40 DAT
T ₁ (Control)	4.33	61.67	2.47	19.90	14.53	6.98	2.13	2.53	20.67	97.43
T ₂ (IBA 100ppm)	4.00	51.67	2.47	21.87	14.40	7.16	2.13	2.53	22.82	97.23
T ₃ (IBA 200ppm)	4.00	63.33	2.40	15.77	14.80	7.19	2.13	2.47	17.13	100
T ₄ (IBA 400ppm)	4.67	70.00	2.47	20.03	15.27	7.22	1.93	2.47	21.08	100
T ₅ (NAA 100ppm)	5.00	60.00	2.33	16.90	15.07	7.22	1.93	2.53	18.18	100
T ₆ (NAA 200ppm)	4.00	60.00	2.33	14.77	15.27	7.43	2.00	2.47	16.36	100
T ₇ (NAA 400ppm)	4.67	58.33	2.47	18.47	15.20	7.14	2.07	2.47	20.15	80.05
T ₈ (IBA 100ppm + NAA 100ppm)	5.33	63.33	2.53	16.33	14.87	7.41	2.20	2.47	18.18	100
T ₉ (IBA 100ppm + NAA 200ppm)	4.33	56.67	2.40	15.73	15.07	7.46	2.40	2.67	17.36	100
T ₁₀ (IBA 100ppm + NAA 400ppm)	4.67	65.00	2.47	15.26	15.20	7.49	2.27	2.47	16.78	100
T ₁₁ (IBA 200ppm + NAA 100ppm)	5.00	61.67	2.33	14.13	15.67	7.36	2.33	2.60	15.95	100
T ₁₂ (IBA 200ppm + NAA 200ppm)	5.67	61.67	2.40	14.26	15.33	7.25	2.00	2.53	16.10	97.43
T ₁₃ (IBA 200ppm + NAA 400ppm)	4.00	60.00	2.27	12.40	15.33	7.47	1.93	2.53	14.07	100
T ₁₄ (IBA 400ppm + NAA 100ppm)	4.33	60.00	2.40	14.70	15.47	7.28	2.20	2.53	16.43	95.57
T ₁₅ (IBA 400ppm + NAA 200ppm)	4.00	75.00	2.67	22.67	17.80	7.81	2.53	3.00	24.11	100
T ₁₆ (IBA 400ppm + NAA 400ppm)	5.67	55.00	2.33	16.78	15.60	7.36	2.27	2.53	18.39	91.67
F-test	N S	N S	N S	S	S	N S	N S	S	S	S
SEm	0.63	7.407	0.109	1.663	0.544	0.220	0.191	0.103	1.621	3.916
C.D.	1.37	14.97	0.22	3.37	1.10	0.45	0.39	0.210	3.31	7.95

Table 1: Effect of NAA and IBA on rooting of hard wood cutting in phalsa (Grewia subinaequalis L.)

plantation. The possible explanation of this lies in, better development of root system with good quality and shoot parameters enabling the rooted cutting to make better growth under field conditions after plantation and there by accounted the highest field survivability. Sandhu and Singh (1986) reported similar result that higher number of sprouts and greater sprout length with NAA, 200ppm concentration. Sharma and Sharma (1987) who studied the rooting pattern of hard wood and semi-hard wood cutting of wild pomegranate, observed higher rooting with IBA treatment (quick dip) while Ghosh et al. (1988) obtained more rooting with IBA treatment than NAA in semi-hard wood and hard wood cuttings of pomegranate. Likewise, Sharma and Kumar (1988) compared the effect of IBA, NAA and IAA on rooting of pomegranate under controlled conditions and recorded the highest rooting percentage with the treatment of IBA and NAA. The present findings also get support from the work of Singh (1994) who obtained the best rooting with IBA treatment in pomegranate cuttings, while Arumugam et al. (1996) got the best rooting in soft wood, semi-soft wood and hard wood cuttings of pomegranate with IBA (quick dip) treatments. Similar findings were also reported by Shirol and

patil (1992) and Rajarama (1997). Early sprouting and higher shoot parameters in initial stages might have brought early and better rooting. Patil et al. (2000) recorded 80 percent survival and maximum number of roots, length of longest sprout and diameter of thickest sprout per rooted cuttings treated with 100ppm IBA in hard wood cuttings of grape. These observations are in agreement with the findings of Gupta (1995) achieved highest rooting percentage (91.0%) and root length (10.63 cm), number of roots per cutting (26.30) of rooted cuttings of Budlea asiatica. Pandey (1996) obtained the highest percent of rooting (71.96%) number of roots (35.30), longest root (21.43 cm) and 75.83 percent survival was observed in cuttings of pineapple guava or feijoa (Feijoa sellowiana Berg). Dhillon and Sharma (1992) reported highest root length in pomegranate cuttings treated with low concentration of IBA at 100 ppm soaked for 24 hrs.

CONCLUSION

From the findings of present experiment it may be concluded that the highest rooting and establishment success was obtained by pre-treatment of cuttings with IBA 400ppm + NAA 200ppm under shade net in August.

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Effect of CCC, NAA and GA₃ on growth and flowering of gladiolus (*Gladiolus grandiflorus*) cv Novalux and White Prosperity.

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ABSTRACT

The investigation was conducted to find out the effect of foliar spray of CCC, GA₃ and NAA on growth, flowering and quality of gladiolus cv. Novalux and White Prosperity. The data on vegetative growth were recorded Plant height (Novalux 79.44cm and White Prosperity 79.89cm), No. of shoot (Novalux 3.67 and White Prosperity 3.22) No. of leaves per plant (Novalux 20.78 and White Prosperity 20.00), minimum Days to 50% spike initiation (Novalux 76.67 and White Prosperity 77.33), minimum Days to opening of the first florets (Novalux 83.33 and White Prosperity 84.67), First florets durability (Novalux 7.22 and White Prosperity 6.67 days), Spike length (Novalux 84.11 and White Prosperity 83.33) in cm and Number of florets/spike (Novalux 18.89 and White Prosperity 18.00) and quality parameter such flower size (Novalux 116.59cm² and White Prosperity 124.00cm²) and vase life (Novalux 10.33 days in T₇ and White Prosperity 10.33 days in T₁₀) were recorded maximum with the application NAA @ 200ppm 90 days after sowing, whereas minimum value was recorded in control.

Keywords: CCC, GA3, NAA and gladiolus

INTRODUCTION

Gladiolus (Gladiolus sp.) particularly known as the Sword Lily belongs to Iridaceae family. It is one of the most important bulbous flowers in India as well as in many parts of the world. It has been rated as the fifth most popular flower in the world, especially from the commercial point of view. Gladiolus is popular for its attractive spikes having florets of huge form, richly varied in color and prolonged vase life. It is used for indoor decoration and in vases, particularly in urban areas. Since it has many florets these open sequentially, extension of its vase life helps the floriculture industry. It is known fact that application of growth regulators such GA₂, NAA and CCC had positive effects on growth and development of gladiolus plants at different concentrations. NAA is used in cell enlargement, cell division, vascular tissue differentiation, root Initiation and apical dominance. GA₂ is used in stem growth, bolting in long day plants; Induction of seed germination, Enzyme production during germination CCC is required for cell division and cell elongation. The reports indicated that the growth, yield and quality of gladiolus was enhanced by application of NAA and GA₃. Hence the present study was conducted to find the effect of growth regulators on growth, flowering and corm production of gladiolus Gladiolus grandiflorus L. cv. Novalux and White Prosperity.

MATERIALS AND METHODS

This experiment was conducted in Floriculture Unit, Department of Horticulture, Allahabad School of Agriculture, SHIATS, Allahabad during 2011-2012. Soil of the experimental plot was sandy loamy, uniform in texture and well drained. FYM was applied @ 25 t ha⁻¹ at the time of land preparation. The experiment was laid at Randomized Block Deign (RBD) with three replications. In total fifteen treatments comprised of three plant growth regulators level of each viz. CCC @ 300, 600, 900, 1200, 1500ppm, NAA @ 50, 100, 150, 200, 250 ppm and GA₃ @ 50, 100, 150, 200, 250 ppm with control (only water) were adopted. Gladiolus cv. Novalux and White Prosperity corms of above 5.5 cm diameter were purchased from Vatika Nursery Lucknow and placed at room temperature for 15 days. The shade dried corms were planted at a spacing 30cmx30cm in raised beds of 2mx2m dimensions. The plants were sprayed with aqueous solution of the growth regulators as per treatments schedule at 30th and 45th and 60th day after planting. The intercultural operations were followed as and when required. The growth and yield parameters for each treatments were observed in five plants selected by random sampling method. The data were statistically analyzed and critical differences were worked out at five percent level to draw statistical conclusions as suggested by Panse and Sakhatme (1978).

RESULTS AND DISCUSSION

The statistically analyzed data on various growth are presented in *table 1* It is evident from the table that there are significant differences among the treatment for all parameters. In the year 2011-12 cultivar Novulux. The maximum plant height (79.44) was recorded under T_{10} NAA @ 250 ppm the

minimum plant height (64.78) was noticed with Control. In the same year in cultivars White Prosperity maximum plant height (79.89) was recorded under T_0 and T_7 are both treatment followed by T2, T5 and T8 minimum plant height (65.11) was noticed with (Control). Application of 100ppm GA₃ resulted in 32.83 cm plant height which was at par with the Control (31.91 cm). GA₃ increased height of the plant over control which may be due to the growth promotion effect of GA₂ in stimulating and accelerating cell division, increasing cell elongation and enlargement or both (Hartmann et al., 1990). The CCC decreases, inhibits, and block gibberellins biosynthesis (Moore, 1989). The maximum number of shoot (3.67) was recorded under T_{a} NAA@200ppm followed by T_{13} , T_{10} and T_{6} and the minimum number of shoot (1.33) was noticed with Control. In the same year in cultivars White Prosperity maximum number of shoot (3.22) was recorded under T_{o} NAA@200ppm followed by T₇, T₈ and T₃ and minimum number of shoot (1.44) was noticed with (Control). The maximum number of leaves per plant (20.78) was recorded under T₉ NAA @ 200 ppm followed by T_{13} , T_8 , T_4 and T_5 and the minimum number of leaves per plant (15.67) was noticed with Control. In the

same year in cultivars White Prosperity maximum number of leaves per plant (20.00) was recorded under T_o NAA @ 200 ppm followed by T_5 , $T_2 T_6$ and T_4 and the minimum number of leaves per plant (15.44) was noticed with control. The plant height, number of leaves, number of shoot per corm, and length of spikes were significantly increased due to GA₃ and NAA application. Whereas CCC and application significantly reduced these parameters when compared with control. These findings are in consonance with the reports of Sharma et al., (2004) Kumar et al., (2008), Chopde et al., (2012) and Awasthi et al., (2012) in gladiolus. The minimum days to 50% spike initiation (76.67) was recorded under T_{o} NAA @ 200 ppm followed by T_6 , T_4 and the maximum days to 50% spike initiation (88.33) was noticed with Control. In the same year in cultivars White Prosperity minimum days to 50% spike initiation (77.33) was recorded T_o NAA @ 200ppm followed by T_{12} , T_{13} and T_6 and the maximum days to 50% spike initiation (88.67) was noticed with Control. The minimum days to opening of the first florets (83.33) was recorded under T_9 NAA @ 200 ppm followed by T_{14} , T_{15} and the maximum days to opening of the first florets (93.00) was noticed with Control. In the same year in cultivars White

 Table 1 : Effect of CCC, NAA and GA3 on growth and flowering of gladiolus (Gladiolus grandiflorus) cv Novalux and White prosperity.

Treatments	Plant (c	height m)	No. of	f shoot	No. of per j	leaves plant	Days t spi initia	o 50% ike ation	Day openi the floi	rs to ing of first rets	First f dura	florets bility	Spike in	length cm	Num florets	ber of s/spike
	Nova	White	Nova	White	Nova	White	Nova	White	Nova	White	Nova	White	Nova	White	Nova	White
	lux	Prosp	lux	Prosp	lux	Prosp	lux	Prosp	lux	Prosp	lux	Prosp	lux	Prosp	lux	Prosp
		erity		erity		erity		erity		erity		erity		erity		erity
T ₀	64.78	65.11	1.33	1.44	15.67	15.44	88.33	88.67	93.00	86.00	5.00	5.33	73.11	73.44	15.00	15.11
T 1	74.11	65.11	2.78	1.44	15.78	16.11	81.33	87.67	89.00	88.33	6.11	5.67	73.89	73.11	16.56	16.11
T ₂	74.22	78.00	3.00	2.33	18.33	19.11	80.33	82.00	90.33	90.00	6.00	6.00	75.44	76.22	16.00	15.67
T ₃	66.56	73.56	2.56	2.56	18.22	17.33	80.00	82.00	90.67	93.33	6.22	6.22	77.33	77.00	17.11	17.33
T ₄	79.44	70.78	2.56	2.44	19.67	18.56	79.67	82.00	88.67	85.67	6.67	6.33	75.67	75.78	17.11	15.78
T ₅	75.56	79.11	2.67	2.33	19.22	19.56	86.33	82.67	88.00	87.00	6.11	6.67	71.00	74.44	16.67	16.67
T ₆	74.44	76.44	3.11	2.11	17.11	18.67	79.33	81.67	90.33	85.33	6.00	5.78	79.76	74.67	17.22	16.11
Τ ₇	74.67	79.89	3.00	2.67	17.67	18.00	80.33	83.00	89.67	91.00	6.22	6.67	72.56	78.56	16.78	16.22
T ₈	75.22	79.11	2.67	2.56	20.11	16.67	82.33	82.67	91.00	85.67	6.78	5.67	73.89	78.89	17.00	16.89
Τ ₉	77.56	79.89	3.67	3.22	20.78	20.00	76.67	77.33	83.33	84.67	7.22	6.67	78.33	83.33	18.89	18.00
T ₁₀	79.44	79.67	3.22	2.22	15.89	15.89	82.33	82.00	90.67	90.00	6.11	6.33	84.11	72.44	16.44	16.67
T ₁₁	73.56	74.33	2.44	2.33	17.33	16.44	85.00	85.00	89.33	87.67	6.00	7.11	74.33	74.33	18.67	17.00
T ₁₂	73.78	73.11	2.67	2.22	17.89	17.22	83.67	78.33	90.33	92.00	6.11	6.56	77.78	79.56	16.33	16.56
T ₁₃	74.78	74.11	3.56	2.22	20.78	16.56	83.33	78.00	88.67	91.33	6.67	6.56	82.33	77.78	17.00	17.11
T ₁₄	70.67	73.33	2.56	2.22	16.56	15.44	84.00	82.33	86.67	87.00	6.44	6.33	74.67	79.33	15.89	16.33
T ₁₅	77.00	75.11	2.78	2.00	19.11	16.00	80.67	83.67	86.00	87.00	6.22	6.56	79.33	80.67	16.56	17.22
F-test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	NS
S.Ed (+)	3.20	3.65	2.78	1.44	0.73	1.21	2.67	2.79	1.72	2.53	0.43	0.19	2.93	2.18	0.94	0.81
C.D.at 5%	6.59	7.53	3.00	2.33	1.51	2.50	5.51	5.75	3.53	5.21	0.89	0.40	6.03	4.49	1.94	1.67

Prosperity minimum days to opening of the first florets (84.67) was recorded T_0 NAA @ 200 ppm followed by T_8 , T_4 , and T_6 and the maximum days to opening of the first florets (93.33) was noticed with treatment T₃ CCC @ 200 ppm. Application of treatment four growth regulators with their two levels of each viz., GA₃ (25,50mg/), NAA (50,100mg/l) and CCC (250, 500mg/l) including control only water) minimum days required for spike initiation as maximum number of spike per plant spike length, number of florets the reduction in the average number of days for initiation under NAA @ 200ppm, GA, and CCC may be due to quick vegetative growth which resulted in an earliest shift reported, in gladiolus. Similar results were reported by Patel et al. (2010) and by Lal and Mishra (1986) in China aster and marigold and Doddagoudar et al. (2004) in China aster. The maximum First florets durability of Novalux (7.22days) was recorded under T_9 NAA@200ppm followed by T_8 , T_4 and T_{13} and the minimum First florets durability (5.00 days) was noticed with Control. In the same year in cultivars White Prosperity maximum First florets durability (7.11) was recorded under T_{11} NAA @ 250 ppm followed by T_{72} , T_{5} and T_{12} and the minimum First florets durability (5.33) was noticed with (Control). The maximum Spike length (84.11) was recorded under T_{10} NAA @ 250 ppm followed by T_{13} , T_6 and T_{15} the minimum Spike length (73.11) was noticed with Control. In

the same year in cultivars White Prosperity maximum Spike length (83.33) was recorded under T_o NAA @ 200 ppm followed by T_{15} , T_{12} and T_{13} and minimum Spike length (73.44) was noticed with Control. The quality parameters of flowers like number of florets/spike and flower length were significantly increased by the application of all growth regulators. The findings of present studies are in consonance with those of Barman and Rajni (2004), Pal and Chowdhary (1998) and Ravidas et al., (1992), Patel et al., (2010) and Chopde et al., (2012) with GA₂ in gladiolus. The maximum Number of florets per / spike (18.89) was recorded under T_{o} NAA @ 200 ppm followed by T₁₁, T₆ the minimum Number of florets per / spike (15.00) was noticed with Control. In the same year in cultivars White Prosperity maximum Number of florets per / spike (18.00) was recorded under T_o NAA @ 200 ppm followed by T₃, T₁₅, T₁₃ and the minimum Number of florets per / spike (15.11) was noticed with Control. The maximum flower size (125.38 cm2) was recorded under T_o NAA @ 200 ppm followed T_{10} , T_4 and T_5 and the minimum flower size (70.15 cm2) was noticed with Control. In the same year in cultivars White Prosperity maximum flower size (124.90 cm²) was recorded under T_{10} NAA @ 250 ppm followed by T_{9} , T_2 , T_6 , and T_{14} and the minimum flower size (70.48 cm2) was noticed with Control. The yield and quality of gladiolus corms were improved due to foliar application of NAA with higher

Table 1Effect of CCC, NAA and GA, on quality of gladiolus (Gladiolus grandiflorus) cv Novalux and White prosperity.

Treatments		Quality para	ameters	
	Flov	ver size in (cm)	Vase li	fe of spike
	Novalux	White Prosperity	Novalux	White Prosperity
T ₀	70.15	70.48	5.67	5.67
T ₁	86.51	81.12	8.00	7.33
T ₂	97.68	112.65	8.00	8.00
T ₃	93.35	96.89	8.67	9.33
T_4	110.88	98.11	8.67	8.67
T ₅	109.44	107.45	9.00	10.00
T ₆	100.76	109.55	9.33	10.00
T ₇	88.32	102.72	10.33	10.00
T ₈	99.20	101.53	9.33	8.33
T ₉	125.38	113.79	8.67	10.33
T ₁₀	116.59	124.00	8.33	10.33
T ₁₁	91.93	95.05	10.00	9.00
T ₁₂	106.24	93.99	10.00	9.00
T ₁₃	103.38	101.92	9.67	10.00
T ₁₄	92.03	107.91	9.33	8.00
T ₁₅	87.65	96.56	10.00	10.00
F-test	S	S	S	S
S.Ed(+)	4.54	7.25	0.46	0.88
C.D.at 5%	9.36	14.95	0.96	1.82

concentration, which might have been due to the delayed and less production of flower spikes due to which the plant energy might have been diverted towards the development of corms and it would have resulted into the production of more number of better quality corms. The similar results are also reported by Sharma et al. (2004) and Kumar et al. (2008) in gladiolus. The maximum Vase life of spike (10.33) days was recorded under T_7 NAA @ 100 ppm followed by T_{11} , T_{12} , T_{15} and the minimum Vase life of spike (5.67) was noticed with Control. In the same year in cultivars White Prosperity maximum Vase life of spike (10.33) was recorded under T_o NAA @ 200ppm followed by T_{13} and T_6 the minimum Vase life of spike (5.67) was noticed with Control. The increase in spike length might due to presence of sucrose increasing the vase life of flower by acting as the main source of food and reparable substrate during flower opening and more uptake of water from vase solution during vase life Naidu and Reid (1989).

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Response of FYM and NPK on Growth and Yield of Onion (*Allium cepa* L.)

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ABSTRACT

The present investigation was conducted during winter season of 2012-2013 at research farm of Department of Horticulture Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad (U.P.) India.The experiment was conducted in randomized block design with nine treatments and three replications. Response of onion (*Allium cepa*) on growth and yield to different levels of Nitrogen, Phosphorus and Potash (NPK). Doses 100:75:75 and 120:75:75 kg per hectare combination with farm yard manure (FYM), 20 and 25 t ha⁻¹ Ahmad *et al.* (2006) The statistical analysis using F test revealed that FYM, NPK and combination of these two fertilizers significantly affected all the growth parameters studied. Maximum leaf length (47.00 cm) was recorded in plots fertilized with NPK 120:75:75 kg ha⁻¹ + FYM 25 t ha⁻¹, whereas maximum plant height (55.33 cm), bulb weight (83.83 g), yield (28.41 t ha⁻¹).

INTRODUCTION

Onion (Allium cepa L.) belongs to the family Alliaceae, genus Allium and species cepa with basic chromosome number x = 8 (2n = 16). The genus Allium is large consisting of more than 500 species, biennial and perennial, mostly bulbous. Cultivated onion is herbaceous annual for edible bulb production and biennial for seed production. It has bisexual flower without protoandraus and highly crosspollinated. The inflorescence stalk is the only internode, which elongates in the life cycle of the onion plant. The edible portion is a modified stem, botanically known as "Trunicatedbullb" which develops underground, consists of vegetative stem axis and the storage leaf bases of the outer leaves. It is the commodity of mass consumption and is used as salad, cooked in various ways in curries, fried and boiled. It is also used in soup making, pickles, etc. Onion has got many medicinal uses. Annually production of major vegetables shows estimated that around the world over 9,000,000 acres (3,642,000 ha) of Onion are grown annually. Productivity of vegetables may be in caused by organic and inorganic supplement to soil from time to time, organic matter increases with growth and yield of onion. In Indian scenario, there is a great importance of organic manures, but many agricultural scientists have mostly emphasised on complementary role in combination with the inorganic fertilizer. Compost obtained through urban solid waste enriched with mineral fertilizers has proved to be economically favourable and agro-nomically more suitable. Organic sources are relatively bulky materials and are added mainly to improve the physical condition of soil, to replenish and keep up its humus status to maintain the optimum condition, for the activities of soil microorganisms. However, it has got a number of advantages, like it improves the soil health, physical condition of the soil and water holding capacity. Moreover, they are very slow in action. Therefore, they are useful at a long run only. Although the inorganic manures are required in very small quantities and are very quick in action, the interaction of chemical fertilizers with the soil is considered less favourable to environment in comparison to organic source of crop nutrients. Chemical fertilizers deplete the soil rapidly because of their-chemical nature and, hence, they are one of the major causes for soil, water and air pollution. Besides, they are not economical and eco-friendly.

Therefore, obvious choice is to maintain a natural balance for having a good soil health and to keep clean environment. Natural balance means application of organic & inorganic fertilizers in a balanced form, which is important in improvement in the quality of agricultural produce.

Keeping in view the above facts in mind, an experiment was conducted on "Effect of FYM and NPK on growth and yield of Onion (*Allium cepa* L.) cv. Pusa Red",

MATERIALS AND METHODS

The field trial was conducted in a RBD with three replications and plot size of 2.25 m^2 (spacing 10 cm x 20 cm) on onion cv. Pusa Red at Research Farm Department of Horticulture of Sam Higginbottom Institute of Agriculture, Technology and Sciences, (Formerly Allahabad Agricultural Institute) Allahabad, during rabi season of 2012-13. FYM and NPK was applied as basal dose @ 100, 75, 75 and 120, 75, 75 kg ha⁻¹ and FYM 20, 25 t ha⁻¹ respectively. Ten plants were randomly selected from each treatment. The data recorded

on these factors were subjected to statistical analysis as described by Ahmed Abbas, **Sultan** *et al.* (2006).

RESULTS AND DISCUSSION

The data pertaining to the plant height of onion under different treatments recorded at 54, 72 and 90 days after transplanting (DAT) is show in *Table 1*. Treatment T₃ (farm yard manure 25 t ha⁻¹ + Nitrogen 120kg ha⁻¹ + P₂O₅ 75kg ha⁻¹ +K₂O 75kg ha⁻¹) recorded maximum plant height (55.92 cm) followed by 53.58 cm with T₂ (farm yard manure 25 t ha⁻¹ + Nitrogen 100kg ha⁻¹ + P₂O₅ 75kg ha⁻¹ + K₂O 75kg ha⁻¹) and the minimum (39.33 cm) was recorded with T₀ (Control). Similar trend was observed at subsequent growth stages also. On increasing the dose of FYM and NPK from 120:75:75 kg ha⁻¹ + 25 t ha⁻¹ increase in plant height was recorded. On decreasing the dose of NPK from 120:75:75 kg ha⁻¹ + FYM 25 t ha⁻¹ to NPK 100:75:75 kg ha⁻¹ + FYM 25 t ha⁻¹ decreasing the plant height slightly was recorded. Ahmed Abbas, Sultan **Mohammad** *et al.* (2006).

Number of leaves per plant under different treatments counted and recorded at 54, 72 and 90 days after transplanting (DAT) is shown in *Table 1*. Treatment T_6 (FYM 20 t ha⁻¹ + NPK 120:75:75 kg ha⁻¹) recorded maximum number of leaves per plant (10.83) followed by 10.75 with T_5 (FYM 20 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) and the minimum (6.83) was recorded with T_0 (Control). Similar trend was observed at subsequent growth stages also. On decreasing the dose of NPK from 120:75:75 kg ha⁻¹ + FYM 25 t ha⁻¹ to NPK 100:75:75 kg ha⁻¹ + FYM 25 t ha⁻¹ + FYM 25 t

slightly was recorded. Singh, S. Yadav, P.K. and Singh, B. (2004)

Length of leaves (cm)

Length of leaves under different treatments counted and recorded at 54, 72 and 90 days after transplanting (DAT) is shown in *Table 1*. Treatment T_2 (FYM 25 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) recorded maximum length of leaves (47.00 cm) followed by 44.42 cm with T_1 (FYM 25 t ha⁻¹) and the minimum (31.17 cm) was recorded with T_0 (Control). Similar trend was observed at subsequent growth stages also. **Ahmed Abbas, Sultan Muhammad** *et al.* (2006).

Size of bulb in polar diameter (cm)

Size of bulb in polar diameter under different treatments recorded at is presented in *Table 2*. The table indicates that the effect of FYM + NPK of bulb in polar diameter at different treatments significant effect was observed. Treatment T₅ (FYM 20 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) recorded maximum polar diameter(6.00 cm) followed by 5.83 cm with T₆ (FYM 20 t ha⁻¹ + NPK 120:75:75 kg ha⁻¹) and the minimum (4.18 cm) was recorded with T₀ (Control). **Ahmed Abbas, Sultan Muhammad** *et al.* (2006).

Size of bulb in equatorial diameter (cm)

Size of bulb in equatorial diameterunder different treatments recorded at is presented in *Table 2*. The table indicates that the effect of size of bulb in equatorial diameterat different treatments significant effect was observed. Treatment T_s (FYM 20 tha⁻¹ + NPK 100:75:75 kg ha⁻¹) recorded

Plant height (cm) Treatment Treatments Number of leaves per plant Length of leaves (cm) 54 DAT **54 DAT** 72 DAT 90 DAT No. 72 DAT **90 DAT** 72 DAT 90 DAT 54 DAT T₀ Control 33.08 36.08 39.33 5.42 6.25 6.83 25.83 27.67 31.17 Τ. 40.33 51.50 5.92 7.33 9.00 41.92 FYM 25 t ha-1 54.58 28.83 44.42 FYM 25 t ha⁻¹ + NPK 48.58 53.58 55.33 6.75 8.92 10.33 38.75 43.17 47.00 Τ₂ 100:75:75 kg ha-1 Τ, FYM 25 t ha⁻¹ +NPK 55.92 7.00 10.75 43.50 48.15 52.58 8.58 37.50 40.92 120:75:75 kg ha-1 FYM 20 t ha⁻¹ 42.25 48.17 50.83 6.00 7.25 9.08 31.67 38.33 T₄ 39.33 FYM 20 t ha-1 +NPK T₅ 47.92 51.50 53.08 6.50 7.92 10.75 40.08 42.58 36.67 100:75:75 kg ha-1 T₆ FYM 20 t ha⁻¹ +NPK 52.00 10.83 34.92 41.50 44.08 46.92 53.25 6.92 8.50 120:75:75 kg ha-1 T_{7} NPK 100:75:75 kg 35.08 43.83 46.25 47.83 6.08 7.25 9.08 32.08 36.83 ha-1 NPK 120:75:75 kg ha⁻¹ 5.92 36.50 39.75 49.75 7.83 8.75 26.58 30.83 39.25 T₈ C.D. (P = 0.05)_

 Table 1 : Effect of different combinations of FYM and NPK on plant height (cm), number of leaves per plant and length of leaves (cm) of onion (Allium cepa L.) at different intervals

maximum equatorial diameter (5.02 cm) followed by 4.73 cm with T_6 (FYM 20 t ha⁻¹ + NPK 120:75:75 kg ha⁻¹) and the minimum (3.88 cm) was recorded with T_0 (Control). **Ahmed Abbas, Sultan Muhammad** *et al.* (2006).

Neck diameter (cm)

Neck diameter under different treatments recorded at is presented in *Table 2*. is presented in. The analysis of variance has been given in appendix (4). The table indicates that the effect of neck diameter at different treatments significant effect was observed. Treatment T₅ (FYM 20 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) recorded maximum neck diameter (1.90 cm) followed by 1.81 cm with T₆ (FYM 20 t ha⁻¹ + NPK 120:75:75 kg ha⁻¹) and the minimum (1.46 cm) was recorded with T₀ (Control). Similar trend was observed at subsequent growth stages also. Neck diameter increased with the increase increase in doses of FYM and NPK, at all the stages of growth. Combination of FYM 20, 25 t ha^{-1} + NPK 100:75:75 and 120:75:75 kg ha^{-1} recorded maximum fresh weight. Better photosynthetic activity might have result higher fresh weight. **Ahmed Abbas, Sultan Muhammad** *et al.* (2006).

Yield per (t ha⁻¹)

Yield per hectareunder different treatments recorded at is presented in *Table 2*. The table indicates that the effect of yield per hectare at different treatments significant effect was observed. Treatment T_5 (FYM 20 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) recorded maximum yield per hectare (28.41t ha⁻¹) followed by 24.82 t ha⁻¹ with T_6 (FYM 20 t ha⁻¹ + NPK 120:75:75 kg ha⁻¹) and the minimum (16.29 t ha⁻¹) was recorded with T_0 (Control). Yield per hectare Fresh weight of bulb increased

 Table 2 : Effect of different combinations of FYM and NPK on polar diameter of bulb (cm), equatorial diameter of bulb (cm), neck diameter of bulb (cm), fresh weight of bulb (g) and bulb yield (t ha⁻¹) of onion (Allium cepa L.) at different intervals

Treatment	Treatments	Polar	Equatorial	Neck diameter	Bulb fresh	Bulb yield
No.		diameter of	diameter of bulb	of bulb (cm)	weight (g)	(t ha ⁻¹)
		bulb (cm)	(cm)			
T ₀	Control	4.18	3.88	1.46	35.17	16.29
T ₁	FYM 25 t ha ⁻¹	4.87	4.16	1.56	49.83	20.16
T ₂	FYM 25 t ha ⁻¹ +NPK 100:75:75 kg ha ⁻¹	5.73	4.19	1.62	66.83	24.64
T ₃	FYM 25 t ha ⁻¹ +NPK 120:75:75 kg ha ⁻¹	5.80	4.67	1.65	70.50	23.16
T ₄	FYM 20 t ha ⁻¹	5.54	4.09	1.79	62.83	20.76
T ₅	FYM 20 t ha ⁻¹ +NPK 100:75:75 kg ha ⁻¹	6.00	5.02	1.90	83.83	28.41
T ₆	FYM 20 t ha ⁻¹ +NPK 120:75:75 kg ha ⁻¹	5.83	4.73	1.81	76.17	24.82
T ₇	NPK 100:75:75 kg ha ⁻¹	5.44	4.23	1.39	59.92	19.60
T ₈	NPK 120:75:75 kg ha ⁻¹	5.27	4.16	1.48	55.33	17.93
	C. D. (P=0.05)					

in doses of FYM and NPK at all the stages of growth. Combination of FYM 20, 25 t ha⁻¹ + NPK 100:75:75 and 120:75:75 kg ha⁻¹ recorded maximum neck diameter. **Pachouri, C.P.,Pachouri, S.P.,Saraf, R.K. and Kushwaha, S.S.(2005)**.

Fresh weight of bulb (g)

Fresh weight under different treatments recorded at is presented in *Table 2*. The table indicates that the effect of fresh weight at different treatments significant effect was observed. Treatment T_5 (FYM 20 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) recorded maximum fresh weight of bulb (83.83 g) followed by 76.17 g with T_6 (FYM 20 t ha⁻¹ + NPK 120:75:75 kg ha⁻¹) and the minimum (35.17 g) was recorded with T_0 (Control). Similar trend was observed at subsequent growth stages also. Fresh weight of bulb increased with the with the increase in doses of FYM and NPK, at all the stages of growth. Combination of FYM 20, 25 t ha⁻¹ + NPK 100:75:75 and 120:75:75 kg ha⁻¹ recorded maximum yield per hectare. Treatment T_5 (FYM 20 t ha⁻¹ + NPK 100:75:75 kg ha⁻¹) proved to be the appropriate combination of FYM and NPK, which emerged as superior over all other treatments for yield of onion. **Banafer,R.N.S., Namdeo, S. L. and Asati, K. P.** (2004).

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Effect of dates of Planting, NPK Level and Varieties on growth and Yield of Turmeric

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ABSTRACT

The investigation were carried out during the successive ziad / kharif seasons of the year 2008-09 and 2009-10. Maximum plant height was obtained during 2008-09 and 2009-10 when planting was done on 13th June. Height of plant was affected due to various NPK levels. Maximum height was recorded in 2008-09 and 2009-10 with 180: 90: 90 Kg NPK/ha. Height of variety NDH-18 was found superior than NDH-14 during both the years. Minimum number of days (203.24 and-208.24) were involved to mature the crop during 2008-09 and 2009-10 respectively at date of planting on 28th June.

Duration of crop was also affected by various NPK levels. Maximum number of days for maturation of crop was noted (235.00 and 240.00) during-2008-09 and 2009-10 respectively with 180:90:90 Kg NPK/ha.NDH-18 took maximum days for its maturity. Maximum weight of mother rhizomes were recoreded (40.94 and 39.70g) during 2008-09 and 2009-10 respectively at planting on 14th June. Maximum value (43.66 and 42.33g) was recorded in 2008-09 and 2009-10 respectively with 180:90:90 kg NPK/ha fertility levels. Weight of mother rhizomes of NDH-18 was higher than NDH-14. Maximum fresh rhizome yield (q/ha) i.e. 398.98 and 406.33 q/ha was obtained when planting was done on13th June during 2008-09 and 2009-10 respectively. Yield was recorded 425.50 q/ha during- 2008-09 and 433.43 q/ha during 2009-10 with 180:90:90Kg NPK/ha fertility levels. Yield of cv. NDH-18 was higher than cv. NDH-14.

Keywords : Rhizomes, Variety, Duration & Fertility

INTRODUCTION

Turmeric (*Curcuma longa* L.) is an important spice crop of India. India is the largest producer and exporter of turmeric, contributing about 82% of production and 45 percent of export. The optimum time of planting of turmeric varies with the varieties. The time of planting plays an important role on growth and yield. Turmeric is a season bound crop. May -June is recommended for its planting. **Mishra et al. (1997)** studied the effect of planting dates on yield of turmeric varieties. During the period of growth, Nitrogen, Phosphorus and Potassium are required in large quantities for healthy growth of the plant. For higher economic yield, balanced nutrient supply is one of the key factor.

Under genus *Curcuma* nearly 40 species have been recognized. *Curcuma longa L. curcuma aromatica, Curcuma angustifolia, Curcuma amada, Curcuma zadoaria* and *Curcuma xanthorrhiza* are prominent species of turmeric. Studies on suitable dates of planting, NPK level and varieties of turmeric are meagre in India. Therefore a detailed study of planting dates, NPK levels and varieties on growth and yield of turmeric have been presented in this paper.

MATERIALS AND METHODS

The experiments were laid out at Main Experiment Station, Vegetable Science, N. D. University of Agriculture and Technology Kumarganj, Faizabad in a leveled field with proper drainage.

The investigations were carried out during the successive zaid/ kharif season of the year 2008-09 and 2009-10. The experiment was framed in split plot design. Four dates of planting details 14th May (D_1), 29th May (D_2), 13th June (D_3) and 28th June (D_4) and NPK levels 0:0:0 (F_0), 100:50:50 (F_1), 140:70:70 (F_2) and 180:90:90 (F_3) were used. Cultivars of turmeric NDH-18 and NDH-14 were selected for this investigation. Growth and yield characters of turmeric varieties were recorded during both the years.

RESULTS AND DISCUSSION

Data presented in table-1 indicated that planting of turmeric at various intervals caused non significant response on plant height and as the planting of rhizomes were delayed an increasing trend with respect to enhancement of plant height was observed and maximum plant height i.e. 129.20 cm and 133.92 cm were obtained during 2008-09 and 2009-10 respectively when planting was done on 13th June. **Hu** *et al.* (1996) and **Baruah** (2001) reported mid May is best planting time for turmeric.

Height of plant was affected due to various NPK levels and a significant increase in plant height was observed when NPK levels were increased. Maximum values were recorded 137.81 cm and 142.92 cm in 2008-09 and 2009-10 respectively at F_2 (180:90:90 Kg NPK/ha) fertility level.

Two cultivars of turmeric were tested. NDH-18 was found superior than NDH-14 with respect to plant height during both the years.

Data obtained on account of duration of the crop as influenced by dates of planting, NPK levels and varieties have been presented in *table- 1*.

Planting of turmeric at various planting dates caused non-significant decrease in duration of crop. Minimum number of days 203.24 and 208.24 were involved to mature the crop during 2008-09 and 2009-10 respectively at planting on 28th June. Duration of crop was also affected by various NPK levels. Maximum number of days for the maturation of crop were noted 235.00 and 240.0 during 2008-09 and 2009-10 respectively at F_3 (180 : 90 :90 KgNPK/ha) fertility level. NDH-18 variety took maximum days i.e. 220.35 and 224.35 during 2008-09 and 2009-10 respectively for maturity of the crop.

Data collected on account of weight of mother rhizomes as influenced by dates of planting, NPK levels and varieties have been presented in *Table- 1*.

Planting of turmeric at various planting dates caused non significant increase in weight of mother rhizomes. Maximum

weight of mother rhizomes were recorded 40.94 and 39.70 gm during 2008-09 and 2009-10 respectively at planting on 13th June. Maximum values of mother rhizomes i.e. 43.66 and 42.33 gm were recorded in 2008-09 and 2009-10 respectively at F_3 (180:90:90 Kg NPK/ha) fertility level, **Tayde and Deshmukh** (1986) studied the effect of planting material and 5 level nitrogen on turmeric and reported that the highest yield of mother rhizomes was found (30.67t/ha). Weight of mother rhizomes was found to be more quantitatively in cv. NDH-18 in comparison to NDH-14 the trend of increase was similar during both the years of experimentation.

The observation recorded on yield of fresh rhizomes (q/ha) as influenced by various treatment has been compiled in *Table-1*. Planting of turmeric at various planting dates caused non significant enhancement with respect to fresh rhizomes yield (q/ha). Mishra et.al. reported Effect of Planting dates and varieties on yield of turmeric. Maximum yield of fresh rhizomes i.e. 398.98 and 406.33 q/ha was obtained when planting was done on 13th June (D_3) during 2008-09 and 2009-10 respectively. Maximum yield of fresh rhizomes was recorded 425.50 q/ha during-2008-09 and 433.43 q/ha during 2009-10 with F_3 (180:90:90 Kg NPK/ha) fertility level. **Hussain et al. (2006)** reported that highest

Treatments	Plant h	eight	Duration	1 of corp	Weight of	mother	Yield of r	hizome
	(cn	n)	(da	ys)	rhizome	s (gm)	(q/h	a)
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
Dates of planting								
14 th May (D _i)	115.72	120.45	216.37	221.37	37.03	35.89	360.88	367.64
29^{th} May (D ₂)	119.28	123.67	215.00	200.00	37.85	36.66	368.58	375.36
13^{th} June (D ₃)	129.20	133.92	206.50	211.50	40.94	39.70	398.98	406.33
28^{th} June (D ₄)	126.67	131.35	203.24	208.24	40.16	38.94	391.29	398.58
SEm±	1.89	1.99	3.20	3.22	0.60	0.58	5.89	6.06
C.D. (P=0.05)	4.80	5.06	8.10	8.17	1.53	1.47	14.93	15.21
NPK Levels (Kg/ha)								
$0:0:0(F_0)$	98.19	102.18	167.74	172.73	31.18	30.25	303.99	309.56
$100:50:50(F_1)$	122.0	126.52	200.74	214,73	39.01	37.80	379.85	386.98
140:70:70 (F ₂)	131.84	136.78	226.62	231.62	42.11	40.81	410.38	417.94
1 80:90:90 (F ₃)	137.81	142.92	235.00	240.00	43.66	42.33	425.50	433.43
SEm±	1.63	1.70	2.84	2.90	0.51	0.49	5.04	5.13
C.D. (P=0.05)	3.49	3.64	6.08	6.20	1.10	1.05	10.77	10.97
Varieties :				-	-	-		-
NDH-18 (V_1)	131.12	133.93	220.35	224.35	40.94	39.69	398.97	406.33
NDH,-14 (V ₂)	116.81	121.26	203.18	209.18	37.05	35.90	360.89	367.63
SEm±	1.12	1,15	1.86	1.92	0.35	0.34	3.42	3.48
C.D. (P-0.05)	2.38	2.45	3.93	4.05	0.74	0.72	7.24	7.37

Table-1: Effect of dates of planting, NPK levels and varieties on growth and yield of turmeric.

yield of turmeric 117.35 q/ha was obtained with 100 Kg N/ha. NDH-18 proved to be superior is regard to production of rhizomes yield than cv NDH-14.

CONCLUSION

The planting of turmeric Cv. NDH-1(18) upto June 13th with the application of 140:70:70 kg NPK/ha may be safely recommended for the farmers of this area.

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Response of Different Level of Nitrogen and Boron on Growth, Yield and Quality of Cauliflower (*Brassica oleracea* L.) var. botrytis

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ABSTRACT

The investigation was conducted at Department of Soil Science, SHIATS, Allahabad. During the year 2011-2012. The experiment was laid out in a 3³ factorial design with three levels of nitrogen and boron giving nine treatments combinations. Studies showed that, significant effect on the plant height (24.59 cm), number of leaves per plant (14.89), curd diameter (12.01 cm), curd height (9.45 cm), fresh weight of curd (725 g), dry weight of curd (356 g), curd yield (16.59 t ha⁻¹), pH of soil (7.80 w/ v), electrical conductivity (0.44 dSm⁻¹), organic carbon (0.49 %), available nitrogen (210.35 kg ha⁻¹), available phosphorus (25.51 kg ha⁻¹), available potassium (214.85 kg ha⁻¹), available boron (0.40 ppm) in the over all treatments. The treatment T₈ (N 200 kg + B 2 kg) was found to be the best out of 9 treatment in level of nitrogen and boron physico- chemical properties of soil and growth and yield of cauliflower.

Keywords: nitrogen, boron, growth, yield, physic-chemical, cauliflower

INTRODUCTION

Cauliflower is the most popular Cole crop among the winter vegetables. In India, the crop was introduced during 1822. The Crop is mainly cultivated for its white tender head called 'curd" Cauliflower can be cultivated in almost all types of soils with good fertility and drainage .early crop prefers rich sandy loam whereas late crop needs loam and clay loam. Soil with slight acidic to neutral pH of 6.0 to 7.0 gives better crop. Based on temperature, the Indian cauliflower is grouped into two types. One is the tropical types and other the annual temperate types called 'effurt' or 'Snow ball' types. The tropical types form curds at 20° C- 25° C while the temperate annuals require a temperature of 10° C- 16° C for curd formation. The tropical types are more resistant to heat.

Cauliflower (*Brassica oleracea* L.) can be grown in all types of soil with good soil fertility and good water regime. Because of over mining of the plant food elements by the crops, most of the micronutrients become in short supply to the crops and some disorders appear resulting in low yields (**Joshi 1997**). Nitrogen and boron play an important role in cauliflower curd production and in their deficiency many symptoms occur which badly affects the crop.

Nitrogen is an essential plant nutrient, which is involved in physiological processes and enzyme activities. Farmers use urea excessively as a nitrogen fertilizer, to enhance flowering, curd set and increase curd size in cauliflower (*Brassica oleracea* L.). Nitrogen could increase production of cauliflower, but the curd quality is affected. Cauliflower is a perishable and tissue deterioration occurs during cold storage. High nitrogen contents with defects of other nutrients could reduce the storage life of cauliflower (Kirthisinghe, 2009).

In cauliflower (Brassica oleracea L.) boron deficiency has been reported very frequently. At the time which stage of growth, external symptoms of boron deficiency is not apparent. The first sign is the appearance of small water soaked areas in the center of the curd. In later stages and in seriously affected plants, the stem becomes hollow with water socked tissue surrounding the walls of the cavity. In more advanced stages, pinkish or rusty brown area develop on the surface of the curd which is known as Red rot and cause low curd yield. This may be controlled by applying borax or sodium borate @ 20 kg ha⁻¹ (Chatterjee 1986). He further reported that boron increased the curd size and weight. Ghimire (1991) reported that the highest yield (15.45 t ha⁻¹) was obtained when the crop was supplied with borax @ 22.5 kg ha⁻¹. A normal crop usually contains only a fraction of a pound of boron per hectare. The symptoms show mostly on young leaves because boron is relatively non-mobile in plants (Thompson and Troech 1957). The requirement of boron quantity by the crop depends upon the variety and soil fertility status of the area. Therefore, it has been necessary to determine the rate of boron application to the cauliflower. So this experiment was conducted with an objective of evaluating the application levels of boron on the production of the cauliflower curds.

MATERIALS AND METHODS

The present investigation entitled "RESPONSE OF DIFFERENT LEVEL OF NITROGEN AND BORON ON

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GROWTH, YIELD AND QUALITY OF CAULIFLOWER (*Brassica olerace* L.)" was conducted in a Factorial R.B.D with nine treatments and three replications and twenty seven plots, during winter season (2011-2012) at department of soil science. Research Farm of the Sam Higginbottom Institute of Agriculture, Technology and Sciences Allahabad (Deemed-to-be-University), Allahabad, Uttar Pradesh. Three level of nitrogen (0 kg, 100 kg, 200 kg ha⁻¹) and three level of boron (0 kg, 1 kg, 2 kg ha⁻¹) were taken for study. The plot size was 2×1 m and spacing of 60×45 cm. Data were recorded at 15, 30, 45 DAT i.e. Plant height, number of leaves but other parameter also recorded after harvest of the crop. After collection of data, it was tabulate in proper form and subjected to statistical analysis.

Details of treatment combination

$T_0 (N 0 kg + B 0 kg)$	$@ [0 g N kg ha^{-1} + 0 g B kg ha^{-1}]$
(control)	
$T_{1}(N100 kg + B0 kg)$	@ [43.5 g N kg ha ⁻¹ + 0 g B kg ha ⁻¹
1]	
$T_{2}(N200 kg + B0 kg)$	@ [87.0 g N kg ha ⁻¹ + 0 g B kg ha ⁻¹
1]	
$T_{3}(N 0 kg + B 1 kg)$	@ $[0 g N kg ha^{-1} + 0.2 g B kg ha^{-1}]$
T_{4} (N 100 kg + B 1 kg)	@ [43.5 g N kg ha ⁻¹ + 0.2 g B kg
ha-1]	
$T_{5}(N 200 kg + B 1 kg)$	@ [87.0 g N kg ha ⁻¹ + 0.2 g B kg
ha-1]	
$T_{6}(N 0 kg + B 2 kg)$	$@ [0 g N kg ha^{-1} + 0.4 g B kg ha^{-1}]$
$T_{7}(N 100 \text{ kg} + \text{B} 2 \text{ kg})$	@ [43.5 g N kg ha ⁻¹ + 0.4 g B kg ha ⁻¹
, c c.	• •

 $T_{g} (N 200 \text{ kg} + \text{B 2 kg}) \quad @ [87.0 \text{ g } N \text{ kg ha}^{-1} + 0.4 \text{ g } \text{B kg ha}^{-1}]$

RESULTS AND DISCUSSION

The result of present investigation entitled "Response of Different Level of Nitrogen and Boron on Growth, Yield and Quality of Cauliflower (Brassica olercea L)" are summarized. In the case of Plant height and number of leaves of cauliflower vegetable crop increased progressively as the plant advanced in age up to 45th DAT. At 45th DAT T_o (N200 kg+B2 Kg was recorded the maximum plant height (25.55 cm) and maximum number of leaves per plant (14.89). The increase in plant height and number of leaves due to increase in the rate of N application have been reported by Mishra (1992). The maximum curd height (9.45 cm), curd diameter (12.01 cm), fresh weight of curd (725 g), dry weight of curd (356 g) and curd yield (16.59 t ha⁻¹) in the treatment T_8 (N 200 kg + B 2 kg) due to increase in the rate of N application have been reported by Kandil and Gad (2009), Moniruzzaman et al. (2007), Kodithuwakku et al. (2009). In the case of Soil parameters average pH of soil after harvesting (7.76 w/v) in treatment T₂ (N 0 kg + B 1 kg) results reported by Moniruzzaman et al. (2007). Electrical conductivity of soil after harvesting (0.29 dSm^{-1} in treatment T₀ (N 0 kg + B 0 kg) results reported by Cutcliffe and Gupta (1980). Maximum organic corbon of soil after harvesting (0.53 %) in treatment T_o (N 200 kg + B 2 kg)results reported by Cutcliffe and Gupta (1980). Maximum available nitrogen of soil after harvesting (221.33 kg ha-1) in treatment T_{s} (N 200 kg + B 2 kg) results reported by Moniruzzaman et al. (2007). Maximum available phosphorus

Table 1: Performance of Growth and Yield of Cauliflower in Different Level of Nitrogen and Boron.

Treatment	Plan	t Hei	ght	Nu	mbe	r of	Curd	dia	meter	Cur	d H	eight	Fres	h W	eight	Dry	We	ight	Cu	rd yi	eld
	((cm)		Lea	Leaves/Plant			(cm)		(cm)		of Curd (g)		of (Curd	(g)	(1	(t ha ⁻¹)			
T ₀	2	1.07			11.44	1		8.71		6.01		285.55		120.25		12.08					
T ₁	2	2.16			12.22	2		9.86			7.22		542.55		244.33		14.23				
T ₂	2	3.01			12.44	1	1	10.00)		7.41		568.89		278.44			14.58			
T ₃	2	1.27			11.66	5		8.96			6.24		4	77.7	7	2	21.6	6		13.23	
T ₄	2	3.11			12.55	5	1	11.02	2		8.30		5	77.2	2	2	279.6	7		15.18	
T ₅	2	5.21			13.89	Ð	1	11.98	3		9.40		697.22		345.11		16.22				
T ₆	2	2.03			12.1	1		9.05		6.76			480.55		230.55		14.04				
T ₇	2	3.14			13.33	3	1	11.79)	9.04			632.22		2	3	804.6	6	15.43		
T ₈	2	5.55			14.89	Ð	1	12.01	l	9.45			725.00		356.00		16.59				
	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.
	(±)	Ed.	at 5%	(±)	Ed.	at 5%	(±)	Ed.	at 5%	(±)	Ed.	at 5%	(±)	Ed.	at 5%	(±)	Ed.	at 5%	(±)	Ed.	at 5%
Nitrogen (N)	S	0.03	0.06	S	0.03	0.06	S	0.04	0.08	S	0.03	0.06	S	0.05	0.10	S	2.39	5.06	S	0.05	0.11
Boron (B)	S	0.03	0.06	S	0.03	0.06	S	0.04	0.08	S	0.03	0.06	S	5.06	10.73	S	2.39	5.06	S	0.05	0.11
Interaction	S	0.05	0.10	S	0.05	0.11	S	0.07	0.14	S	5.06	10.73	S	8.77	18.58	S	1.14	8.77	S	0.09	0.19
(N×B)																					

Treatment	pH	of S	oil	E	lectri	cal	0	rgan	ic	A	vailat	ole	A	vailat	ole	A	vailab	le	A	vailab	le
				Сог	nduct	ivity	0	Carbo	n	N	itrog	en	Ph	ospho	rus	Po	tassiu	ım]	Boron	
				(dSm ⁻	¹)		(%)		(1	kg ha	⁻¹)	(1	kg ha	·1)	(1	kg ha [.]	¹)		(ppm)	
T ₀		7.80			0.29			0.27			162.88	3		13.45			122.82	2		0.60	
Τ ₁		7.69			0.22			0.37		2	212.2	7		24.08			201.01	l		0.90	
T ₂		7.66			0.20			0.40		2	213.93	3		24.45			202.92	2		0.93	
T ₃		7.76			0.26			0.30		1	204.7	7		23.30			203.86	5		0.83	
T ₄		7.64			0.17			0.42		2	215.55	5		24.66			205.30)		0.93	
T ₅		7.59			0.11			0.49			218.55	5		25.22		1	207.02	2		1.37	
T ₆		7.72			0.24			0.33			209.1	7		23.81			208.61	l		0.87	
T ₇		7.61			0.13			0.45		2	217.33	3		24.94			211.23	3		1.23	
T ₈		7.47			0.09			0.53			221.33	3		25.51			214.85	5		1.40	
	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.	F-test	S.	C.D.
		Ed. (±)	at 5%		Ed. (±)	at 5%		Ed. (±)	at 5%		Ed. (±)	at 5%		Ed. (±)	at 5%		Ed. (±)	at 5%		Ed. (±)	at 5%
Nitrogen (N)	S	0.01	0.01	S	0.01	0.01	S	0.009	0.018	S	0.62	1.32	S	0.12	0.26	S	0.41	0.86	S	0.01	0.02
Boron (B)	S	0.01	0.01	S	0.01	0.01	S	0.009	0.018	S	0.62	1.32	S	0.12	0.26	S	0.41	0.86	S	0.01	0.02
Interaction	S	0.01	0.02	S	0.01	0.02	S	0.015	0.032	S	1.82	2.29	S	0.22	0.46	S	0.70	1.49	S	0.01	0.03
(N×B)																					

Table 2: Performance of Soil of Different Level of Nitrogen and Boron.

of soil after harvesting (25.51 kg ha⁻¹) in treatment T_8 (N 200 kg + B 2 kg) results reported by **Batal** *et al.* (1997). Maximum available potassium of soil after harvesting (214.85 kg ha⁻¹) in treatment T_8 (N 200 kg + B 2 kg) results reported by **Mishra** *et al.* (1992). Maximum available boron of soil after harvesting (1.40 ppm) in treatment T_8 (N 200 kg + B 2 kg) results reported by Kelling *et al.* (1999).

CONCLUSION

On all of the count status it was concluded that 200 N kg ha⁻¹ (N₂) and 2 B kg ha⁻¹ (B₂) treatment combination was the best treatment as compared to others. It was only 3 months experiment to test the specific dose of B along with N cauliflower.

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Effect of Different Levels of Sulphur and Biofertilizer on Soil Properties and Yield of Indian Mustard (*Brassica juncea* L.)

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ABSTRACT

A study was conducted on the Effect of different levels of Sulphur @ 0, 20 and 40 kgha⁻¹ and Azotobactor (0, 100g/10 kg seed and 200g / 10 kg seed) on Soil properties and Yield of Indian mustard (*Brassica juncea* L.) Cv. Varuna. The Grain yield (qha⁻¹) was significantly increased by the application of Sulphur and *Azotobactor*. The maximum yield was obtained by Sulphur @40 kg ha⁻¹. The maximum yield was obtained by the source of *Azotobactor* @200g / 10kg seed. The interaction between Sulphur (40 kg ha⁻¹) and *Azotobactor* @ 200g / 10kg seed was significant and the maximum yield was obtained. The soil samples collected after harvest of Indian mustard showed the significant decreases in pH and EC and inverses in Organic Carbon, Available Nitrogen, Phosphorus, Potash and Sulphur was recorded by the application of Phosphorus, Sulphur and *Azotobactor* applied alone or in conjunction with each other.

Key words: Sulphur and Azotobactor, Indian mustard and Soil Health.

INTRODUCTION

The oilseed form essential part of human diet. Besides it produces basic raw materials for agro based industries and has large acreage covering 20.7 mha under various oilseeds in different agro-climatic zones of this country. The average Indian consumer uses relatively low quantities of edible oil, no doubt influenced by his modest level of income. This has been primarily due to phenomenal increase in human population and lower rate of productivity of these crops. Rapeseed and mustard are the major Rabi oil seed crops of India and stand next to groundnut in the oilseed economy. Rapeseed and mustard are one of the most important edible oils of northern and eastern parts of India. Various nutrients and micronutrients are required for oilseed production, but the nutrient which plays a multiple role in providing nutrition to oilseed crops, particularly those belonging to cruciferae family is sulphur. Each unit of fertilizer sulphur generates 3-5 units of edible oil, a commodity needed by every family. Sulphur can be rightly called as fourth major element of the plant because it is a constituent of three amino acids and helps in the formation of chlorophyll and synthesis of oils. Sulphur application also has marked effect on soil properties and is used as soil amendment to improve the availability of other nutrients in soil as gypsum and pyrite. Sulphur is the cheapest of the four major plant nutrients today. Between the two common sources of sulphur, a relatively large deposit of gypsum are available in India and is a cheap source of sulphur, hence could also be better source of sulphur for oilseed crops. showed the highest seed and oil yield in mustard (Brassica juncea) Cv. Kranti, Varuna and Rohini was obtained by applying 20 kg sulphur per hectare. Biofertilizer

are known to play a number of vital roles in soil fertility, crop productivity and production in agriculture as they are ecofriendly but can not at any cost replace chemical fertilizers that are indispensable for getting maximum crop yields. They supplement chemical fertilizers for meeting the integrated nutrient demand of the crops. Azotobactor inoculants when applied to many non-leguminous crop plants, promote seed germination and initial vigor of plants by producing growth promoting substances. Application of Biofertilizer results in increased mineral and water uptake, root development, vegetative growth and nitrogen fixation. Therefore, present study deals with the combined effect of sulphur and Biofertilizer on yield of mustard crop and soil properties.

MATERIALAND METHODS

Field experiment was conducted on the soil science research field of SHIATS-DU-Allahabad (U.P) during Rabi season of 2012-13. The surface soil samples (0-15 cm) collected from the experiment site were analyzed for physicochemical characteristics as suggested by Jackson and results are summarized in *table.1* Indian Mustard (*Brassica juncea* L.) Cv. Varuna was tested for three levels of Sulphur@ 0,20 and 40kgha⁻¹ by source of Gypsum and *Azotobactor* @0, 100g/10 kg seed and 200g/10 kg seed. Irrigation scheduling, fertilizers application and intercultural operation are followed as per normal agronomic practise. The experiment was laid out in 1.5x1.5 m 32 factorial R.B.D with a treatments and three replications. Grain yield was recorded at harvest for all the treatments. At harvest of crops for textural classes, pH, EC as per standard laboratory methods.

S.No	Soil Properties	Result
1.	Soil Texture	Sandy Loam
2.	Soil pH(1:2)	7.81
3.	Soil EC(dSm ⁻¹)	0.25
4.	Organic Carbon (%)	0.35
5.	Available Nitrogen (kgha-1)	258.58
6.	Available Phosphorus (kgha-1)	24.16
7.	Available Potassium (kgha-1)	102.70
8.	Available Sulphur (ppm)	7.03

Table 1.Pre sowing mechanical and chemical analysis of Soil Properties at 0-15 cm depth of Soil.

RESULT AND DISCUSSION

The grain yield of Mustard:

The Grain yield qha⁻¹ data presented in *Table 4.7.1* and depicted in *Fig.4.7.1* clearly shows that the grain yield q ha⁻¹. The grain yield qha⁻¹ of seeds showed a significant increase by the increasing levels of Sulphur, Phosphorous from S₀ - S₀ kgha⁻¹ < S₁(S₂₀ kg ha⁻¹ < S₂ - S₄₀ kg ha⁻¹ and their data 19.72, 22.29, 24.00 qha⁻¹. The grain yield qha⁻¹ showed a significant increase by the increasing levels of Azotobactor from A₀ (0gm/10kg seed) < A₁ (100gm / 10kg seed) < A₂ (200gm / 10kg seed) and their data 19.28, 22.59, 24.13 qha⁻¹. The interaction between the Sulphur, Azotobactor, on an average grain yield qha⁻¹ showed a significant Effect. The interaction between Sulphur and Azotobactor on grain yield qha⁻¹ was significant. The maximum grain yield qha⁻¹ 25.54 was recorded in S₂A₂ treatment was significantly higher than the grain yield qha⁻¹ was 15.93 recorded in S₀A₀ (control).

Effect of different treatments on chemical properties of soil : The different treatments of Sulphur and Azotobactor tended to have a marked effect on the health of soil at crop harvest.

 Table .2 : Effect of different levels of Sulphur (Gypsum)

 and Azotobactor on Grain yield (qha⁻¹)

Levels of	Lev	vels of Sulpl	nur	Mean
Azotobactor	$S_0 - S_0 kgh^{-1}$	$\mathbf{S_{1}\text{-}S_{20}}\mathbf{kgh^{-1}}$	$\mathbf{S_2}\text{-}\mathbf{S_{40}}\mathbf{kgh^{-1}}$	(A)
A ₀ @ 0g/10kg	15.93	19.78	22.14	19.28
seed (0%)				
A ₁ @100g/10kg	20.35	23.11	24.31	22.59
seed (50%)				
A ₂ @200g/10kg	22.88	23.98	25.54	24.13
seed (100%)				
Mean (L)	19.72	22.29	24.00	
		F-test	S. Em. (±)	C.D.
				at 5%
Due to Sulphur		S	0.044	0.094
Due to Azotobac	tor	S	0.044	0.094
Inter (S x A)		S	0.076	0.162

1. Soil pH (1:2 w/v):

The data presented in table clearly shows that pH of the post harvest soil ranges from 7.67 to 8.10, in comparison to the initial pH of 7.80 of the soil. The application of Sulphur resulted in decreases in soil pH with increases in the subsequent does of Sulphur, the interaction between Sulphur, with Azotobactor treatment on soil pH, was significant the lowest pH 7.67 was recorded in S_2A_2 and 7.80 in S_0A_0 treatment at A_1 and A_2 levels of Azotobactor and at L_2A_2 levels of Sulphur, the decreases in pH are due to higher growth of crops as respiration is more, respiration evolves carbon dioxide and reacts with water to form carbonic acid in soil, so resulted in decreases in pH.

Table.3.Effect of different levels of Sulphur (Gypsum) and Azotobactor on Soil pH(1:2) w/v.

Levels of	L	evel of Sulph	ur	Mean
Azotobactor	S ₀ -S ₀ kgha ⁻¹	S ₁ -S ₂₀ kgha ⁻¹	$\mathbf{S_2}\text{-}\mathbf{S_{40}}\mathbf{kgha^{-1}}$	(R)
A ₀ @ 0g/10kg	7.80	7.78	7.85	7.81
seed (0%)				
A ₁ @100g/10kg	7.82	7.82	7.77	7.80
seed (50%)				
A ₂ @200g/10kg	7.79	7.79	7.67	7.74
seed (100%)				
Mean (S)	7.81	7.79	7.76	
		F-test	S. Em. (±)	C.D.
				at 5%
Due to Azotobac	tor	NS	0.082	0.173
Due to Sulphur		NS	0.082	0.173
Inter (A x S)		NS	0.142	0.300

2. Electrical conductivity:

The EC of post harvest soil ranges from 0.20 to 0.29 dSm^{-1} .

The data with respect to EC of post harvest soil is presented in table clearly shows that the initial EC was 0.30 dSm⁻¹, the EC of post harvest soil ranges from 0.20 to 0.29 dSm⁻¹. The applied Sulphur result was as usual same in EC of post harvest soil with increasing in doses of Sulphur. The effect of EC on available EC of soil was significant, the maximum available EC of soil was 0.26 dSm⁻¹ was in S₀ levels of Sulphur combination S₂ levels of Sulphur combination was significantly less than S₀ levels of Phosphorus and Sulphur. The application of *Azotobactor* also showed significant effect on EC availability in soil, the maximum available EC 0.28 dSm⁻¹ was recorded in A₀ levels and minimum 0.21 dSm⁻¹ was recorded in A₂ levels of *Azotobactor*. The interaction between Sulphur and Azotobactor on available EC of post harvest was significant, the maximum available EC 0.29 dSm⁻¹S₀A₀ treatment which was significantly greater and is followed by 0.28 dSm⁻¹S₂A₀, minimum 0.20 dSm⁻¹ was recorded in S2A2 levels of interaction between Sulphur and Azotobactor, however, with increasing the levels of Sulphur and Azotobactor the available EC has significantly decreased thus helping in maintain EC status of soil.

 Table.4 Effect of different levels of Sulphur (Gypsum) and Azotobactor on on Soil EC (dSm⁻¹)

Levels of	Le	evel of Sulph	ur	Mean
Azotobactor	S ₀ -S ₀ kgha ⁻¹	S ₁ -S ₂₀ kgha ⁻¹	S_2 -S ⁴⁰ kgha ⁻¹	(R)
A ₀ @ 0g/10kg	0.29	0.27	0.28	0.28
seed (0%)				
A ₁ @100g/10kg	0.25	0.26	0.24	0.25
seed (50%)				
A ₂ @200g/10kg	0.23	0.21	0.20	0.21
seed (100%)				
Mean (S)	0.26	0.25	0.24	
		F-test	S. Em. (±)	C.D.
				at 5%
Due to Azotobac	tor	S	0.004	0.008
Due to Sulphur		S	0.004	0.008
Inter (A x S)		S	0.007	0.014

3. Organic Carbon (%) :

The data presented in *table*, the available Organic carbon in post harvest soil increases with application of Sulphur, the initial available Organic carbon was 0.18 %. The effect of Organic carbon on available Organic carbon of soil was significant, the maximum available Organic carbon of soil was 0.43% was in S₂ levels of Sulphur combination, S₂ levels of Sulphur combination was significantly greater than S₀ levels of Sulphur. The application of Azotobactor also showed significant effect on Organic carbon availability in soil, the maximum available Organic carbon 0.39% was recorded in A, levels and minimum 0.31% was recorded in A₀ levels of Azotobactor. The interaction between Sulphur and Azotobactor on available Organic carbon of post harvest was significant, the maximum available Organic carbon 0.51% S₂A₂ treatment, minimum 0.25% was recorded in S_0A_0 levels of interaction between Sulphur and Azotobactor, however, with increasing the levels of Sulphur and Azotobactor the available Organic carbon has significantly increased thus helping in maintain Organic carbon status of soil.

 Table.5: Effect of different levels of Sulphur (Gypsum)
 and Azotobactor on Soil Organc Carbon(%).

Levels of	L	evel of Sulph	ur	Mean
Azotobactor	S ₀ -S ₀ kgha ⁻¹	S ₁ -S ₂₀ kgha ⁻¹	$\mathbf{S_2}\text{-}\mathbf{S_{40}}\mathbf{kgha^{-1}}$	(R)
A ₀ @ 0g/10kg	0.25	0.30	0.38	0.31
seed (0%)				
A ₁ @100g/10kg	0.29	0.35	0.41	0.35
seed (50%)				
A ₂ @200g/10kg	0.31	0.36	0.51	0.39
seed (100%)				
Mean (S)	0.28	0.34	0.43	
		F-test	S. Em. (±)	C.D.
				at 5%
Due to Azotobac	tor	S	0.008	0.017
Due to Sulphur	r	S	0.008	0.017
Inter (A x S)		S	0.014	0.029

4. Soil Nitrogen(kg ha⁻¹)

The data presented in *table*, the Available Nitrogen in post harvest soil increases with application of Sulphur, the initial Available Nitrogen was 265.33 kgha⁻¹. The effect of sulphur on Available Nitrogen of soil was significant, the maximum Available Nitrogen of soil was 266.00 kgha⁻¹ was in S₂ levels of Sulphur. S₂ levels of Sulphur was significantly greater than S₀ levels of Sulphur. The application of *Azotobactor* also showed significant effect on Nitrogen availability in soil, the maximum available Nitrogen 260.66 kgha⁻¹ was recorded in A₂ levels, and minimum 256.11 kgha⁻¹ was recorded in A₂ levels of *Azotobactor*. The interaction between Sulphur and *Azotobactor* on available nitrogen of post harvest was significant, the maximum Available Nitrogen 271.33 kgha⁻¹ S₂A₂ treatment which was significantly

 Table.6:
 Effect of different levels of Sulphur (Gypsum)

 and Azotobactor on Soil Nitrogen (kgha⁻¹)

Levels of	Le	vel of Sulph	lur	Mean
Azotobactor	S ₀ -S ₀ kgha ⁻¹	$S_1 - S_{20} kgha^{-1}$	$S_2 - S_{40} kgha^{-1}($	R)
A ₀ @ 0g/10kg	250.00	257.00	261.33	256.11
seed (0%)				
A ₁ @100g/10kg	253.66	258.00	265.33	259.00
seed (50%)				
A ₂ @200g/10kg	249.33	261.33	271.33	260.66
seed (100%)				
Mean (S)	251.00	258.78	266.00	
		F-test	S. Em. (±)	C.D.
				at 5%
Due to Azotob	actor	S	0.643	1.363
Due to Sulph	ıur	S	0.643	1.363
Inter (A x S	5)	S	1.114	2.361

greater and is followed by S_2A_1 , minimum 250 kgha⁻¹ was recorded in S_0A_0 levels of interaction between Sulphur and *Azotobactor*, however, with increasing the levels of Sulphur and *Azotobactor* the Available Nitrogen has significantly increased thus helping in maintain Nitrogen status of soil.

5. Soil Phosphorus (kg ha⁻¹)

The data presented in *table*, the available Phosphorus in post harvest soil increases with application of Sulphur, the initial available was 25.33 kgha-1. The Effect of sulphur on Available Phosphorus of soil was significant, the maximum Available Phosphorus of soil was 28.66 kgha-1 was in L₂ levels of Sulphur. S₂ levels of Sulphur was significantly greater than S₀ levels of Sulphur. The application of Azotobactor also showed significant effect on Phosphorus availability in soil, the maximum Available Phosphorus 26.36 kgha⁻¹ was recorded in A, levels, and minimum 22.07 kgha-1 was recorded in A₂ levels of Azotobactor. The interaction between Phosphorus, Sulphur and Azotobactor on available Phosphorus of post harvest was significant, the maximum available Phosphorus 31.32 kgha⁻¹ S₂A₂ treatment which was significantly greater and is followed by S_2A_1 , minimum 18.33 kgha⁻¹ was recorded in S_0A_0 levels of interaction between Sulphur and Azotobactor, however, with increasing the levels of Sulphur and Azotobactor the Available Phosphorus has significantly increased thus helping in maintain Phosphorus status of soil.

Table 7. Effect	of different	levels of	Sulphur	(Gypsum)
and Az	zotobactor of	n on Soil I	Phosphor	us (kgha ⁻¹)

Levels of	Le	evel of Sulph	ur	Mean
Azotobactor	S ₀ -S ₀ kgha ⁻¹	$S_1 - S_{20} kgha^{-1}$	$\mathbf{S_{2}\text{-}S_{40}}\mathbf{kgha^{\text{-}1}}$	(R)
A ₀ @ 0g/10kg	18.33	22.55	25.33	22.07
seed (0%)				
A ₁ @100g/10kg	19.20	23.66	29.33	24.06
seed (50%)				
A ₂ @200g/10kg	21.33	26.44	31.32	26.36
seed (100%)				
Mean (S)	19.62	24.22	28.66	
		F-test	S. Em. (±)	C.D.
				at 5%
Due to Azotoba	ctor	S	0.286	0.605
Due to Sulphu	ır	S	0.286	0.605
Inter (A x S)		S	0.495	1.048

6. Soil Potash (kg ha⁻¹)

The data presented in *table*, the available Potash in post harvest soil increases with application of Sulphur, the initial Available Potash was 25.33 kgha⁻¹, the effect of Potash on available Potash of soil was significant, the maximum available Potash of soil was 104.00 kgha⁻¹ was in S₂ levels of Sulphur , S₂ levels of Sulphur was significantly greater than S₀ levels of Sulphur. The application of *Azotobactor* also showed significant effect on Potash availability in soil, the maximum available Potash 104.00 kgha⁻¹ was recorded in A₂ levels and minimum 101.17 kgha⁻¹ was recorded in A₀ levels of *Azotobactor*. The interaction between Sulphur and *Azotobactor* on Available Potash of post harvest was significant, the maximum available Potash of post harvest was significant, the maximum available Potash 106.23 kgha⁻¹ S₂ A₂ treatment which was significantly greater and is followed by 104.26 kgha⁻¹ S₂A₁, minimum 99.99 kgha⁻¹ was recorded in S₁A₀ levels of interaction between Sulphur and *Azotobactor*. However, with increasing the levels of Sulphur and *Azotobactor* the Available Potash has significantly increased thus helping in maintain Potash status of soil.

 Table .8: Effect of different levels of Sulphur (Gypsum)

 and Azotobactor on Soil Potash (kgha⁻¹)

Levels of	Le	evel of Sulph	of Sulphur			
Azotobactor	S ₀ -S ₀ kgha ⁻¹	$S_1 - S_{20} kgha^{-1}$	S_2 - S_{40} kgha ⁻¹	(R)		
A ₀ @ 0g/10kg	99.99	101.16	102.36	101.17		
seed (0%)						
A ₁ @100g/10kg	101.11	103.46	104.26	102.94		
seed (50%)						
A2@200g/10kg	102.21	103.57	106.23	104.00		
seed (100%)						
Mean (S)	101.10	102.73	104.28			
		F-test	S. Em. (±)	C.D.		
				at 5%		
Due to Azotob	actor	S	0.571	1.210		
Due to Sulpl	hur	S	0.571	1.210		
Inter (A x S	5)	NS	0.988	2.095		

7. Soil Sulphur (ppm)

The data presented in *table*, the available Sulphur in post harvest soil increases with application of Sulphur, the initial Available Sulphur was 6.42 (ppm). The effect of Sulphur on Available Sulphur of soil was significant, the maximum Available Sulphur of soil was 7.75 (ppm) was in S₂ levels of Sulphur, L₂ levels of Sulphur was significantly greater than S₀ levels of Sulphur. The application of Azotobactor also showed significant effect on Sulphur availability in soil, the maximum Available Sulphur 7.52 (ppm) was recorded in A₂ levels, and minimum 6.78 (ppm) was recorded in A₀ levels of Azotobactor. The interaction between Sulphur and Azotobactor on Available Sulphur of post harvest was significant, the maximum Available Sulphur 8.01 (ppm) S₂A₂ treatment which was significantly greater and is followed by 7.82 (ppm) S_2A_1 , minimum 6.20 (ppm) was recorded in S₁A₀ levels of interaction between Sulphur and Azotobactor, however, with increasing the levels of Sulphur and *Azotobactor* the Available Sulphur has significantly increased thus helping in maintain Sulphur status of soil.

Table.9:	Effect of different levels of Sulphur (Gypsum)
	and Azotobactor on Soil Sulphur (ppm).

Levels of	Level of Sulphur					
Azotobactor	S ₀ -S ₀ kgha ⁻¹	$\mathbf{S_{1}}\textbf{-}\mathbf{S_{20}}\mathbf{kgha^{-1}}$	$\mathbf{S_2}\text{-}\mathbf{S_{40}}\mathbf{kgha^{\text{-}1}}$	(R)		
A ₀ @ 0g/10kg	6.72	6.20	7.42	6.78		
seed (0%)						
A ₁ @100g/10kg	6.33	6.31	7.82	6.82		
seed (50%)						
A ₂ @200g/10kg	7.21	7.33	8.01	7.52		
seed (100%)						
Mean (S)	6.75	6.61	7.75			
		F-test	S. Em. (±)	C.D.		
				at 5%		
Due to Azotobactor		S	0.275	0.583		
Due to Sulphur		S	0.275	0.583		
Inter (A x	S)	NS	0.477	1.010		

CONCLUSION

On the basis of above findings it may be concluded that the treatment combination (Sulphur @40kgha⁻¹ +200g Azotobactor/10 kg seed) shows best result with respect to growth, yield, Nutrient concentration and Fertility status of soil in comparison to other treatment combinations. Though there is however need to confirm the results and to work out particularly the extent of increases in grain yield, with added Sulphur and Azotobactor.

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Study of different Soil Profiles and their Physico-chemical properties around Bundelkhand region in Uttar Pradesh

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ABSTRACT

The present investigation was undertaken with deferent soil profiles (0-10, 10-20. 20-30, 30-40 and 40-50 cm.) to evaluate the fertility status of 5 districts at Chitracoot, Mahoba, Jhansi, Hamirpur and Banda of Bundelkhand region in Uttar Pradesh to characterize their Physico-chemical properties of soils. Analyzed the soil in different districts was found that the soil coloure (10YR, 5/4 Yellowish Brown, 5YR, 4/4 Reddish Brown, 5YR, 4/6 Yellowish Red, 5YR, 4/1 Dark Gray and 2.5Y 5/4 Light Olive Brown) in Hamirpur and Banda district are better than other districts. The sand (8.5-72%) and sand (72%) highest to Jhansi district, Silt (20.55-51.14%) and Silt (51.14%) highest to Banda district, and clay (6.76-68.45%) and clay (68.45%) highest to Hamirpur district in comparison to other district. The Bulk densities are (1.10-2.16 Mg m³) highest Bulk density (2.16 Mg m⁻³), Particle density (2.10-4 Mg m⁻³) and highest Particle density (4 Mg m⁻³) and Pore space are (36.5-64.7%) and highest % of pore space (64.7%) of Chitracoot (A) district in comparison to other district. The pH value of study area varied from 6.5-8.26 and the highest soil pH (8.26) to Jhansi district in comparison to other district, The Electrical conductivity is ranged from 0.05-0.27 dSm-1and highest Electrical conductivity (EC) (0.27 dSm⁻¹) to Chitracoot district, The Organic carbon are ranged from (0.16-1.19%) and highest Organic carbon (1.19%) to Hamirpur district, organic matter are ranged from (0.27-2.05%) and organic matter (2.05%) to Hamirpur district, The available Nitrogen are ranged from (106.27-256.8 kg ha⁻¹) and the highest available Nitrogen (256.8 kg ha⁻¹) in Jhansi district, The available Phosphorus are ranged from (10.58-24.38 kg ha⁻¹) and the highest available Phosphorus (24.38 kg ha⁻¹) in Chitracoot, The available Potassium are ranged from (180.63-295.14Kg.ha⁻¹) and the highest available Potassium (295.14 kg ha⁻¹) in Hamirpur district comparison to other districts, the soils of study area were found soil fertility statues in black soil organic matter is high and available Nitrogen and Phosphorus low and available Potassium is high in Bundelkhand soils.

Key word: Soil fertility, Soil Profiles, Physical Properties and Chemical Properties.

INTRODUCTION

The Bundelkhand Region of central India is a semi-arid condition that encompasses 6 districts of northern Madhya Pradesh (MP) and 7 districts of southern Uttar Pradesh (UP). It is located in the central Hind belt south of the Yamuna River, between the fertile Gangetic plain stretching across northern UP and the highlands of central MP. Bundelkhand is an old landmass composed of horizontal rock beds resting on a stable foundation (**Singh** *et al.* **2002**).

The major part of the rainfall is received during the month of July and August. The length of growing season in Bundelkhand ranges between 90 to 150 days depending upon rainfall and temperature regimes. The winter rains are erratic, occasional, meager and uncertain. The total rainy days/year vary from 30-45 in the region with an average of 37. The distribution of rainfall is very erratic. Low rainfall and drought are common features. Long dry spells during rainy season are also experienced often, which adversely affect the crops. It has been observed that in a cycle of 5 years, 2 are normal, 2 drought years and 1 is excessive rainfall year (**Tiwari** *et al.* **1998**).

These soils lying in the Bundelkhand region of the state constitute nearly 10.9 per cent of the total area of the state. They have developed from Vindhayan rocks abounding in gneiss and granites of the Deccan trap with highly ferruginous beds and often soft lime stone. Above an impervious layer of rock that is found at depths of 6 to 15 meters, several kinds and grades of soil are found across Bundelkhand. Broadly, the soils fall into two categories: red soils and black soils. Across Bundelkhand, soils of both categories have poor organic content. Red soil, locally called pathari, are found over granites, from which it is derived, and is seen in shades of brown, yellow or grey, depending on the iron content. The soil is rich in potash, but has poor phosphate and nitrogen constituents. It is hence not suitable for farming; some varieties of trees can however be grown in it. A yellowish, light-colored variety of red soil, called parua, is sandy and has some clay content. It is well aerated and easily accepts water. Parua soil is found across UP Bundelkhand and is suited for cultivation of wheat. Two kinds of black soils are found Bundelkhand. The first, known as kabar, resembles black cotton soils of central India. Its colour varies from dark black to grey black and brownish black. It has high clay content; hence it is highly adhesive, retains moisture, and quickly turns dry and into hard blocks (FAO, 1993).

Physical properties of black and associated soils particlesize distribution, namely sand, silt, clay and bulk density (BD were determined. The chemical properties of black soils include pH, electrical conductivity (EC) and organic carbon. The basic property of Vertisols is that they have high waterholding capacity. This is controlled primarily by the relative proportion of different soil-size fractions. Vertisols are usually dominated by clay, which commonly ranges from 40 to 60%, but may be as high as 80% (**Dudal 1965; DeVos and Virgo 1969; Bhattacharyya** *et al.* **2003**).

In general, surface soils show low amount of clay that increases with depth. Clay content of black soils is uniformly high to a depth of 50 cm (**Raychaudhuri** *et al.* **1963, Dudal 1965, Yule and Ritchie 1980**).

With additional specifications of the mean annual soil temperature and duration of the period in which the control section of the profile remains moist or goes dry, the ustic regime typifies tropical regions with a monsoon climate that has at least one rainy season lasting 3 months or more in a year. Alfisols usually possess an argillic horizon within the profile, which means that the clay content of these soils increases with depth. Shallow and gravelly Alfisols-A result of erosion-are also common. Such Alfisols are distinguished from Ultisols by the high base saturation of their control section (>35%). The enrichment of surface layers with coarse particles is assumed to be the result of clay migration with percolating water, termite activity, and/or selective removal of fine particles by erosion. Effective rooting depths of crops are limited either by the shallow soil depth down to the murrum layer, or by the compact argillic horizon that may restrict water and root penetration. The criteria for characterizing Alfisols are so flexible that many diverse soils are included in this taxonomic order. This is particularly true of the argillic horizon criterion (Naga et al. 1983).

MATERIALS AND METHODS

Area of Study:

The Bundelkhand falls in Vindhayan hilly tract and surrounded by Betwa, Dhasan, Pahuj and Jamuna, Mandakini, Sind, Lechery, Kene rivers. The entire Bundelkhand is situated in Vindhayan hills and ravines, catchment of Betwa, Yamuna. The Bundelkhand lies in hilly track, in Southern plate and North East part with plain land and ravinous in the middle. The soil profiles are collected between 24° 48' and 26° 26' N latitude and 78° 09' and 81° 33' E longitude with an average elevation of 613 m above Mean Sea Level (MSL). Bundelkhand Region is administratively divided into 5 districts in part of Uttar Pradesh.

These are Jhansi, Lalitpur, Mahoba, Banda and Chitracoot districts. The location of the selected area is shown in *Fig.1*.



Fig.1: Location Map of study aria of Bundelkhand region in Uttar Pradesh (India).

Climate and Soils:

Table3.3: Dynamics of average maximum temperature (Degree Celsius).

Parameters	Nov.	Dec.	Jan.	Feb.
1975-84	29.5	24.1	23.2	26.5
1985-94	29.4	24	23.5	26.6
1995-2006	29.9	24.7	21.6	25.9
2007-2013	30.2	24.9	21.8	26.2

Source: Indian Grassland and Fodder Research Institute, National Research Centre for Agro forestry's, Jhansi and IMD, Pune).

The average rainfall of Jhansi district is 877.4 mm (1944-2009) with average rainy days of 44. Out of 66 years, 35 years received less than the average rainfall. In spite of the fairly decent average rainfall of the districts, its uncertainty and erratic behavior leads to dry spells causing droughts. There has been severe drought, a famine like situation from 2004 until 2007. The uncertainty in the rainfall is the main reason of poor agriculture yield. Rain is also received in a very small amount during November to May, but this rain is very important for agriculture in this region. This rain is called "Mahawat" in the vernacular language.

The soil of the Bundelkhand is mostly red morramy soil sandy, black cotton, rocker. Most of the area is stony with sand stone beds around 7 - 10 ft. down.

Sample Collection:The soil sample collected should be representative of the area sampled. Soil samples collected from deferent soil profiles in five depths (0-10, 10-20, 20-30, 30-40 and 40-50 cm.) at five districts (Chitracoot, Mahoba, Jhansi, Hamirpur and Banda) of Bundelkhand region in Uttar Pradesh. Separate sets of composite samples need to be collected from each such area. Recently fertilized plot, bunds, channels, marshy tracts and spots near trees, wells, compost piles or other non-representative locations must be avoided during sampling. If a spade/ Khurpi is used, a V-shaped cut may be first made up to the plough layer and a uniform 1.5 cm thick slice taken out. The collected soil sample should be thoroughly mixed on a clean piece of cloth, polythene sheet or thick paper and kept it in with suitable description and identification marks.

Soil Profiles:



Fig. 3.10: Collection of soil Profiles in deferent soils of Bundelkhand region.

Preparation of Sample for Analysis:

A sample, brought to the laboratory, is spread out on an aluminum tray, plastic or thick brown paper. Collected soil samples were air dried in shade, crushed gently with a wooden roller and then pass through 2.0 mm sieve to obtain a uniform representative sample. The material larger than 2 mm is discarded. The soil samples are grinding, queering, quatring, and then selected 500 g. soil samples for analysis. They were stored with proper labeling in polythene bags for Physico-chemical analysis.

Soil parameters:

The soil samples were analyzed for the Physico-chemical properties i.e. Soil color, soil Texture, Particle density, Bulk density, Pore space (%), Soil pH, EC, Organic carbon, Organic matter, and Macronutrients.

Physico-chemical analysis:

Samples were properly labelled with the aluminium tag and stored in polythene bags for analysis. The processed soil samples were analyzed by standard methods for Physical/Mechanical analysis Determination of soil texture by Bouyoucous Hydrometer method, Determination of the Bulk density, Particle density and Pore space of given soil sample by 100 ml. measuring cylinder (**BLACK 1965**), and Chemical analysis pH and electrical conductivity (1:2 soil water suspensions), Organic carbon, Organic matter (**Walkley and Black, 1934**), available nitrogen (**Subbiah and Asija, 1956**), available phosphorus (**Olsen et al. 1954**), available potassium (**Jackson, 1973**).

RESULTS AND DISCUSSION

This chapter presents the results obtained during the investigations carried out in the field and laboratory, are reported under the following headings.

Morphological characteristics:

The soil color was determined by Mussel soil color chart. (Anonymous, 1971) Mussel soil color chart Inc. 2441 N, Calvert Street, Baltimore, Maryland 2/2/2, USA. And described in Hand book of (USDA), 1994.

Name of District	0-10 (cm.)	10-20 (cm.)	20-30 (cm.)	30-40 (cm.)	40-50 (cm.)
Chitracoot (A)	7.5YR, 4/4	7.5YR, 4/5	7.5YR, 6/4	7.5YR, 6/4	7.5YR, 5/6
	Dark Brown	Brown	Light Brown	Light Brown	Strong Brown
Chitracoot (B)	10YR, 5/4	10YR, 5/3	10YR, 6/4	10YR, 6/3	10YR, 7/3 Very
	Yellowish Brown	Brown	Light Brown	Pole Brown	Pole brown
Mahoba (C)	5YR, 4/4	2.5YR, 5/6 2.5YR, 4/6		2.5YR, 3/6	2.5YR, 3/6
	Reddish Brown	Light Red	Red	Dark Red	Dark Red
Jhansi (D)	5YR, 4/6	5YR, 4/6	10YR, 4/4 Dark	5YR, 5/4	5YR, 5/4
	Yellowish Red	Yellowish Red	Yellowish Brown	Reddish Brown	Reddish Brown
Hamirpur (E)	5YR, 4/1	5YR, 3/4 Very	5Y, 2.5/1	5Y, 2.5/1	5Y, 2.5/1 Black
	Dark Gray	Dark Gray	Black	Black	Black
Banda (F)	2.5Y, 5/4 Light	2.5Y, 3/4	5Y, 5/3	10YR, 6/4 Light	10YR, 6/3
Olive Brown Light		Light Olive	Olive	Yellowish Brown	Pole Brown

Soil Texture (Sand, Silt and Clay%) Analysis of soil texture was done by Bouyoucos hydrometer method (Bouyoucos, 1927).

Determination of Soil Texture (Sand, Silt and Clay %) of soils from (0-10, 10-20, 20-30, 30-40 and 40-50 cm.) of different districts of Bundelkhand region in U.P. The soil depths of different location of study area were non significantly whereas the soil of different places were significantly in fewer of Soil Texture (Sand and silt %). And the soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Soil Texture (Clay %).

Determination of Bulk density, Particle density and percents of Pore space of soils from (0-10, 10-20, 20-30, 30-40 and 40-50 cm.) of different districts of Bundelkhand region in U.P. The soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Bulk density (gcm⁻³). The maximum average Bulk density (gcm-3) was 1.50 gcm-3 in Chitracoot (A) and the minimum average was 1.24 Bulk densities (gcm⁻³) in Mahoba (C) district soil. The maximum Bulk density 2.16 gcm⁻³ was obtained at the depth of 40-50 cm in Chitracoot (A) and the minimum Bulk density was obtained 1.10 gcm⁻³ at the depth of 0-10 cm in Chitracoot (A) district, Particle density (gcm⁻³). The maximum average Particle density was 3.37 gcm⁻³ in Chitracoot (A) and the minimum average was 2.13 g cm⁻³ Particle density (gcm⁻³) in Mahoba (C) district soils. The maximum Particle density 4.0 g.cm⁻³ was obtained at the depth of 40-50 cm. in Chitracoot (A) and the minimum Particle density was obtained 2.10 gcm⁻³ at the depth of 30-40 cm in Mahoba (C) district, and The maximum average Pore space was 55.93 percent in Chitracoot (A) and the minimum average Pore space was 41.75 percent in Mahoba (C) district soil. The maximum Pore space was obtained 64.70 percent present at the depth of 0-10 cm. in Chitracoot (A) and the minimum Pore space was obtained 36.5 percent present at the depth of 40-50 cm. in Mahoba (C) district of Bundelkhand soil profiles are increases in respect to depths of soil. The Bundelkhand region comes under low and medium of soil Bulk density, Particle density, and Pore space in deferent soils.

Descriptive statistics of Soil pH of soils from (0-10, 10-20, 20-30, 30-40 and 40-50 cm.) of different districts of Bundelkhand region in U.P. The soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Soil pH. The maximum average Soil pH was 8.26 in Jhansi (D) and the minimum average Soil pH was 7.21 in Mahoba (C) district soil. The maximum Soil pH was obtained 8.26 % at the depth of 40-50 cm. in Hamirpur (D) Soil pH was obtained 8.65 % present at the depth of 0-10 cm. in Mahoba (C) district, The soil depths of different location of study area were significant

whereas the soil of different places were significantly in fewer of Electrical conductivity. The maximum average Electrical conductivity was 0.22 in Chitracoot (A) and the minimum average Electrical conductivity was 0.08 in Banda (F) district soil. The maximum Electrical conductivity was obtained 0.27 present at the depth of 0-10 cm. in Chitracoot (A) Electrical conductivity was obtained 0.05 at the depth of 40-50 cm. in Banda (F) district, The soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Organic carbon. The maximum average Organic Carbon was 0.87 percent in Hamirpur (E) and the minimum average Organic carbon was 0.38 percent in Mahoba (C) district soil. The maximum Organic carbon was obtained 1.19 present at the depth of 0-10 cm. in Hamirpur (C) and minimum Organic carbon was obtained 0.315 percent at the depth of 40-50 cm. in Banda (F) district and The soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Organic matter. The maximum average Organic matter was 1.49 percent in Hamirpur (E) and the minimum average Organic matter was 0.64 percent in Mahoba (C) district soil. The maximum Organic matter was obtained 2.05 present at the depth of 0-10 cm. in Hamirpur (C) and minimum Organic matter was obtained 0.64 percent at the depth of 40-50 cm. in Banda (F) district. The Organic matter of Bundelkhand soil profiles are decreases in respect to depths of soil.

Descriptive statistics of Soil Nitrogen (Kg.ha⁻¹) of soils from (0-10, 10-20, 20-30, 30-40 and 40-50 cm.) of different districts of Bundelkhand region in U.P. The soil depths of different location of study area were non significant whereas the soil of different places were non significantly in fewer of Nitrogen (Kg.ha⁻¹). The maximum average Nitrogen (Kg.ha⁻¹) was 177.14 Kg. ha⁻¹ in Jhansi (D) and the minimum average Nitrogen was 136.38 Kg.ha⁻¹ in Banda (F) district soil. The maximum Nitrogen (Kg.ha⁻¹) was obtained 256.8 Kg.ha⁻¹ present at the depth of 40-50 cm. in Jhansi (C) and minimum Nitrogen (Kg.ha⁻¹) was obtained 106.27 Kg.ha⁻¹ at the depth of 40-50 cm. in Chitracoot (B) district, The soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Phosphorus (Kg.ha⁻¹). The maximum average Phosphorus (Kg.ha⁻¹) was 22.22 Kg.ha⁻¹ in Chitracoot (A) and the minimum average Phosphorus was 13.44 Kg.ha⁻¹ in Banda (F) district soil. The maximum Phosphorus (Kg.ha⁻¹) was obtained 24.38 Kg.ha⁻¹ present at the depth of 0-10 cm. in Chitracoot (A) and minimum Phosphorus (Kg.ha⁻¹) was obtained 10.58 Kg.ha⁻¹ at the depth of 40-50 cm. in Banda (F) district and The soil depths of different location of study area were significant whereas the soil of different places were significantly in fewer of Potassium (kg.ha⁻¹). The maximum average Potassium (Kg.ha⁻¹) was 296.58 kg ha⁻¹ in Jhansi (D) and the minimum average Potassium was 230.47 Kg.ha⁻¹ in Chitracoot (B) district soil. The maximum Potassium (Kg.ha⁻¹) was obtained 295.14 Kg.ha⁻¹ present at the depth of 0-10 cm. in Hamirpur (E) and minimum Potassium (Kg.ha⁻¹) was obtained 180.63 Kg.ha⁻¹ at the depth of 40-50 cm. in Mahoba (C) district. The Nitrogen, Phosphorus and Potassium (Kg ha⁻¹) of Bundelkhand soil profiles are decreases in respect to depths of soil.











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CONCLUSION

Among the various study we found all parameters like Physical properties (Soil Coloure, Texture, Water holding capacity, Bulk density, Particle density, and pore space,) and Chemical properties (soil pH, Electrical conductivity, Organic carbon, Organic matter, Available Nitrogen, Available Phosphorus, and Available Potassium) of Bundelkhand region in Uttar Pradesh. The best for agriculture purpose to Hamirpur and Banda districts soils. Results indicated that Nitrogen and Phosphorus deficiency and Potassium dominant in Bundelkhand soils.

Result of the present investigation as available macronutrients will help in realizing the need of desired irrigation water, Nitrogen, Phosphorus for crop productivity of the area by Manures and Fertilizers. There is also need for stabilizing sources, levels and methods of most limiting macronutrients on Bundelkhand soils.

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Comparision of Biochemical Constituents in the leaves and roots of two varieties of Clitoria ternatea

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ABSTRACT

The present study was carried out to compare the biochemical constituents i.e., protein, carbohydrate, total ash, crude fibre, minerals (phosphorus and iron) ascorbic acid, total phenol, total flavonoid and proline content in purple and white flowered varieties of Clitoria ternatea. Clitoria ternatea purple flowered variety showed higher total ash, phosphorus, and proline content as compared to Clitoria ternatea white flowered variety, whereas Clitoria ternatea leaves of white flowered showed higher carbohydrate, protein, iron, ascorbic acid, total phenol and total flavonoid content as compared to purple flowered variety showed higher content of total ash, total phenol, total flavonoid and proline as compared to white flowered variety, whereas white flowered variety roots showed higher crude fibre, carbohydrate, protein, mineral, ascorbic acid and activities of catalase and ascorbic acid oxidase as compared to purple flowered variety.

Key Words: Clitoria ternatea and biochemical parameters.

INTRODUCTION

Clitoria ternatea belongs to the family Fabaceae and is distributed in tropical Asia, Philippines Islands and Madagascar. It is an ornamental perennial climber with conspicuous blue or white flowers. In India, it is commonly called butterfly pea. It is a highly palatable forage legume, generally preferred by livestock over other legumes. It is also used as a cover crop or green manure. The plant is considered as a good brain tonic and is useful for throat and eye infection, skin diseases, ulcer and antidotal properties (**Malabodi and Nataraja**, 2001). The extract of Clitoria ternatea was found to have anxiolytic, antidepressant, anticonvulsant and antistress properties.

MATERIALS AND METHODS

Collection of Sample

The plants of two Clitoria ternatea varieties (purple and white flowered) were procured from the local nursery, Civil lines, Allahabad.

Extraction of sample

The leaves and roots of two Clitoria ternatea varieties were washed under tap water separately. The leaves and roots were cut into small pieces and then dried under shade. The dried samples were used for proximate analysis.

Biochemical Analysis

The total ash content was determined according to **AOAC** (1990). The total protein content was analysed by using the method of **Lowry** *et al.* (1951) and total carbohydrate content was determined by the method of **Hedge and Hofreiter** (1962).

Total amount of phosphorus was determined by method of **Fiske and Subba Row (1925)** and the amount of iron was estimated by the method of **Piper (1950)**. The method for the determination of ascorbic acid has been given by **Harris and Ray (1935)**. Flavonoids content was estimated according to the method given by **Chang et al. (2002)**. Total phenol content was estimated according to the method given by **Bray et al. (1954)**. Proline was estimated according to the method given by **Bates et al. (1978)**.

RESULTS AND DISCUSSION

In the present study maximum total ash was found to be 3.76% in leaves of white flowered and 1.99% in leaves of purple flowered variety; whereas in case of roots the total ash was found to be 2.79% in purple flowered variety followed by purple flowered (2.28%). The results of the study are in accordance to **Ullah** *et al.* (2013) who observed the total ash content in whole part of Alhagi maurorum which was 12.66%. Similarly **Ponnuswamy** *et al.* (2011) determined the total ash content in leaves of Clitoria ternatea which was 9.95 mg/ 100g.

The maximum crude fibre was found to be 3.43% in leaves of white flowered and 3.4% in purple flowered. Whereas in case of roots among the two varieties of Clitoria ternatea, white flowered showed maximum increase 2.21% in crude fibre content followed by purple flowered (1.94%). The results of the present study are in agreement with those of **Mahala** *et al.* (2012) who observed the total crude fibre in whole plants of Clitoria ternatea which was 25%. The carbohydrate content was maximum 28.12mg/100g in leaves of white flowered whereas in leaves of purple flowered 26.09mg/100g. In case of roots the maximum carbohydrate 25.25mg/100g was reported in white flowered and 24.24mg/ 100g in purple flowered variety. The results of the present study are similar to those of **Ponnuswamy** *et al.* (2011) who also observed that the amount of total carbohydrate in leaves of Clitoria ternatea was 32.41 mg/100gm and accordingly Ullah et al. (2013) observed the total carbohydrate in whole part of Alhagi maurorum which was 56.52%.

The present study showed maximum protein 10.7 mg/100g in white flowered and 9.143 mg/100g in purple flowered leaves. In case of roots the protein content was found to be 8.433 mg/100g in white flowered and 7.57 mg/100g in purple flowered variety. The results of the present study can be supported by those of **Ponnuswamy** *et al.* (2011) who also observed that the amount of total protein in leaves of Clitoria ternatea was 9.62 mg/100gm and concordantly to **Ullah** *et al.* (2013) who observed the total carbohydrate in whole part of Alhagi maurorum as 6.56 %.

The phosphorus content in the present study was $409.33(\mu g/g)$ in leaves of purple flowered and $205.67(\mu g/g)$ in leaves of white flowered. Whereas in case of roots the phosphorus content was $135.6(\mu g/g)$ in white flowered and $103(\mu g/g)$ in purple flowered variety. The observations made here are in agreement with those of **Khanzada** *et al.* (2008) who also observed 30 mg/kg phosphorus in whole plant of Tamarindus indica.

The maximum iron content here was $2.38\mu g/g$ in leaves of white flowered and $2.29 \ \mu g/g$ in purple flowered variety. Whereas in case of roots of two varieties of Clitoria ternatea the iron content was $1.187\mu g/g$ in white flowered and $0.883 \ \mu g/g$ in purple flowered variety. The results of the present

study can be supported by those of **Jayachitra and Padma** (2012) who observed that 1.9 ppm iron in leaves of blue flowered variety of Clitoria ternatea and 1.1 ppm in leaves of blue flowered variety of Clitoria ternatea. Similarly **Khanzada** *et al.* (2008) also observed that 14.07 mg/kg iron content in whole plant of Tamarindus indica.

The present study showed maximum level of ascorbic acid 114.133 mg/100g in leaves of white flowered 108.5 mg/100g in leaves of purple flowered . Whereas in case of roots of two varieties of Clitoria ternatea the maximum ascorbic acid 98.97 mg/100g in purple flowered and 93.5 mg/100g in white flowered.The observations made on the parameter are in agreement with those of **Sharma** *et al.* (2013) who also observed 0.04 mg/g ascorbic acid in roots of Cassia nodosa.

The total flavonoids here were 43.06 mg/100g in leaves of white flowered and 38.93 mg/100g in purple flowered. In case of roots the total flavonoids was found to be 33.47 mg/100g in purple flowered and 32.59 mg/100g in white flowered. Accordingly similar results were observed by **Zafar** *et al.* (2011) regarding total flavonoids in whole plant of Mimosa pudica which was 27.263 μ g/mg.

In the present work total phenol content was found to be 43.06 mg/g in leaves of white flowered 38.73 mg/g in leaves of purple flowered. Whereas in case of roots total phenol 33.6 mg/g in purple flowered and 32.15 mg/g in white flowered. The observations made on this parameter are concordant with those of **Rabeta and Nabil (2013)** who observed 18.5 mg GAE/g total phenol content in aqueous extracted leaves of Clitoria ternatea and 64.8 mg GAE/g total phenol content in methanolic extracted leaves of Clitoria ternatea. **Zafar** *et al.* (2011) also observed the amount of total phenol content 71.23 mg/g gallic acid in whole parts of Mimosa pudica.

Biochemical parameters	Lea	ives	Ro	oots
	PF	WF	PF	WF
Total ash contents (%)	1.99±0.02	3.76±0.42	2.79±0.35	2.28±0.24
Total crude fibre (%)	3.4±0.40	3.43±0.45	1.94 ±0.57	2.21 ±0.18
Carbohydrate contents (mg/100g)	26.09±0.2	28.12±0.19	24.24±0.13	25.25±0.27
Protein content (mg/100g)	9.14±0.29	10.77±0.46	7.58±0.26	8.43±0.44
Ascorbic acid (mg/100g)	108.5±0.7	114.1±4.53	93.5±0.3	98.9±0.49
Phosphorus (µg/g)	409.33±11.01	205.66±6.80	103±5.29	135.66±20.20
Iron (µg/g)	2.29±0.74	2.38±0.37	0.88±0.1	1.19±0.15
Total flavonoids content(mg/100g)	38.93±0.49	43.06±0.70	33.47±0.06	32.59±0.34
Total phenol content(mg/g)	38.74±0.57	43.06±0.70	33.6±0.35	32.15±0.11
Proline content(µg/g)	3.13±0.21	2.1±0.2	2.53±0.06	1.7±0.2

 Table 1: Biochemical constituents in leaves and roots of PF (Purple flowered) and WF (White flowered) varieties of Clitoria ternatea

Note: Data have been reported as mean \pm standard deviation (n=3).

Here maximum proline was $3.132 \,\mu$ g/g in leaves of purple flowered and 2.1 μ g/g white flowered variety. Whereas in case of roots proline content was 2.53 μ g/g in purple flowered and 1.7 μ g/g in white flowered variety. The observations made on the parameter are in agreement with **Pugalenthi** *et al.* (2007) who also observed proline content 1.12 g/100g in whole plant of Tamarindus indica and 2.80 g/100g in whole plant of Erythrina indica.

CONCLUSION

From the above study it can be concluded that the white flowered variety is a more potent source of antioxidants than purple flowered variety of Clitoria ternatea.

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Estimation of Purity of Morphine content in Opium samples obtained From different Districts of Uttar-Pradesh

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ABSTRACT

The purity of Opium Samples was determined as per British Pharmacopoeia method obtained from Forensic Science Laboratory, Lucknow, which was seized from four Districts of Uttar-Pradesh. Their purity percentages were tested to determine the quality of opium. After analysis it was found that opium samples of district Barabanki and Bareilly containing more morphine 4.12-5.49% and 4.2-5.2% respectively as compared to that of other Districts viz. Rae-Bareli, Bahraich and Lucknow having range of 2.4-3.4 %, 2.64-3.40 % and 1.2-2.4 % of morphine in sample of respective districts.

Key Words- Opium, Morphine, Narcotic Drugs,

INTRODUCTION

Narcotic drugs are analgesic i.e. they relieve pain by exerting a depressing action on Central Nervous System. Regular use of narcotic analgesic invariably leads to physical dependence, addition with all its dire consequences. The chief source of most narcotic analgesic is opium, the air dried latex obtained by incision from unripe fruit capsule of plant 'Papaver somniferum Linn.' The plant grows in most of the parts of Asia.Opium contains two main groups of alkaloids-Phenanthrenes which include morphine, codeine, and thebaine having significant effect on Central Nervous System.

Morphine is an amphoteric pentacyclic alkaloid that exists naturally in its levorotatory form as columnar colourless prism. It has five chiral carbons the naturally occurring disteriomer a biologically active compound. The purity test of opium was performed first by **Ramanathan and Ramchandran (1974)** who studied the effect of temperature on the estimation of morphine. Six Samples of opium taken from Barabanki (U.P.), Ratlam (M.P.), Kota and Jhalwad (Rajasthan) analysed. They found that the morphine in the opium samples were the highest at 20°-21°C in the month of January were as lowest at 38°-39°C in the month of June. **Cordell (1981).**

The present work was undertaken to find the purity of samples seized from different districts of Uttar Pradesh to assess the quality of the samples.

METHODOLOGY

Small amount of seized samples were taken and dissolved in distilled water, left for 1-1.5 hrs. The contents were filtered and tested with following reagents-

- 1. Meconic Acid Test- To a small amount of aqueous extract of opium 2-3 drops of neutral ferric chloride solution was added and colour was observed.
- 2. Test with Mayer's Reagent- To a small amount of aqueous extract of opium 2-3 drops of mayer's reagents was added and colour was observed.

Quantitative analysis of morphine in opium-

8.0 g opium sample was taken in mortar and 2.0 g calcium oxide was added to it. Sample and lime was mixed with the help of 30 ml water. This paste was transferred to ground glass stoppered bottle with the help of 50 ml water, so that quantity becomes 90 ml. This mixture was shaken thoroughly and than occasionally for half an hour. After thorough shaking the contents were filtered and 52 ml quantity of content were taken, representing 5 g of opium.

2 g Ammonium Chloride was added to filtrate and the filtrate was transferred to conical flask, 5 ml ethyl alcohol and 25 ml solvent ether was added, mixed and contents were allowed to stand overnight for crystallisation in a refrigerator.

After crystallisation, ether layer was decanted and the bottle was plugged with cotton plug. The contents of flask were again rinsed with ether solvent and ether layer was separated with the help of cotton plug, taking care that no crystal got disturbed. Then both the flask and the plug were washed with distilled water so that crystals did not get dissolved. Contents of the flask were mixed with 10 ml 0.1N sulphuric acid and boiled on water bath and than cooled down, The contents was titrated against 0.1N potassium hydroxide using methyl-red as an indicator till orange colour end point.

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RESULTS AND DISCUSSION

The percentage of morphine in opium samples were found ranging between 5.49% - 1.2%. This amount was calculated using British Pharmacopoeia method.

District from	Sample	Amount of	0.1N sulphuric	0.1N potassium	Sulphuric acid	Percentage
which opium	no.	Sample	acid	hydroxide	consumed	of morphine
seized		taken (g)	taken(ml)	used (ml)	(ml)	
	1	8	10	2.9	7.1	5.09%
	2	8	10	3.1	6.9	4.5%
Barabanki	3	4	10	6.1	$3.9 \times 2 = 7.8$	5.49%
	4	4	10	7.3	$2.7 \times 2 = 5.4$	4.12%
	5	8	10	2.6	7.3	5.2%
	6	8	10	3.3	6.7	4.8%
Bareilly	7	4	10	7.0	$3.0 \times 2 = 6.0$	4.46%
	8	4	10	7.2	$2.8 \times 2 = 5.6$	4.26%
	9	8	10	6.8	3.2	2.8%
	10	8	10	7.1	2.9	2.6%
Raebareli	11	4	10	7.9	$2.1 \times 2 = 4.2$	3.4%
	12	4	10	8.8	$1.2 \times 2 = 2.4$	2.4%
	13	8	10	6.5	3.5	3.0%
	14	4	10	7.9	$2.1 \times 2 = 4.2$	3.4%
Bahraich	15	4	10	8.1	$1.9 \times 2 = 3.8$	3.21%
	16	4	10	8.6	$1.4 \times 2 = 2.8$	2.64%
	17	8	10	7.5	2.5	2.4%
	18	8	10	7.9	2.1	2.2%
Lucknow	19	4	10	9.1	$0.9 \times 2 = 1.8$	2.06%
	20	4	10	9.8	$0.2 \times 2 = 0.4$	1.2%

Table- Morphine estimation by British Pharmacopoeia method in different samples of opium

SUMMARY AND CONCLUSION

20 Suspected seized samples of opium received from State Forensic Science Laboratory, Lucknow viz. S1-S20 were analysed for obtaining the total morphine content in given samples of opium. Chemical analysed samples were quantified for opium and its alkaloids. Morphine estimation of samples was carried out using British Pharmacopoeia method. Samples were estimated for obtaining total percentage of morphine to determine the quality of opium. From above analysis and tests it is confirmed that opium samples of Districts Barabanki and Bareilly were highest as compared to that of other districts.

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Prediction of flat plate collector by using hybrid technique

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ABSTRACT

Solar water heaters (SWH) are becoming increasingly attractive in sustainable development. Hence the Efforts continuously made here is to reduce their costs to make them more affordable. Solar energy has experienced a remarkable development in recent years because of cost reduction due to technological development as well as renewable energy scheme supported by the government. The process of using sun's energy to heat water is not a new technology. Solar water heating (SWH) technology has improved a lot during the past century. The primary method of energy transport in solar energy from sun is electromagnetic radiation. This type of radiation coming from the Sun also depends on temperature. The Sun generates electromagnetic radiation in extensive span of wavelengths. However, most of the radiation is being sent out in the observable range due to its surface temperature. The amount of solar energy received in a particular region depends on the time of the day, the season of the year, the sky's cloudiness, and how closeness of Earth's equator. Also Predicting weather is important in order to model a system and also to prevent the environment produced by several effects. The prediction of weather plays an important role in day today activities. There are many techniques available for prediction of weather analysis, and it requires a minimum number of input parameters to continue the process. For modeling we utilized Genetic algorithm and for prediction we employed hybrid ABC and PSO techniques. Genetic algorithm is utilized in order to optimize the modeling technique by using the dataset collected. Therefore by using hybrid ABC and PSO algorithms data prediction procedure is carried out. The proposed method has proved as an efficient method for modeling and prediction of the solar water heater outlet temperature with an effective accuracy.

INTRODUCTION

In this paper, we present the results obtained from the experimentation on the proposed modeling and prediction of solar water heater using genetic algorithm and hybrid ABC and PSO algorithm. We have showed the study area under Modeling and Prediction in detail. The proposed technique for modification and prediction for solar water heater has been implemented with the system configuration of i5 processor, 4 GB RAM in the working platform of MATLAB 7.12.0 (R 2011a). Here the experimental results for the proposed modeling using genetic algorithm and prediction using hybrid ABC-PSO algorithm were shown below in detail and hence the experimental results shown that our proposed method is effective for the modeling and prediction of data.

Modeling is very useful to represent the evolution of fluid flow, temperature and stratification processes. The decision making in agriculture and forestry, weather data from the automated weather stations has moreover turn into a main element. For considering of total energy accessible for employ a system, a concise plan about climatic parameters such as temperature, relative humidity, pressure, rainfall, visibility, etc. is of significance. In fact environment presents a huge range of liberally accessible alternatives for producing energy. These data's were accumulated from Weather Monitoring Stations. The modeling of weather study by means of genetic algorithm result discussed below. On the basis of characteristics such as weather, humidity, temperature, global Solar Radiation, Air Temperature, Relative humidity and wind speed, the data set is appeared from dissimilar weather forecasting locations. As a result by means of the genetic algorithm process the modeling process will be solved out and the below equation is applied to get the weight.

Since weather is a natural phenomenon that is beyond human control, it is necessary to evolve adaptation and mitigation strategies to reduce the risks and impact of its extremes early warning through timely and accurate weather information is an effective strategy. It is fundamental to emergency preparedness against weather related disasters. In prediction of weather, it permitting us to watch huge expanses of the world and revise cloud formations, fronts, temperatures, composition etc, Satellites acts a significant role. Here we are using forecast of solar water heater by means of ABC-PSO algorithm and the result obtained were discussed briefly here as follows

Literature Review : Research on Flat Plate Collector

In the solar-energy industry great emphasis has been placed on the development of "passive" solar energy

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systems, which involve the integration of several subsystems: Flat Plate collectors, heat-storage containers, fluid transport and distribution systems, and control systems. The major component unique to passive systems is the Flat plate collector. This device absorbs the incoming solar radiation, converting it into heat at the absorbing surface, and transfers this heat to a fluid (water) flowing through the Flat plate collector. The warmed fluid carries the heat either directly to the hot water or to a storage subsystem from which can be drawn for use at night and on cloudy days. The results show that the system could reach satisfactory levels of efficiency. Furthermore it proved to be inexpensive and easier to manufacture which makes it a potential technological solution to the domestic water heating problems in rural India.

Fawaz S. Abdullah et al (2012). have developed to determine the performance of the solar collectors to develop thermal energy conversion system. This research was to develop a tool for predicting the performance of a flat-plate solar collector from knowledge the absorbed solar radiation quantity. Also, the factors that effects on absorbed solar radiation value have been considered. These factors represented with collector tilt angle, the season changes that represented with month of year that the global solar radiation on horizontal surface has been measured, the location from the world represented with the latitude, time interval represented with hours of daylight from sunrise to sunset. Another optical factors effect on intensity of absorbed solar radiation had been considered. These factors correlated with absorptivity and transmissivity of the transparent glass cover which represented. The result of each factor was analyzed for different collector tilt angle, latitude of place, and solar hour angle.

Amir Hematian et al (2012). have proposed a flat plate solar air collector. The absorber of solar collector made by steel plate with an area of 2×1m2 and thickness of 0.5mm in the form of window shade has been developed for increasing the air contact area. The surface of absorbent plate was covered by black paint. To insulate the collector, the glass wool with the thickness of 5cm was used. The experiments on the efficiency were conducted for a week during which the atmospheric conditions were almost uniform and data was collected from the collector. The results of the collector efficiency in the natural and forced convection were evaluated and their graphs were plotted. The results showed that the collector efficiency in forced convection was lower, but the low temperature difference between inlet and outlet of the collector decreased its heat loss. In addition, the average air speed in forced convection was about 21% higher than the natural convection.

Akachukwu Ben Eke et al. have presented a flat plate surface solar collector of dimension 0.5 m2, hinged on a horizontal support for quick adjustment of inclination from 0 to 90 Measurement of the solar radiation, varying degrees of inclination were taken between 12:00 noon and 2:30 pm for 4 days at clear sky hours, within the week of n th day of the year. The measurements were made for each month of the year in Zaria, Kaduna State, Nigeria. At each degree of inclination, the solar radiation intensity was replicated three times and the average value was taken. The flat plate was set truly facing south with an engineering prismatic compass. The result showed that the optimum angle of inclination of a flat plate for maximum collection of solar radiation intensities are 26.5, 24.5, 10.0, 19.5, 26.0, 30.0, 24.0, 21.0, 11.5, 19.5, 27.0 and 30.0 o, in the months of January to December, respectively. This proposed work revealed that the average angle of inclination at which a flat surface solar collector mounted at fixed position in Zaria is 22.5 . The analysis indicated that when a flat surface was located at the predicted optimum angle of inclination for each month of the year, an average annual increment of 4.23 % solar radiation intensity was achieved, when compared with the yearly average solar radiation intensity harnessed by the same flat plate collector on horizontal position, and under the same condition. This percentage increase amounted to annual average solar energy gain of 370,670 MJ/m2, at no extra-cost, other than positioning the solar collector at the identified optimum angle of inclination. Comparison of the measured and calculated optimum values of angle of inclination of a flat plate surface for trapping maximum solar radiation intensity for each month of the year indicated a high correlation with R2 of 0.97.

Adnan Ibrahim et al (2011). have proposed Flat plate photovoltaic/thermal (PV/T) solar collector produces both thermal energy and electricity simultaneously. This proposed method, the state-of-the-art on flat plate PV/T collector classification, design and performance evaluation of water, air and combination of water and/or air based. This review also covers the future development of flat plate PV/T solar collector on building integrated photovoltaic (BIPV) and building integrated photovoltaic/thermal (BIPVT) applications. Different designs feature and performance of flat plate PV/T solar collectors have been compared and discussed. Future research and development (R&D) works have been elaborated. The tube and sheet design is the simplest and easiest to be manufactured, even though, the efficiency was 2% lower compared to other types of collectors such as, channel, free flow and two-absorber. It is clear from the review that for both air and water based PV/ T solar collectors, the important key factors that influenced the efficiency of the system were the area where the collector covered, the number of passes and the gap between the absorber collector and solar cells. From the literature review, it was obvious that the flat plate PV/T solar collector was an alternative promising system for low-energy applications in residential, industrial and commercial buildings. Other possible areas for the future works of BIPVT ware also mentioned.

S. Farahat et al (2009), an exergetic optimization of flat plate solar collectors is developed to determine the optimal performance and design parameters of these solar to thermal energy conversion systems. A detailed energy and energy analysis is carried out for evaluating the thermal and optical performance, energy flows and losses as well as energetic efficiency for a typical flat plate solar collector under given operating conditions. In this analysis, the following geometric and operating parameters are considered as variables: the absorber plate area, dimensions of solar collector, pipes' diameter, mass flow rate, fluid inlet, outlet temperature, the overall loss coefficient, etc. A simulation program was developed for the thermal and energetic calculations. The results of this computational program ware in agreement with the experimental measurements noted in the previous literature. Finally, the exergetic optimization has been carried out under given design and operating conditions and the optimum values of the mass flow rate, the absorber plate area and the maximum exergy efficiency have been found. Thus, more accurate results and beneficial applications of the exergy method in the design of solar collectors have been obtained.

M. Pradhapraj et al (2010). have flat plat collectors are the best heat transferring devices. But the effectiveness of these collectors is very low because of lack of technology. Solar assisted heated air is successfully used for drying applications and space heating under controlled conditions. From the solar flat plate air heater the hot air was transferred to a conventional dryer or to the combined heater and drying chamber directly. Hence, solar assisted air heaters were cheaper and reliable. The air heater efficiency dependson the design of the system as well as the construction materials and the assembly. The solar air heating systems has acceptable life span of 15 to 20 years. The addition of side mirror enclosures was to increase the amount of solar radiation absorption at the collector plate so that the collector increases the yield and operate in a higher temperature range. Therefore with the addition of side mirrors one could able to maximize the output of fixed flat plate collectors. A flat plate air collector will be more efficient if it was made up of porous medium when comparing it with the non-porous collectors according to the study. In this proposed method, the performances of porous and non-porous absorber plates were discussed.

Balaram Kundu et al. (2012). have presented an analytical analysis of both Fourier and non-Fourier heat conduction in the absorber plates of a flat-plate solar collector. Separation of variables was employed to develop the model. For the analysis, a repetitive heat transfer module was used for the solution of parabolic and hyperbolic equations. From the practical point of view, two types of boundary conditions were separately chosen. A numerical technique based on the finite difference method was employed to determine the temperature for validation purposes. A comparative investigation was carried out to understand the requirements for use of the non-Fourier heat conduction model easily. A significant difference in the temperatures obtained from the Fourier and non-Fourier models was observed for lower values of the Fourier number and higher values of the Vernotte number. Finally, the effect of the boundary conditions on the Fourier and non-Fourier heat transfer was demonstrated.

N. Ehrmann and R. Reineke-Koch(2012) have increased the efficiency of solar-thermal flat-plate collectors at temperatures above 100 °C or with low solar irradiation, they implemented a double glazing with a low-emitting (lowe) coating on the inner pane to improve the insulation of the transparent cover. Since commercially available low-e glazing provides only insufficient solar transmittance for the application in thermal flat-plate collectors they were developing a sputter-deposited low e-coating system based on transparent conductive oxides which provides a high solar transmittance of 85% due to additional antireflective coatings and the use of low-iron glass substrates. Durability tests of the developed coating system show that our low ecoating system was well suitable even at high temperatures, humidity and condensation.

Khaled Zelzouli et al (2012). the modeling of a solar collective heating system in order to predict the system performances. Two systems were proposed: 1) the first, Solar Direct Hot Water, which was composed of flat plate collectors and thermal storage tank, 2) the second, a Solar Indirect Hot Water in which we added an external heat exchanger of constant effectiveness to the first system. The mass flow rate by a collector is fixed to 0.04 Kgs-1 and the total number of collectors was adjusted to 60. For the first system, the maximum average water temperature within the tank in a typical day in summer and annual performances were calculated by varying the number of collectors connected in series. For the second, this proposed method, shows the detailed analysis of water temperature within the storage and annual performances by varying the mass flow rate on the cold side of the heat exchanger and the number of collectors in series on the hot side. It was shown that the stratification within the storage is strongly influenced by mass flow rate and the connections between collectors. It was also demonstrated that the number of collectors that could be connected in series was limited. The optimization of the mass flow rate on cold side of the heat exchanger was seen to be an important factor for the energy saving.

Application of Solar Energy

Solar energy is one of the most important source of renewable energy that world needs. The major applications of solar energy can be classified into two categories,

- Thermal system (T)
- Photovoltaic system (PV) cell [64].
- In conventional solar thermal system, external electrical energy is required to circulate the working fluid through the system. In conventional photovoltaic system, high incident solar radiation on (PV) panel should give high electrical output. However, high incident will increase the temperature of the solar cells and that will decrease the efficiency of the panel. Therefore, to achieve both higher cell efficiency and higher electrical output we must cool the cells by removing the heat in some way [80].
- To eliminate an external electrical source from the thermal system and to cool the cells in photovoltaic system we integrate a photovoltaic panel with solar air / water heater collector, this can make when photovoltaic cells pasted directly on the flat plate absorber. This type of system is called photovoltaic-thermal collector [84].
- Solar water heaters save electricity and thus money; electricity is becoming more and more expensive; they could even turnout to be more reliable than electric power supply (at least in many parts of our country); they are clean and green and thus reflect one's commitment for preservation of environment; they are safer than electric geysers as they are located on the roof; and, if well designed, may even look good on the house top [62].
- Concentrators are used mostly in commercial applications because they are expensive and because the trackers need frequent maintenance. Some residential solar energy systems use parabolic trough concentrating systems. These installations can provide hot water, space heating, and water purification. Most residential systems use single axis trackers, which are less expensive and simpler than dual-axis trackers [81].

Motivation of the Paper

To further improve the efficient prediction of Analysis and running cost estimation of (SWH) systems. The weather parameters such as air temperature, atmospheric pressure, direct radiation, global radiation, net radiation, relative humidity, sunshine duration, wind speed and solar water heater parameters such as inlet water temperature, glass wool temperature, copper plate temperature, storage water temperature are used as input dataset. These data's were collected from Weather Monitoring Stations.

Experimental Results of Modelling outputs

Modeling data is a conceptual representation of the data that are required by a database. The database includes the data objects, the associations between data objects, and the rules which govern operations on the objects. As the name implies, the data model focuses on what data is required and how it should be organized rather than what operations will be performed on the data. In our experiment for modeling the graph is plotted for number of data in x-axis and measured outlet temperature of solar water heater and fitness value on the y-axis



Here in modeling experimental output graph is plotted between measured outlet temperature of solar water heater and fitness value against number of data on x- axis. The above figure shows the y axis of our modeling output. There are four graphs showing four different iterations such as iteration 25, 50, 75 and 100. Hence the discussion and the results of modeling and prediction using our proposed techniques are shown below.

The figure 1.1 shows the plotted results of modeling using genetic algorithm. Under *figure 4.1 figures (1.1 to 1.4)* shows the different iterations of modeling using our proposed technique such as genetic algorithm.



Figure 1.1 shows the modeling outlet temperature of solar water heater during 25th iteration.

Figure 1. 4 shows the modeling outlet temperature of solar water heater during 100th iteration

Fig: 4.1: Plotted after modeling process using genetic algorithm



Figure 1. 2 shows the modeling outlet temperature of solar water heater during 50th iteration.



Figure 1. 3 shows the modeling outlet temperature of solar water heater during 75th iteration

Thus after modeling of input data the outlet temperature of the system is shown above. Therefore the figure shows the best modeled output of the system using genetic algorithm

Experimental Results of Prediction outputs

In the solar water heater the predicted output will be done by using ABC-PSO algorithm. Hence we have compared the predicted output with the actual values and it is shown in the below figures. The predicted output was very close to the actual input values. For evaluating the proposed technique, we have utilized genetic algorithm for modeling the weather prediction using genetic algorithm and for prediction we employed hybrid ABC-PSO techniques. Thus for training 80% of the data is used and for testing 20% of the data was used. Hence the proposed method has proved as an efficient method for modelling and prediction of the weather condition with an effective accuracy.



Figure 2.1 shows the predicted outlet temperature of solar water heater during 1st iteration



Figure 2.2 shows the predicted outlet temperature of solar water heater during 2nd iteration

The *figure 2.2* shows the plotted output of predicted output data using our proposed ABC-PSO algorithm. Thus *figure 2.1* shows the predicted outlet temperature of solar water heater for 1st iteration. The *figure 2.2* shows the predicted outlet temperature of solar water heater for 2nd iteration.



Figure 2.3 shows the predicted outlet temperature of solar water heater during 3rd iteration

The *figure 2.3* shows the predicted outlet temperature of solar water heater for 3rd iteration. The *figure 2.4* shows the predicted outlet temperature of solar water heater for 4th iteration. Here the actual and predicted output is shown in figure for number of experiments in x axis and outlet temperature in y-axis. The *figure 2.5* shows the predicted outlet temperature of solar water heater for 5th iteration. The *figure 2.6* shows the predicted outlet temperature of solar water heater for 5th iteration.



Figure 2.4 shows the predicted outlet temperature of solar water heater during 4th iteration

If you have been collecting and recording weather data over the last several days, you should be very familiar with the process. You should now carefully record data concentrating on one day. These experiments brings closure to the study provided by the various activities and should help the learner to connect the previous experiences more effectively. On a continental scale, heating and cooling cells are responsible for low and high pressure zones. The air masses with different characteristics (pressure, humidity, temperature) form and weather systems.



Figure 2.5 shows the predicted outlet temperature of solar water heater during 5th iteration

Because of the variety of weather conditions on the day the activity starts, it is not possible to give a specific Examining Results and our proposed technique shows the best effective predicted output at the end. This experimental activity probably falls into structured inquiry because the question to be resolved has been set and the challenge is to predict tomorrow's weather and the procedure has been shown in our chapter 3. Therefore the proposed ABC-PSO algorithm showed the system to best for prediction and this were conformed after comparing the proposed results with the existing method.



Figure 2.6 shows the predicted outlet temperature of solar water heater during 6th iteration

Experimental comparison results of existing and proposed method for the prediction of output :

The Experimental comparison results of Existing and Proposed Method for the prediction of output are shown in *table* and the corresponding graph is drawn as mentioned 6.1. Therefore the system shows the best effective output after the comparison of our proposed techniques.



Figure 6.2: Comparison graph of proposed method and existing method

Thus the above figure shows the actual data and the predicted data over different number of iterations. Here 80% of the data is used for training and 20% of the data is used for testing. Thus after the training and testing of data by using our proposed technique the solar water heater outlet temperature measure was predicted. The Figure 4.6.2 shows the comparison between proposed and existing techniques. Hence the predicted data were tabulated and plotted by using the actual and predicted error data over different number of iterations. Therefore we can see the difference between proposed and existing for various numbers of iterations. From the above figure it is very clear that our proposed technique showed to be a better technique to predict the solar water heater outlet temperature.

CONCLUSION

In this thesis, an effective hybrid technique such as ABC and PSO algorithm is proposed in order to predict the solar water heater outlet temperature and genetic algorithm for modeling. Genetic algorithm is used as optimization model in solar water heater and ABC and PSO for prediction. Here in ABC scout process does not takes place, instead of Scout bees process we will use PSO for the prediction of the presented solar water heater. Therefore this hybrid technique makes system effective. The proposed PSO method makes use of the faster computational time of the PSO coupled with its convergence strength to implement the results yielded by the ABC in getting better near global solution. The final blind regression procedure is to determine the weights of parameters used and hence the model used to predict the output weather. By using the ABC and PSO data prediction procedure is carried out. After the system is properly trained, a set of test data that was not used in the modeling is applied to the network. Therefore the weights of the data are predicted by using hybrid techniques. Therefore the Modeling and

prediction of weather carried out in an effectively manner though out our research. Thus in our thesis we observed and discussed about the results obtained and the section shows that our present investigation about modeling, prediction of solar water heater outlet temperature using Genetic algorithm, ABC and PSO algorithm. Finally, the proposed method has proved as an efficient method for modeling and prediction of solar water heater outlet temperature in an effective manner.

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Institutionalised and Non-institutionlised Elderly of Kathmandu in relation to their Psychosocial Problems

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ABSTRACT

With an increasing population living for longer years and by the changing context of the world, elderly has been pushed into a state leading to various psychosocial problems. The study was conducted to assess and compare the psychosocial problems of the old age people living in institutional and home settings in Kathmandu, Nepal.

This correlational comparative study was carried out in 2013 among 132 elderly aged 60 years and/above residing in old age homes and home settings in Kathmandu by using pre-tested structured interview schedule. Data were analysed by using SPSS version 19.

Neglect by family members ranked first in institutional setting (mean per cent score = 83.8) whereas anxiety ranked first in home setting (mean per cent score=30.25). The psychosocial problems were greater in institutionalized elderly (mean scores=40.12) than home living elderly (mean scores=18.83). There was significant difference between mean scores of the elderly living in institutional and home settings for psychosocial problems (P<0.01).

The institutionalized elderly were facing more psychosocial problems. The study shows the need of encouragement towards joint family norms. Older adults should be trained for active ageing. Old people should be involved in the family activities and useful works instead of keeping them away.

Key Words: Psychosocial problems, institutionalized elderly, non-institutionalised elderly.

INTRODUCTION

Longevity is an achievement because of advancement of science and medicine. The increase in life expectancy, decreased birth and death rate has resulted in the increased proportion of the old age people. With an increasing proportion of our population living for longer years, we are now confronted with the problem of not knowing how to deal with growing problems of our elderly population. Simultaneously, our senior citizens too are challenged by how creatively occupy themselves so as to become productive for the society.

Population ageing is expanding worldwide including developing countries like Nepal. The percentage of elderly population has increased to 8.13% from 4.6% from 2001 to 2011 (**CBS, 2012**). But due to the changing societal norms young generation is living away from parental home as well as for family business for their livelihood. It is difficult for elderly to change homes and get adjusted to new place. Apart from this because of more and more working women, their traditional role of care giver of the elderly is abandoned. Besides, our social culture is also being broken by the changing context of the world, desire for a small family, poverty and urbanization process. In such

circumstances, the society seems to have empathized the problems and needs of the elderly and hence have attempted, though not sufficient, to ease their life. In developing countries like Nepal number of old age homes and presence of aged patients in hospital is on rise. Elderly homes, religious sites are the only destination for senior citizens out of their family during the old age. Different activities from the side of government, NGOs and individuals are being done for the senior citizens. However, many of them are still deprived of proper care and support and basic need for comfortable survival (Acharya, 2007). Present day society has pushed down the old into a state of loneliness, helplessness, frustration, and meaningless, leading them to various psychosocial problems. Having ample scope, there is a relative paucity of researches done on psychosocial problems of the elderly in Nepal.

The present study the first of its nature had the objectives of comparing the psychosocial problems of the elderly living in institutional and home settings in Kathmandu.

MATERIALS AND METHODS

The correlational comparative study was carried out among 132 elderly aged 60 years and/above residing in old age homes

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and home settings in Kathmandu, Nepal. The sample size was determined on the basis of prevalence of nervous system disorders among the elderly in an urban area of Udaipur Rajasthan, India (**Prakash** *et. al.*, **2004**). At first ward number 14 was selected by simple random sampling for home setting. Then 66 elderly respondents were selected by systematic random sampling from that ward. Similarly, 66 elderly from five old age homes were selected by proportionate random sampling. A total of sixty-six elderly from both the settings were interviewed between 24th December 2012 to 25th February 2012 by using pre-tested structured interview schedule which was developed in consultation with five experts in the respective fields. The data were compiled and analysed by using SPSS version 19 and appropriate statistical tests were performed to draw the inference.

RESULTS AND DISCUSSIONS

The finding of the study showed that around 70% of the respondents from home settings were in the age group 60-69 followed by 24% and 3% each in the age group 70-79, 80-89 and 90 and/above years respectively. Similarly, in the institutional setting 41% were in the age group 70-79 followed by 30%, 24% and 5% in the age group 80-89, 60-69 and above 90 and/above years. In both the settings, male and female were in equal proportion. Only 9% of the elderly from institutional setting were literate. While more than the halves of the elderly (55%) home settings were literate. Most of the respondents (59%) were married and living together in home settings where as in institutional settings around 64% of the elderly were widow/ widower or unmarried. The result also showed that around 27% of the respondents from the home settings were employed whereas 97% of the institutionalized elderly were retired and not employed. The elderly who lived in joint family constituted 71% of the elderly in home setting whereas 58% of the elderly were from nuclear family in institutional setting. More than the halves of the elderly in institutional settings (54.5%) had minimum income up to NRs 2000 per month. But in home settings,

around 35% of the elderly had income more than NRs 10000 per month. The findings of the study are in consistence with the study conducted by **Nagpal and Chadha (1991)** who found that the incidence of widowed persons was relatively higher in institutional group (48.3 per cent), compared with that of family group (25%). Also, it was found that the number of subjects with no income was significantly higher (16.6%) in the institutional group as compared with that of the family group (1.6%).

Mean score and rank of the type of psychosocial problems of the elderly in both the settings are presented in Table No. 1. Neglect by family ranked first in institutional setting (mean percentage score = 83.8) whereas anxiety ranked first in home setting (mean percentage score = 30.25). It was also noted that the mean percentage score of all the psychosocial problems were greater in institutionalised elderly than the home living elderly. These findings are in conformity with the findings of the study conducted by Agarwal and Srivastava (2002) which indicated that the emotional states like anxiety, depression, loneliness, neglect by family members, lack of self confidence, social isolation are more in old people living in institutions. The findings also get support from the study of Kanwar and Chadha (1998) according to which depression and loneliness of institutionalised elderly was higher than that of noninstitutionalised elderly. Hence, it can be concluded that the elderly staying in institutional setting suffer from more psychosocial problems due to lack of communication and psychosocial separation.

Severity of the psychosocial problems of the elderly is presented in *Table No. 2*. Severe psychosocial problems were higher in institutional settings (around 29%) than home settings (6%). Moderate psychosocial problems were present in 51% of the institutionalised elderly whereas most of the home living elderly (around 76%) were having only mild psychosocial problems.

The difference in psychosocial problems of the institutionalised and home living elderly is presented in *Table*

Ту	pes of Psychosocial	Maximum	Inst	Institutional Setting		Home Setting		g
Pr	oblems	Possible	Mean	Mean %	Rank	Mean	Mean %	Rank
		Score	Score	Score		Score	Score	
•	Depression	16	8.13	50.8	6	3.4	6	
•	Loneliness	12	6.69	55.7	3	2.9	5	
•	Social Isolation	12	6.45	53.7	4	2.3	7	
•	Anxiety	12	4.6	38.3	7	3.6	1	
•	Neglect	10	8.38	83.8	1	2.5	4	
•	Lack of self confidence	10	5.81	59.1	2	2.8	2	
•	Memory loss	4	2.06	51.5	5	1.04	3	

Table No.1: Mean Score and Rank of Type of Psychosocial Problems of the Elderly

S.	Severity of Psychosocial	Range	Elderly in Institutional Setting		Elderly in Home Setting		
1 4.	Problem	Scores	Frequency Percentage		Frequency	Percentage	
1	Mild	1-25	13	19.7	50	75.8	
2	Moderate	26-50	34	51.5	12	18.2	
3	Severe	51-76	19	28.8	4	6.1	

Table No.2: Severity of Psychosocial Problems of the elderly

No. 3. It clearly depicts that there was significant difference between mean scores of the elderly living in institutional and home settings for psychosocial problems (P<0.01). Thus, it can be inferred that the obtained mean difference of 21.28 was not by chance, but was a true difference. This clearly showed that elderly living away from their homes were facing more psychological problems.

Chi-square values are presented in *Table No. 4* which shows the association between psychosocial problems and selected demographic characteristics of the elderly. The table depicts that the psychosocial problems of the elderly in institutional setting had significant association with type of family belonged, interpersonal relations, and gender and no association with education, marital status, present job status and monthly income. It also indicated that the psychosocial problems of the elderly living in home setting had significant association with educational status, marital status, monthly income, interpersonal relations, and gender and no association with present job status and type of family of the elderly. The psychosocial problems of the elderly living in both home setting and institutional setting showed significant association with gender in the present study. Female elderly in home setting and institutional setting had more psychosocial problems with mean scores 26.94 and 45.73 respectively than male elderly with mean scores 10.73 and 34.52 respectively. This finding is in consistence with the findings of study conducted by **Sharma and Sidhu (2009)** which showed lower level of subjective well being and more stress in female elderly when compared to male elderly.

 Table No.3: Comparison of Psychosocial Problems of institutionalised and home living elderly

Variable	Elde	erly in El		Elderly in		SE	't'	Sig.
	Institu	ıtional	Home		D	D	value	(2-tailed)
	Set	ting	Setting					
	n =	: 66	n = 66					
	Mean	SD	Mean	SD				
Psychosocial	40.12	14.79	18.83	14.7	21.28	2.56	8.287**	0.000
Problems								

**t value significant at 0.01 and 0.05 level of significance.

 $t_{(130), .0.01} = 2.62$ and $t_{(130), .0.05} = 1.98$

Table No. 4: Association between Psychosocial Problems and Selected Demographic Characteristics of the elderly

S.	Respondent	Elderly in Ins	Elderly in Institutional Setting			Elderly in Home Setting			
N.	Characteristics	Chi-Square	ďť	Asymp.	Chi-Square	ďť	Asymp.		
		Value		Sig. (2-sided)	Value		Sig. (2-sided)		
1	Educational status	15.603	10	0.112	25.897*	12	0.011		
2	Marital Status	12.880	8	0.116	14.134**	4	0.007		
3	Present Job Status	1.941	4	0.747	9.320	8	0.316		
4	Monthly Income	10.691	6	0.098	26.458**	8	0.001		
5	Type of family belong/belonged	9.393**	2	0.009	4.440	2	0.109		
6	Interpersonal Relations	35.061**	4	0.000	34.949**	4	0.000		
7	Sex	8.150*	2	0.017	9.000*	2	0.011		

*Significant at 0.05 level of significance

**Significant at 0.01 and 0.05 level of significance

CONCLUSION

The institutionalized elderly were facing more psychosocial problems and they were not able to cope with those problems in an effective manner as the elderly in home settings do. This may be due to neglect from the family members. Also the psychosocial problems among institutionalized elderly were dependent of type of family belonged, interpersonal relations, and gender and independent of educational, marital status, present job status and monthly income. The psychosocial problems of the elderly living in home settings showed dependency with educational status, marital status, monthly income, interpersonal relations, and sex and were independent of present job status and type of family of the elderly.

The study shows the need of families' encouragement towards joint family norms. Old people should be involved in the family activities instead of keeping them away. They help in better ways to look after the children and can supervise household work. Elderly should not be detached from the children. The planning for old age should be started while the parents are at adulthood with respect to finances, type of work, involvement in decision making, taking benefit of their lifelong experiences. Older adults should be trained for active ageing so that they can participate in the development of nation. Institutionalized elderly as per their capability should be involved in useful works that they know and we can make use of their experiences.

It is the time to understand that if we do not plan now, our future can be same as theirs and if our children do not see us caring for our elderly, one day we can also be in the same situation.

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Type-2 diabetes mellitus: threat for developing countries

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ABSTRACT

Introduction: Early in the 20th century, diabetes mellitus was considered to be a rare medical condition in Asian countries. Over the past 30 or 40 years however, the situation has changed. Diabetes is now regarded as a major public health problem throughout developing countries, mostly South East Asia particularly among urban communities. The disease is little understood in the general population and is often poorly detected. Research shows that 70 per cent of people with type 2 diabetes mellitus in Nepal are unaware of their condition and more than 40 percent diabetes cases are undiagnosed.

Method: Hospital based descriptive study with aims to ascertain the factor responsible for the contribution of disease. Far western region of Nepal was selected purposively. Data collection was carried out from January and February 2013 in two government Zonal hospital Seti and Mahakali and two private physician's clinics. Study population consisted of patients aged 25 years and above. Face to face interviews were carried out with 172 type -2 diabetes subjects.

Result: The findings have indicated disease affect the adult age group (45-55) population. Majority respondents (63.4%) consumed high carbohydrate diet before they have been diagnosed. Majority of respondents (66%) had history of addiction of smoking, chewing tobacco and alcohol. Most of them (95.3 %) were non vegetarian. Association was statistically significant between addiction and duration of disease, which is the large health challenge to change the behaviour of respondents.

Conclusions: The study concludes that the factor responsible were addiction habit and type of food. Government needs to acknowledge the growing threat of NCDs such as diabetes and develop national prevention and control strategies including general public education about the disease.

INTRODUCTION

Diabetes (DM) is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin. There are two basic form of diabetes Type-1, people with this type of diabetes produce very little or no insulin. Common symptoms of this type of diabetes includes excessive thirst, constant hunger, excessive urination, rapid hard breathing, vision changes, weight loss for no reason and drowsiness. Type 2 diabetes (formerly called non-insulin-dependent or adult-onset diabetes) is caused by the body's ineffective use of insulin. It often results from excess body weight and physical inactivity. Most people with type-2 diabetes may have similar symptoms but less obvious symptoms. Many have no symptoms and are only diagnosed after many years of onset. As a consequence, almost half of all people with type -2diabetes are not aware that they have this life threatening condition. A third type of diabetes, gestational diabetes mellitus (GDM) develops in some cases of pregnancy. There is rising prevalence of the disease in the developing countries, which was rare before industrialization, socio-economic development, urbanization and changing life style.

World health organization (WHO) estimated 347 million people have diabetes all over the world. In 2004, an estimated 3.4 million people died from consequences of high blood sugar. More than 80% of diabetes deaths occur in low- and middle-income countries. WHO projects that diabetes deaths will increase by two thirds between 2008 and 2030. The numbers of people with diabetes will be more than double over the next 25 years, to reach a total of 366 million by 2030. Most of this increase will occur as a result of a 150% rise in developing countries.

METHODOLOGY OF STUDY

This was hospital based descriptive study. Far western region of Nepal was selected purposively. Rapid Urbanization causing changes in the life style and dietary habit of people. A set of Pretested Structured Interview Schedule was used to collect data. Two government zonal hospital and two private physician's clinic were selected purposively .Forty three respondents from each hospital and physician's clinic were selected on first come first interview basis, during specified time till the required number (n=172) was achieved. Sample size was calculated in the basis of prevalence 12.75% and applies the following formula.

$$n = \frac{Z^2 * p^* q}{e^2}$$

A main objective of the study was to ascertain the factor responsible for the contribution towards disease precipitation.

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RESULTS

Results consist on factor responsible for the contribution of Type-2 diabetes mellitus.

Table 1 Major diet of the respondents

Diet	Frequency	Percentage
Consumption of rice in Lunch	109	63.4
and dinner as staple diet		
Consumption of rice only in	24	14.0
lunch as staple diet		
Mix consumption (Rice, bread,	39	22.7
fruit, dall, Vegetable. Meat Curd,		
and other varieties)		
Total	172	100.0

Table 1 shows majority of respondent 63.4 per cent consumed rice as a staple diet in lunch and dinner. Whereas 14 per cent respondents consumed rice only lunch and 22.7 per cent were mix consumed in dinner and lunch.

 Table 2 Dietary pattern of the respondents

Dietary habit	Frequency	Percentage
Non vegetarian	164	95.3
Vegetarian	8	4.7
Total	172	100.0

Table 2 shows that 95.3 per cent respondent ware non vegetarian, whereas 4.7 respondents were vegetarian.

Schedule of consumption	Frequency	Percentage	
Daily	66	38.4	
weekly	89	51.7	

12

5

172

Table 3 Consumption of junk food by respondents

Table 3 shows majority of respondents 51.7 per cent respondents were consuming the junk food daily. Whereas 38.4 per cent were consuming weekly, 7 per cent consumed monthly and 2.9 per cent respondents never consumed any junk food.

Table 4 Addiction	l of res	spondents
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Monthly

Never

Total

Addiction of respondents	Frequency	Percentage
Tobacco(chewing)	22	12.8
Smoking	27	15.7
Alcohol	38	22.1
Alcohol and smoking	20	11.6
Tobacco chewing , smoking	6	3.5
and alcohol		
No addiction	59	34.3
Total	172	100.0

Table 4 shows majority of respondent 34.3 per cent had no history of addiction, 22.1 per cent had addiction of alcohol, and 15.7 per cent addicted for smoking, 12.8 per cent were in habit of tobacco chewing.



Figure 1 Addiction of respondents Table 5 Schedule of exercise by respondents

Schedule	Frequency	Percentage
Daily	73	42.4
Weekly	5	2.9
Monthly	1	0.6
No exercise	93	54.1
Total	172	100.0

Table 5 shows 42.4 per cent respondents were involve in physical exercise on daily basis .Where as 2.9 per cent do only on weekly basis, and 54.1 per cent respondents were no exercising at all.

DISCUSSION

7.0

2.9

100.0

Findings of quantitative results are synthesized in an attempt to reach answers belonging to the objective; factor responsible for the contribution of the disease. Study revealed the dietary habit of respondents before diagnosed the disease 63.4 per cent consumed rice in lunch and dinner, 22.7 per cent were mix consumption of different variety of food in dinner and lunch. Among them most of respondents consumed junk food and meat in evening snacks. This suggest those respondents consumed more junk food and high carbohydrate diet had overweight and obese. Majority of (95.3 per cent) respondent were non vegetarian. Whereas 24.4 per cent respondents were consuming daily fruit and 12.8 per cent respondents consumed only monthly. Daily Consumption of the junk food by respondent were 38.4 per cent. Whereas 51.7 per cent respondent consuming on weekly basis. Study revealed that majority of respondent 34.3 per cent had no history of addiction, 65.7 per cent had addiction history of smoking, chewing tobacco and alcohol. This suggests that addiction habit is a result of stress full condition, which is the main contributing factor for type-2 DM. In the finding of the study there is significant relation between addiction and duration of disease. Study reveals that majority of respondents 42.4 per cent were involve in physical exercise on daily basis. Whereas 54.1 per cent respondents were not exercising at all. This shows Counseling regarding exercise and distressing activities is not been provided to the respondents by their physician.

CONCLUSIONS

From the analysis of the data it can be concluded that disease affects mostly in adult population. This is challenging for public health in the community and alarming threat to the health system of country. There is lack of public awareness regarding type-2DM. Majority respondents (63.4%) consumed high carbohydrate diet before they have been diagnosed. Most of them (95.3 %) were non vegetarian. Majority of respondents (66%) had history of addiction of smoking, chewing tobacco and alcohol. which is the large health challenge to change the behaviour of respondents. This suggests that government has to develop the new strategic plan in current health system and early implementation with active community participation regarding the disease, which have been minimize, control and prevention of the high burden of type 2 diabetes in the community.

RECOMMENDATION

Based on the findings of the study and analysis of results, recommendations given by researcher after the research done: Policy formation for new structural establishment to control and prevention of NCDs in current health system. Diabetes specialist should be available in Zonal government hospital. To aware the people, reduce the risk factors like addiction of smoking, alcohol, substances abuse, use of junk food and sedentary life style .Diabetes conference and workshop which provides forum for reviewing scientific evidence and providing guidance on its implementation to improve prevention and health care. Special emphasis on physical therapy in walking, exercising, diet management, and stress release in the community. Further Research and continuous survey program should be organized with collaboration of different stake holder to active community participation.

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Assessing self-care practices on diabetes among diabetic patients attending diabetes clinic in Kathmandu, Nepal

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ABSTRACT

The study was conducted to assess self-care practices among diabetic patients attending in diabetic clinic in Kathmandu, Nepal. This descriptive hospital based study was conducted in Kathmandu, Nepal. Purposively one private hospital and one government hospital was selected for the study. Total of 162 respondents were taken for the study from each organization within limited time period allocated for data collection. The first come first serve basis was used for the selection of the respondents. About 56.4 per cent of respondents were visiting government clinic and 43.6 per cent of respondents were visiting private clinic every month. About 40.7 per cent of respondents who were visiting government hospital and about 59.3 per cent of respondents who were visiting private hospital had got measured their blood sugar more than once in month in the laboratory. About 39.1 per cent of respondents in government hospital and 60.9 per cent of respondents in private hospital had consulted a dietician and reported that following diet chart. Only 21.6 per cent of the respondents had their foot examined. About 73.45 per cent of them prefer for walking for physical exercise.

INTRODUCTION

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Diabetes mellitus is one of the most common non-communicable diseases, and its epidemic proportion has placed it at the forefront of public health challenges currently facing the world. The World Health Organization (WHO) estimated the global burden of diabetes at 135 million cases in 1995, in a worldwide adult population of under 4 billion, and has projected that there will be 299 million cases by the year 2025. It is predicted that between 2000 and 2025, the size of the world's adult population will increase from less than 4 billion to 5.5 billion, mainly on account of a 60 per cent increase in developing countries. The data published in 2011 by WHO showed deaths due to diabetes mellitus reached 3,224 (2.17%) of the total deaths in Nepal. This may be due to changes in life style, urbanization and physical inactivity. Diabetes is also the most common chronic disease with devastating complications which impose significant economic consequences on individuals, families, health systems and countries. (Jagdish and Shetty 2009) Study of self care practice of diabetic patients can be beneficial for utilizing data for the purpose of developing a plan for changing self-care behaviors of diabetic patients. Such plan can enable diabetic patients to control their

blood glucose level, as a result; the incidence of complications and death among diabetic patients can be reduced through controlling diabetes mellitus symptoms, dietary management, diabetes medications, exercise, and basic self-care behavior. The objective of this study was to find out the different self care practices in diabetic patients.

MATERIALS AND METHODS

This descriptive hospital based study was conducted in Kathmandu, Nepal. Purposively one private hospital and one government hospital was selected for the study. The study was conducted among 162 diabetes patients. The diabetic patients who had attended the diabetes clinic during the data collection period were taken as respondents till the sample size was completed. 81 respondents were taken from government hospital and other 81 respondents were taken from private hospital for the study. The first come first serve basis was used for the selection of the respondents and the willingness of the respondents to participate in the study was also considered after the verbal informed consent. Structured interview schedule was used for face to face interview.

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Frequency of visiting physician	Government	Private	Total
Every month	22(56.4%)	17(43.6%)	39(100%)
As advised by physician	27 (41.5%)	38(58.5%)	65(100%)
Only if some problem comes	17(54.8%)	14(45.2%)	31(100%)
2-3 months	15 (55.5%)	12(44.5%)	27(100%)
Total	81 (50%)	81 (50%)	162 (100%)

RESULTS AND DISCUSSION

Table 1: Frequency of visiting physician

Table 1 shows about 56.4 per cent of respondents were visiting government clinic and 43.6 per cent of respondents were visiting private clinic every month. Physicians have an important role to play in the long term control of the disease as diagnosis of early symptoms and correct drug regimen helps in minimizing the complications.

Measured blood sugar/month	Government	Private	Total
More than once	11 (40.7%)	16(59.3%)	27(100%)
Once	50(53.2%)	44 (46.8%)	94(100%)
Not regular	20(48.7%)	21 (51.3%)	41(100%)
Total	81 (50%)	81 (50%)	162 (100%)

Table 2 shows the practice of testing blood sugar during the previous one month, most of the respondents measured once a month which shows that patients are aware that they should have normal blood sugar level which helps them to know about their health and prevention against further complications which was quite similar to study conducted in western Nepal where three-fourths of patients were subjected to blood sugar checking at good intervals and almost all were under regular contact with the physicians. (Shrestha and Nagra, 2005). About 40.7 per cent of respondents who were visiting government hospital and about 59.3 per cent of respondents who were visiting private hospital had measured their blood sugar more than once in month.

Maintain diet	Government	Private	Total
As advised by	9 (39.1%)	14 (60.9%)	23 (100%)
dietician			
As advised by	22 (52.4%)	20 (47.6%)	42 (100%)
physician & health			
professional			
By own (Randomly)	50 (51.5%)	47 (48.5%)	97 (100%)
Total	81 (50%)	81 (50%)	162 (100%)

Table 3 shows the respondents' dietary pattern. About 39.1 per cent of respondents in government hospital and 60.9 per cent of respondents in private hospital had consulted a dietician and reported that following diet chart. This practice is not followed by all the respondents as compared to study in Jamaica where about eighty-five percent had consulted a dietician (**Duff** *et al*, **2006**).

Irregular practice Frequency Percenta			
Yes	28	17.3	
No	134	82.7	
Total	162	100	

Table 4: Practice of irregularly consuming medicines

Medication as prescribed is most important to control the blood glucose level among diabetic patients. *Table 4* shows that only about 17 per cent of respondents had not taken medication as prescribed.

Table 5: Practice of foot examination

Foot examination	Frequency	Percentage
Yes	35	21.6
No	127	78.4
Total	162	100.0

Patients' foot care is required for self foot inspection to prevent from foot ulcer. The *table 5* shows that only 21.6 per cent of the respondents had their foot examined and only about 31 per cent of respondents were washing their feet daily. It was quite similar to study in India where 17 per cent participants knew self care practices to prevent foot ulcers (**Chone** *et al*, **2008**) and in Pakistan only 14 per cent of respondents had good practice for foot care (**Hasnain and Sheikh**, **2009**).

Table 5: Practice of exercise

	Multiple Response N= 130		
Exercise	Frequency	Percentage	
Walking	119	72.1	
Yoga	35	21.2	
Light sport	2	1.2	
Aerobics	7	4.3	
Cycling	2	1.2	

Multiple Deemense N 126

Physical activity is another vital factor that has been linked to numerous metabolic improvements and lower overall mortality. Many studies have confirmed the beneficial role of physical activity in improving glycemic control. Table 1 show that 72.1 per cent of them prefer for walking which is one of the best exercises for the diabetic patients. But 16.67 per cent of respondents were not involved in any type of exercise due to lack of time and many females responded that they are busy in household activity, whereas household work is considered as sedentary work.

CONCLUSION

While considering self-care practices of respondents, about 56.4 per cent of respondents were visiting government clinic and 43.6 per cent of respondents were visiting private clinic every month. About 40.7 per cent of respondents who were visiting government hospital and about 59.3 per cent of respondents who were visiting private hospital had measured their blood sugar more than once in month in the laboratory. About 39.1 per cent of respondents in government hospital and 60.9 per cent of respondents in private hospital had consulted a dietician and reported that following diet chart and 72.1 per cent respondents had good practice of exercise.

The self care practices regarding daily exercise, diet management, medication as prescribed and blood glucose monitoring in the laboratory was adequate but about 78.4% of respondents had never examined the foot. There should be provision in each hospital for the consultation on self care practices.

ACKNOWLEDGEMENT

At this moment of accomplishment, first of all I pay homage to my adviser, Dr.Neena Gupta, Sr. Assistant Professor, Faculty of Health Sciences. This work would not have been possible without her guidance, support and encouragement. I would also like to acknowledge all other teachers of Faculty of Health Sciences, SHIATS for their valuable advice and guidance during this research.

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A Study on patient's satisfaction towards the services provided by District Hospital in Kapilvastu, Nepal

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ABSTRACT

The study has been designed to analyze the factors that are responsible for influencing the satisfaction of patients with respect to district hospital of Kapilvastu district in Nepal. A sample of 217 patients at different educational backgrounds have been selected and studied with reference to various factors that influence the satisfaction of patients. The study attempted to identify factors which are related to patient attitude towards staffs, Nurses, Doctors, laboratory, waiting time, queuing system and other health services. Based on the importance given by the respondents on various factors, opinion scores are calculated. The level of satisfaction according to their attitude was assessed. The result revealed that majority of the male from productive age group were utilizing the health services. Overall level of patient's satisfaction to the services provided by the district hospital was 82.5 per cent which suggests high level of satisfaction. Regarding services in district hospital, registration and electricity facility were found satisfactory whereas toilet cleaning, drinking water facility and waste disposal system needs to be improved. The Chi square test has been employed to analyze the data. The study reveals that there is a significant difference between level of satisfaction and age group.

Thus it is revealed from the study that maximum respondents were using the hospital services. The services can be made better if a public health officer is employed.

INTRODUCTION

Patient satisfaction is of high value and it is useful to understand the need of patients. By understanding the importance of satisfaction and determining its existing level, health care services can be made relevant to the requirements of people and patients. Assessment of level of patient satisfaction is the tool to determine the level of health care delivery, analyze the existing situation and workout strategy to improve it. Patient satisfaction survey is an instrument in monitoring hospital's quality of care in relation to cost and services. Unsatisfied patient will not come back to the hospital and it will lead to wastage of government resources. Patient's satisfaction is the idea obtained by comparing the incidents experienced during the visit period in which the customer search while buying, using and consuming the product or service to their expectation. Therefore, the best interest of any health service organization is to keep its customers happy.

Patient satisfaction has long been considered an important component when measuring health outcomes and quality of care. The rising strength of consumerism in society highlights the central role patient's attitudes play in health planning and delivery. Furthermore, a satisfied patient is more likely to develop a deeper and longer lasting relationship with their medical care providers, leading to improved compliance, continuity of care, and ultimately better outcomes. The concept of patient's satisfaction in the health care system has been introduced first in developed nations. However, this is rapidly becoming a global issue. More and more countries are focusing their attention on patient's satisfaction because of the concern that health care is costly, and therefore, needs to be dispensed appropriately and equitably with minimum variation. The last 20 years have witnessed an accelerating increase in attention given to patient satisfaction within health services

Hospitals act as a bridge between people and health service providers. Hospital is responsible for providing a curative as well as preventive care. A good understanding can only be developed when people are assured in quality, quantity and continuity of services appropriate to their needs with their active participation.

OBJECTIVE

To assess the level of patient's satisfaction with the services provided by the District hospital.

METHODOLOGY OF STUDY

Descriptive hospital based study was conducted. Kapilvastu district hospital was selected purposely for the stud and a structured interview schedule was used for face to face interview. All the OPD patients using services from the District hospital were selected till the sample size was

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met. Respondents were selected on the basis of First come first in method. The sample size was estimated by using the statistical formula.

$$n = \frac{Z^2 * p^* q}{e^2}$$

The sample size calculated according to the formula was 217. Sample size was calculated on basis of prevalence (Patient's satisfaction) 0.83.

RESULTS

Table 1:- Gender wise distribution of the respondents.

Gender	Frequency	Percentage
Male	134	61.8
Female	83	38.2
Total	217	100.0

Table 1 shows that majority (61.8 %) of the respondent were male and female were 38.2 per cent.

Table 2:- Attention provided by the receptionist.

Response	Frequency	Percentage
Yes	173	79.7
No	44	20.3
Total	217	100.0

Table 2 shows that majority (79.7 per cent) of the respondents were satisfied with the attention provided by the receptionist and only 20.3 per cent of the respondents were not satisfied with the attention provided by the receptionist.

 Table 3:- Association between gender and overall health care services.
 N=217

	Overall health care services		
Gender	Disagree	Neutral	Agree
Male	3.8%	23.1%	73.1%
Female	2.4%	36.2%	61.4%
χ 2=4.384	(0.05, df=2)	p-value=0.112	Not significant

Table 3 shows that there is no significant relationship between gender and the overall health care services.

 Table 4: Association between age group and overall health care services.
 N=217

	Overall health care services		
Age group	Disagree	Neutral	Agree
Below 19 year	3.5%	21.5%	75.0%
20-29 year	5.5%	32.0%	62.5%
30-39 year	3.0%	48.5%	48.5%
40-49 year	2.0%	16.4%	81.6%
Above 50 year	0.0%	21.3%	78.7%
χ2=15.840	(0.05, df=8)	p-value=0.045	Significant

Table 4 shows that there is significant relationship between age group and the overall health care services.

Table 5:-	Association between marit	al status and overall
	health care services.	N=217

	Overall health care services		
Marital status	Disagree	Neutral	Agree
Unmarried	6.5%	23.0%	70.5%
Married	2.0%	29.4%	68.6%
Separated/	0.0%	50.0%	50.0%
widow			
χ 2=5.005	(0.05, df=4)	p-value=0.287	Not significant

Table 5 shows that there is no significant relationship between marital status and the overall health care services.

 Table 6: Suggestion and comments as given by the respondents.

Suggestions and comments	Frequency	Percentage
Toilet & Bathroom should be	63	29.0
properly cleaned.		
Drinking water should be kept	25	11.5
in the waiting room.		
Lab. tests should be done	46	21.2
inside the hospital.		
Long waiting time for	31	14.3
consulting the doctor.		
Specialized doctor should be	27	12.4
available in this hospital.		
More chairs should be kept	25	11.5
inside the waiting room.		
Total	217	100.0

Table 5 shows that most of the (29 per cent) respondents commented on improvement and cleanness of the toilet and bathroom. 23.0 per cent respondents suggested keeping drinking water and more chairs in the waiting room. 21.2 per cent respondents suggested performing the lab. 14.3 per cent suggested improving the long waiting time for consulting the doctor. 12.4 per cent respondents suggested for the specialized doctors.

DISCUSSION

Majority (79.7 per cent) of the respondents were satisfied with the attention provided by the receptionist and only 20.3 per cent of the respondents were not satisfied with the attention provided by the receptionist. There was no significant relationship between gender and the overall health care services. There was significant relationship between age group and the overall health care services. There was no significant relationship between marital status and the overall health care services. According to respondent's suggestions and comments the second (23.0%) priority was to increase the number of chairs and to keep drinking water facility in the waiting. Most of respondent commented on waiting time (14.3%), from the point of entry to exit in the hospital, the respondent has to wait at various stages i.e. enquiry/ registration counter, doctor's chamber, laboratory and pharmacy etc. A study conducted in a tertiary care hospital in India also revealed that 25% patients, waiting time for consultation seems to be extends to more than three hour. Some respondents suggested for the specialized doctors in the district hospital.

CONCLUSION

The result revealed that the maximum number of male population was utilizing the services from the district hospital. Overall it was observed that level of satisfaction was not significantly associated with socio demographic variable except with the age group. Regarding the avail services in district hospital, registration and electricity facility were found satisfactory whereas toilet cleaning, drinking water facility and waste disposal system needs to be improved.

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