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PREFACE

The Allahabad Farmer (A Journal of Agricultural Science and Technology) an official Journal of Allahabad Agricultural Institute-Deemed University was for the first time published in the year 1925. Thus it is the foremost and pioneering Journal of Agricultural Science and Technology in India. Perhaps we can mention that it is one of the oldest journal of Agricultural research in whole of Asia.

This is an important publication with all aspects of agricultural rural life, educational research and appropriate technology research, applied to sustainable Agricultural production. This journal is dedicated to farm life development with a vision of **"Feed the hungry"** as commanded to the founders of the Institute by our **Lord Jesus Christ**. Feed the hungry does not only mean to acquire and supply the food to the hungry people but it means to disseminate the latest technology of Agriculture to the farmers in order to enable them to produce more food. The objectives of the journal are to further the work and interest of Agricultural research and scientists and to facilitate cooperation among them through research, to foster scientific honour in order to improve the effectiveness of Agricultural sciences, human resource development and welfare through technology, to enhance public understanding through Agriculture news and to appreciate the importance of innovation and creativeness through agreed highlights. The Allahabd Farmer is a forum for preservation and reviewing of burning issues pertaining to the advancement of sustainable Agriculture on planet earth.

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The Allahabad Farmer Vol. LXI July, 2006 No. 1

Studies on the use of Turmeric on the Organoleptic Quality of Shrikhand

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ABSTRACT

Present investigation was undertaken to study the effect of turmeric (Curccuma Longa L.) on Shrikhand. It can be concluded that turmeric powder has been found to be suitable as a colouring material of Shrikhand. The different levels of turmeric powder are added at the time of boiling of milk. The turmeric powder (0.075%) on the basis of quantity of milk was found to be most acceptable because of its higher score in taste, colour and appearance.

INTRODUCTION

The name Shrikhand is derived from the Sanskrit word "Shikharni", it is a good nourishing indigenous fermented food rich in caloric values. It is easily digestible with functional properties suitable for persons suffering from lactose intolerance. The curd obtained from dahi by draining of the whey (Chakka). It is very popular in Gujarat and Maharastra and South Western part of India. After adding sugar, saffron, nuts and colouring material into Chakka it becomes Shrikhand. The natural colouring material plays a greater role as preservative in the dairy products (eg.) some additional advantage such as its purity availability and applicability, **(Rao, 1983)**. Turmeric is one of the ingredients very commonly used for preparing vegetable and non-vegetable dishes in our country. Turmeric rhizomes are more easily available and comparatively cheaper preservatives of foods. Turmeric is used as blood purifier, antiparasitic for skin infection, antacid, appetizer and antiparasitic in desi system of medicine. Turmeric has antibacterial anti fungal and antioxidant properties even in low concentration **(Ghosh, 1980)**. **Durga Prasad (1982)** reported that turmeric power is nontoxic and can be extracted in concentrated forms.

MATERIAL AND METHODS

The experiment work was carried out at a Research Laboratory, Department of Dairy Technology, Allahabad Agricultural Institute-Deemed University Allahabad. Turmeric powder was added into standardized milk. The experimental Shrikhand were coded as T_1, T_2 and T_3 and were made from standardized milk to with the edition of 0.05 gm and 0.075 gm and 0.1 gm turmeric power respectively. T_0 represented as control without adding turmeric power. The different samples of Shrikhand, replicated ten times were evaluated for sensory quality. The data obtained were statistically analysed by using analysis of variance and critical difference technique.

Physico-chemical analysis : The moisture and ash content of paneer samples were determined by gravimetric method as given in **IS: SP: 18 (Part XI), 1981.** The titratable acidity of samples was determined by the method recommended by the Association of Official Analytical Chemists **(AOAC, 1984)**. For determining the pH, 10 g of the sample was mixed with 10 ml of glass-distilled water and slurry was prepared thereof in a mortar. The pH of the slurry was determined by using double junction electrode pH scan 3 +, Eutech Instruments Pte Limited, Singapore. The protein content of samples were determined following the procedure delineated by **Kosikowski (1982)** with slight modification. Three gram of sample was accurately weighed, and digestion and distillation were carried out by micro-Kjeldahl method **(Meneffee and Overman, 1940)** using Kjeltec automatic digester and distillation equipment (Tecator make, Sweden).

Sensory evaluation : The product was evaluated by panel of 5 judges with regard to the colour & appearance, taste & flavour, body & texture and over all acceptability by using 9 point score card based on Hedonic scale.

Statistical Analysis : The data obtained after physico-chemical and sensory evaluations were subjected to statistical analysis, using analysis of variance technique.

RESULTS AND DISCUSSION

The experimental Shrikhand was made as control with 0.05% turmeric powder (T_1) 0.075% turmeric powder (T_2) 0.10% for turmeric powder (T_3). The samples were also subjected to organoleptic evaluation on a 9 point hedonic scale by the panel of five judges. The data obtained were statistically analysed by analysis of variance technique and critical difference.

Organoleptic evaluation :

Taste and Flavour : From the results obtained from the *Table -1* and *Table - 2*. The average score for taste and flavour of the Shrikhand prepared from different treatments differs significantly, the maximum score (T_1; 8.7) was obtained from Shrikhand prepared with the addition of 0.075% turmeric powder on the basis of milk quality.

Table 1:- Sensory quality of paneer

Sensorial quality	**T_0 (control)**	**T_1**	**T_2**	**T_3**
Taste and Flavour	8.2	8.4	7.9	7.4
Body & Texture	8.0	8.6	7.8	7.6
Colour & Appearance	8.0	8.7	7.9	7.6
Over all acceptability	8.2	8.5	7.8	7.5
Data of mean 8 observation (±) SEM	±0.2	±0.3	±0.1	±0.3

Table 2:- ANOVA on the sensory properties of paneer

	MSS				
Source of Variation	**df**	**Taste & Flavour**	**Body & Texture**	**Colour & Appearance**	**Over all acceptability**
Treatment	9	2.265	0.132	0.168	0.154
Replication	3	0.333	0.609	0.524	0.521
Error	27	0.064	0.028	0.048	0.043
CD		0.33*	0.27*	0.31*	0.25

* Significant at 5 % level of probability

NS: Non significant

Colour and appearance : The average scores for colour and appearance of the Shrikhand prepared from different treatments differed significantly. It is revealed from the *Table-2*. This may be due to the addition of turmeric powder in Shrikhand.

Body and texture : From the findings of *Table -1* and *Table - 2* it is revealed that the average scores of body and texture of the Shrikhand in different treatment varied significantly.

Over all acceptability : From the observations shown in *Table 1* the maximum score of 8.4 was recorded in T_1 followed by T_2 (8.2), T_2(7.9) and T_3 (7.4) The judges opined that Shrikhand prepared by incorporation of (0.075%) level of turmeric appears to be having more soft body and weak texture that attributed to be more desirable and highest sensorial score among all the experimental treatments. The overall acceptability score observed from *ANOVA (Table - 2)* showed significant difference in the over all acceptability ($p>0.05$) of different treatment combinations.

CONCLUSION

From the findings of study undertaken it is concluded that Turmeric powder (Curccuma Longa L.) has been found to be suitable in manufacturing of Shrikhand. The different levels of turmeric powder are added at the time of boiling of milk. Amongst the different proportion of turmeric powder, @0.075% turmeric powder on the basis of quantity of milk was found to be most acceptable because of its higher score in taste, colour and appearance.

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Effect of Selected Operating Parameters of Tractors at Different Loads on Noise

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ABSTRACT

The noise exposure level in farm tractors fluctuates due to various factors; that includes equipment load, draft load, gears and environmental conditions. In this study, different tractors, equipments and environmental conditions were taken into consideration as sources of noise pollution. The influence of different load, engine speeds and transmission gears, on the noise levels were determined. The level of annoyance depends not only on the noise level, but also on the operator's position, and the duration of exposure. The level of noise when the tractor was stationary or neutral was also measured.

The intensity of noise pollution was determined at the ear level of the operator, and at bystander level. A digital sound level meter was used to measure the noise of the two experimental tractors viz: Mahindra B 275 DI and John Deere 5103 S. The effects of different engine speeds (1000 rpm and 2000 rpm) on the noise level were studied. It was found that the tractor produced 5-8 dB(A) more noise as engine speed changed from 1000 rpm to 2000 rpm. Three different transmission gears (1st High, 2nd Low and 3rd Low) were used and their effect on noise level was found not to be very significant, but a trend was observed that as we switch to higher gears, noise level increased. Four different load conditions viz: no load, MB plough, cultivator & seed drill were taken, and it was found that as the load increased, the noise level also increased. It was observed that the trend of increase of noise level was almost similar for both the experimental tractors i.e. noise levels increased linearly in both tractors when load increased or when rpm increased or when we switched to higher gears.

Combining all the factors, the maximum noise level was found on 1st High Gear, at 2000 rpm, for MB plough, which was 89.26 dB(A), and the maximum noise level at the bystander's ear level was found to be 73.33 dB(A) under same conditions. Thus, the study concluded that the noise level at the operator's ear level was on the higher side of the safety limits.

INTRODUCTION

Agricultural tractors as a part of farm mechanization have contributed a lot to the rapid progress in the field of Agricultural production in India and the world at large .The tractor has contributed ease to the farmer with respect to minimizing the total working hours; minimize the energy to perform an agricultural task and increasing the work out put. Tractors have been contributing their effort not only in the field but also off the field. PTO operated threshers, pumps, reapers, movers, hay packers, cotton gins etc. are the common sight on most Indian farms and the list of tractor operated machines is ever increasing. Under the present circumstances, a modern farm is unimaginable with out a tractor in its immediate vicinity.

The designs of modern Tractors not only include its efficient performance but also include 'human factor' considerations, these factors when properly incorporated in the design allow the operator to perform, many complex tasks with efficiency, safety and minimum mental and physical fatigue. In general, human factors include riding comfort, visibility, location of controls, thermal comfort and sound control **Purcell (1980)**. One of the deadliest problems associated with the Tractor is the high level of noise emitted by them because diesel engines, which are much noisy in themselves, run most Tractors. The noise being added to by ill design of the mufflers, transmission systems and poor maintenance. This has led to serious rise in the past few decades of exposure of farm workers to the noise **Meyer et al (1993)**.

The effect of noise is not a reduction of the speed at which the work is carried out but a decrease of accuracy in the work. **Aren and Celen (1995)** reported that to assure healthful working conditions and to preserve human resources workers must be protected from high noise either by technical means or by personal means. Hearing test on tractor driver indicated that exposure to tractor noise for long periods caused a typical early loss of hearing at 4000 Hz. With further exposure, the hearing loss increased at 4000 Hz and extended to other frequencies **Weston (1963)**, apart from causing hearing loss noise seemed to impair various other body functions. It produced annoyance and at moderate levels interfered with performance **Nigum (1980)**. Effects of noise can be divided into three areas – Physiological effects, Psychological effects and Interference with communications. **Dewangan et al (2005)**.

Therefore, a study has been undertaken with an objective to study the effect of different loads, different gears and different engine speeds on noise level.

MATERIAL AND METHODS

As a noise source, two tractors were selected Mahindra - B 275 DI & John Deere – 5103 S, three different loads viz Mould board plough, 9 - Tyne Cultivator and Seed – Drill were taken into consideration for the experiment. The observations were taken in original field conditions at standard operating parameters. Therefore, a plot was randomly selected in the farm and irrigated in order to attain proper moisture content. This field was taken as the test track for the experiment.

For measuring noise level at operator's ear level position, experimental tractor was placed on the test track having a length of 20 m of straight section and was ensured that the tractor speed is stabilized for an adequate time. The measurement device were held 5 centimeters away from ear on the side that gives the highest sound level as determine in preliminary tests, while tractor was running. For Bystander's position, the noise level meter was fixed at a distance of 7.5 meter from the line of travel. The height of measurement device was 1.2 meter. To measure the atmospheric conditions like wind speed, humidity and ambient temperature, anemometer, hygrometer and thermometer were used respectively. The noise level measured were expressed in terms of dB(A). A precision sound level meter was a hand held, portable battery operated, digital display type instrument with a condenser microphone (type 4165) used with a frequency range of 20 Hz to 20 kHz. The sound level meter used, gave precision values up to one digit of decimals.

Before starting measurements, the tractor was run to attain normal running temperature. During all the tests at the draw bar, the governor control were set for selected power. The test tractors were run on the test track initially at no load. The engine speed fixed at selected rpm in the selected forward speed gear and the noise level at the operator's ear level & bystander's level was measure for the trial. The operation parameters are shown in *Table 1*. Three replications were taken for each trial. Similar trials were carried out for all selected engine speeds and gears. Then the test tractor was attached to the load and again noise levels were recorded for all combination of engine speed gears and loads.

Table - 1: Operation Parameters for Testing.

S.N.	Gears	Engine Speed (rpm)
1.	1st High	1000
		2000
2.	2nd Low	1000
		2000
3.	3rd Low	1000
		2000

RESULTS AND DISCUSSIONS

The levels of noise at operator's ear level and bystander's ear level were measured in the actual field conditions to study the ground level realities. The noise levels obtained are shown in the graphs. The wind blew with a speed of 1.5 to 2.5 m/s in the direction parallel to the moving direction of tractor. The relative humidity was measured to be 42% and the soil moisture content was 14% to 16%. The test field was silt loam type soil. The background noise level was found to be 50 to 54 dB(A). The atmospheric conditions are given in *Table 2.*

Table - 2: Atmospheric condition during the experiment.

Atmospheric Conditions	Mahindra B 275DI	John Deere 5103 S
Back ground noise level	50 dB(A)	52 dB(A)
Soil Type	Silt Loam	Silt Loam
Moisture content	14 %	14 %
Ambient Temperature	37.6 ° C	37.6 ° C
Relative Humidity	36	41
Wind velocity	2.5 – 3 km/h at the direction of travel.	2.5 – 3 km/h at the direction of travel

Effect of loads on Noise Levels :

The experiment was conducted under four different categories of loads viz. no loads, MB Plough, Cultivator and Seed Drill. The draft on the implements are given in *Table 3.* The noise level for different loads are shown by graphs *(figs. 1 – 4).* The following

figures clearly demonstrates the effect of loads on noise levels The noise levels increase significantly as the load increases from no load to Seed Drill, Cultivator and finally MB Plough. The maximum noise level for no load was observed to be 86.2 dB(A) at operator's ear level and 68.93 dB(A) at bystander's ear level. At maximum load using MB plough, the maximum noise level was observed to be 89.26 dB(A) at operator's ear level and 73.33 dBA at bystander's ear level. The difference in noise levels varied from 3 dB(A) to 4.5 dB(A) as the load increased. The trend was very much similar for both the experimental tractors clearly indicating that as the load increases on the tractor, noise level also increases. In addition, the increase was observed almost linear for all the selected gears and at different engine speeds. The minimum noise level observed during the experiment at no load was 77.7 dB(A) at ear level of operator's and 61.2 dB(A) at bystander's ear level.

Table - 3: Draft values for different implements.

Mould board plough	Cultivator	Seed drill
224 kg	162 kg	135 kg

Effect of gears on noise levels :

The experiment was conducted under three different sets of gears viz. 1st High, 2nd Low and 3rd Low. The gears set were selected on the basis of preliminary trails conducted in the field. Considering the safety limits of operation of implements and other favourable factors, these set of gears were selected for the experiment. The effect of gears on noise are shown in graphs. These figures clearly indicate the trend that as the gear ratio changes from lower to higher side, noise levels also goes on increasing. In all the observations, it was a clear trend that noise levels are minimum for 2nd Low, increases for 3rd Low and is maximum for 1st High. The difference of noise level on switching from one gear to other depends on several other factors. But keeping all the other factors constant, about 0.5 to 3 dB(A) difference is observed. The graphs also show that this difference between noise levels at different gear sets have been more pronounced at lesser loads and as the tractor becomes more and more loaded the difference between the noise levels at different gears decreases.

Effect of engine speed on noise levels :

The experiment conducted to observe the effects of engine speed on noise level. For the purpose two different engine speeds, viz. 1000 and 2000 rpm were selected based on preliminary test results. The graphs prominently indicate the effect of engine

speed on noise levels. It was observed that there was a sharp increase on noise levels as the engine speed changed from 1000 to 2000 rpm. The maximum noise level observed in the experiment at 2000 rpm was 89.26 dB(A) whereas the maximum noise level at 1000 rpm was 83.1 dB(A) .The readings clearly indicate that the rise in the noise level was about 5 to 8 dB(A) as the engine speed changed from 1000 to 2000 rpm. It was also observed that the load has almost no effects on the noise level increment. The reading also suggest that the trend was same for both the experimental tractors viz. MAHINDRA B275 DI and JOHN DEERE 5103 S and the increment was almost same for all the observation points: Operator's ear level and bystander's ear level. The reason for sharp increase in the noise levels was that at high rpm, engine noise was added sharply by the structural noise of tractor body.

CONCLUSION

Tractors are covered by specific noise legislation. When new, levels of 90 db (A) must not exceed.

1. Change in load significantly influenced the noise levels. Increasing loads creates more noise. Maximum noise level for no load, mould board plough, cultivator and seed drill observed at ear level was 86.2, 89.3, 88.5, 87.6 dB(A) and for bystander was 68.93, 73.33, 72.46, 70.2 dB(A) respectively.
2. As the gear – set went up from low to high, noise level also increased but the increase was not much. Maximum noise level for 2nd low ,3rd low and 1st high gears observed at operators ear level were 87.1, 87.9, 89.3 dB(A) and 71.4, 72.3, 73.3 dB(A) at bystanders level respectively.
3. A sharp increase in noise level was observed as the engine speed changes from 1000 to 2000 rpm. Maximum noise level for 1000 and 2000 rpm engine speed observed at operators ear level were 83.1 and 89.3 dB(A) and 67.8, 73.3 dB(A) at bystanders level respectively.

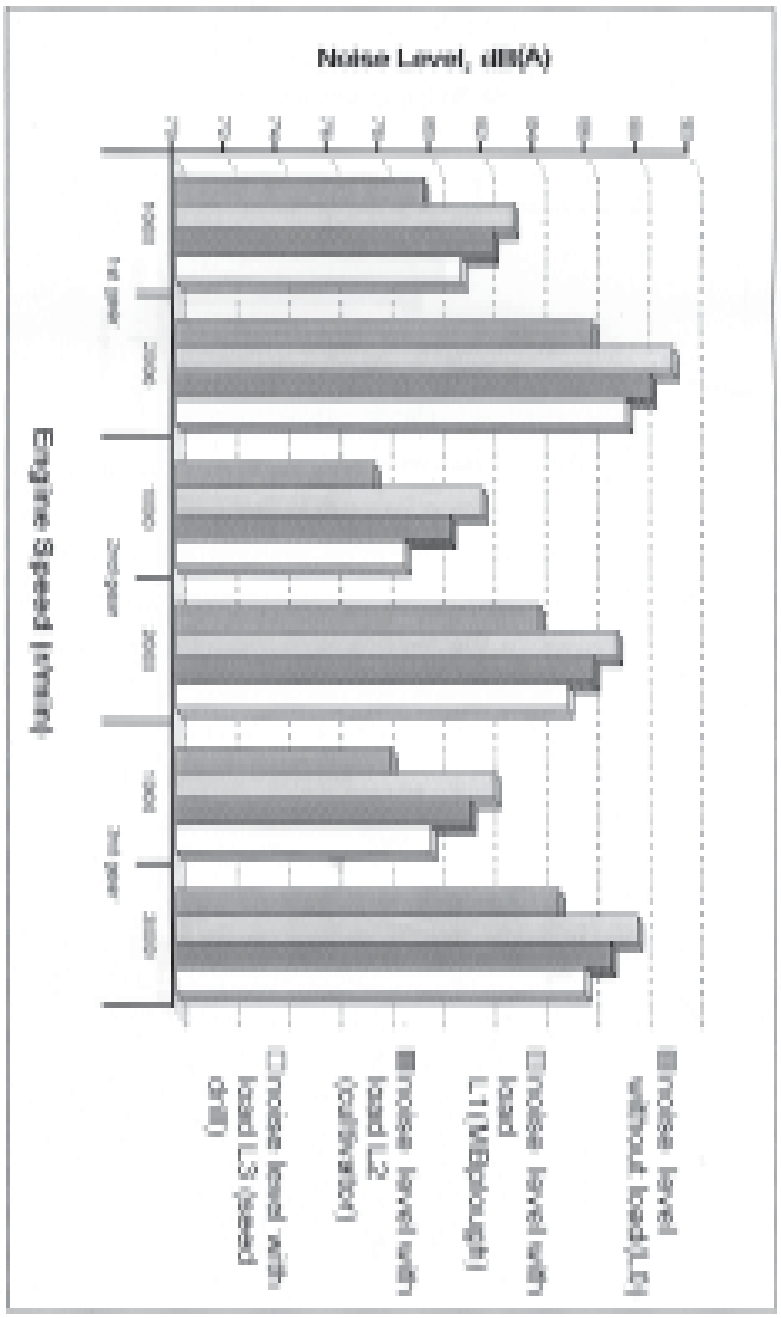

FIGURE 1: NOISE AT OPERATORS EAR LEVEL FOR MAVEDRA RTS 38

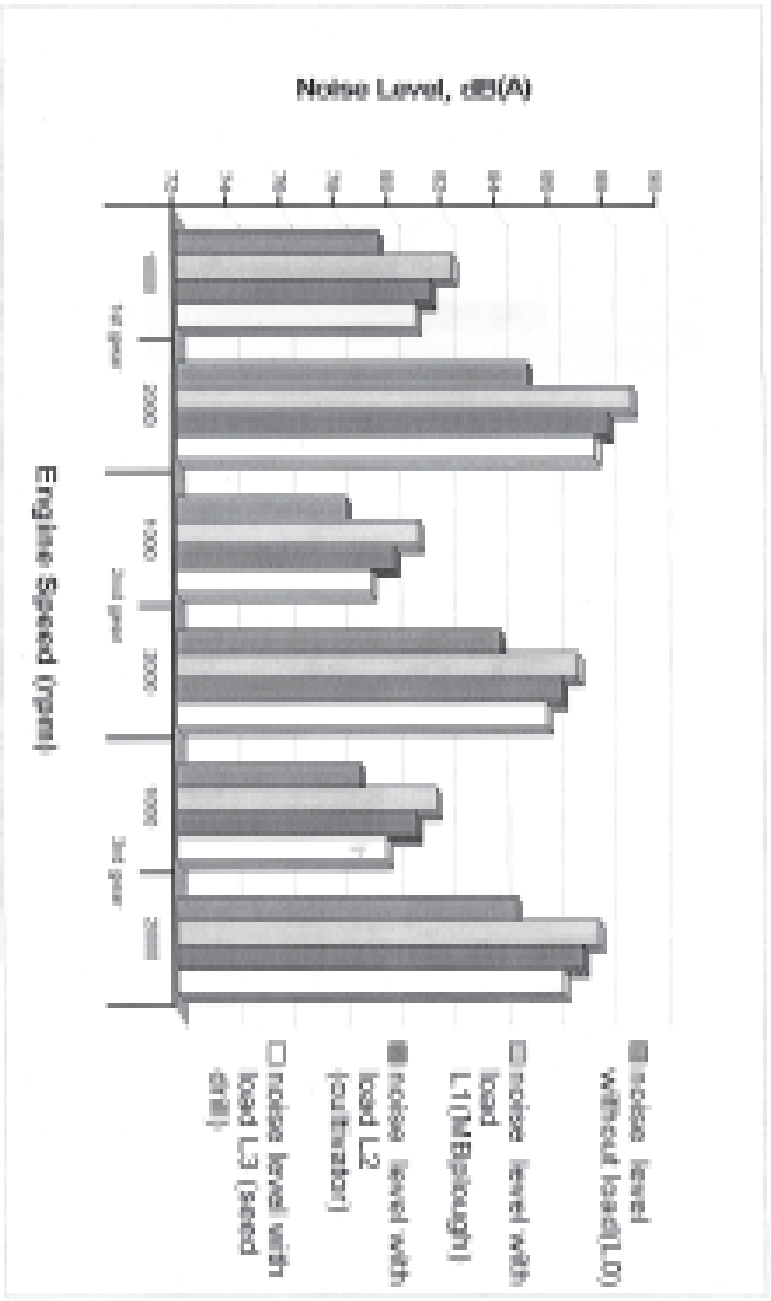

FIGURE 2: NOISE AT OPERATORS EAR LEVEL FOR JOHN DEERE 5605

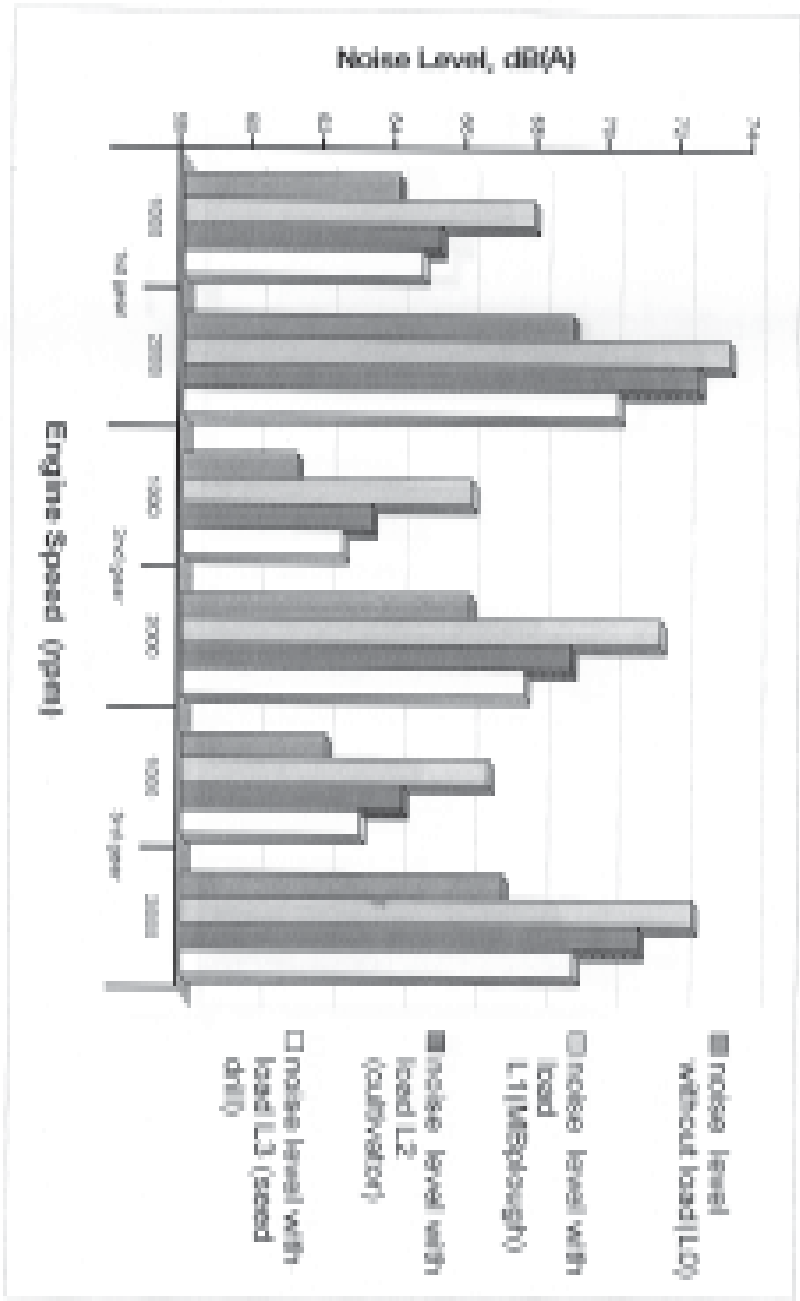

FIGURE 3: MAHINDRA B-275-DI NOISE AT BYSTANDERS EAR LEVEL

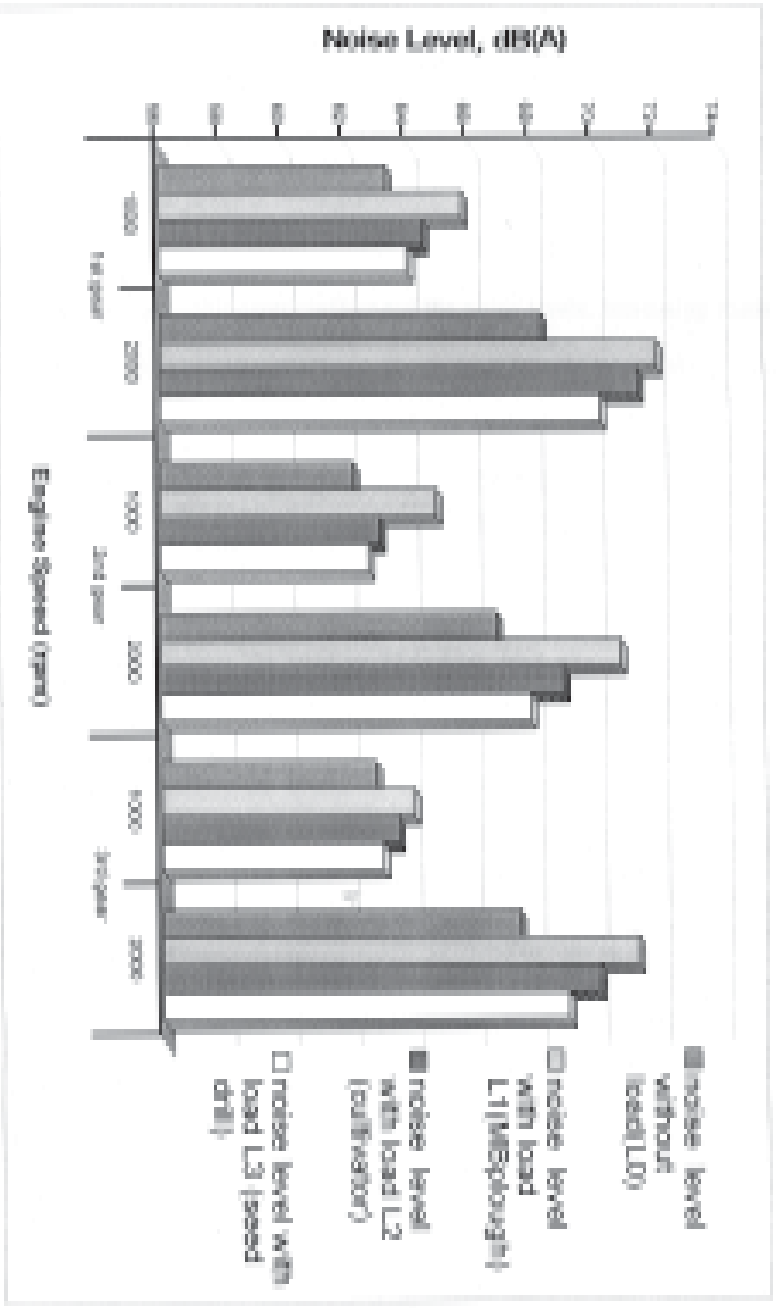

FIGURE 4: JOHN DEERE 5043 S NOISE AT BYSTANDERS EAR LEVEL

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Anaemia in Pre-School children belonging to rural and urban areas of Allahabad District

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ABSTRACT

A comparative study on pre-school children between 4-6 years of age was conducted regarding the prevalence of anaemia in rural and urban areas of Allahabad district. A total of 110 pre-school children, 60 from urban area and 50 from rural area of Allahabad district were selected randomly. Data on anthropometric measurements, height, weight and mid upper arm circumference (MUAC) were recorded. Dietary intake was determined by twenty-four hours dietary recall method for three days and the average nutrient intake was calculated. Biochemical tests included haemoglobin estimation of pre-school children analyzed by cyanmethaemoglobin method. Children with haemoglobin < 11 g/dl were identified as anaemic. Overall, 26.36 percent children where found anaemic with higher prevalence (38%) in rural children than urban children (16.67%). The mean height and weight of both pre-school children were less than the standard values of National Council of Health Statistics (NCHS) except in children in the age group of 6 years and no significant difference was found between height and weight of rural and urban pre-school children. Children in both the areas had a lower calorie intake as compared to Recommended Dietary Allowances (RDA). The mean intake of iron, calcium and protein was significantly lower in rural preschool children than urban children. Iron and protein in the diet of the rural pre-school children were found to be less than the recommended values of Indian Council of Medical Research (ICMR).

INTRODUCTION

In India, Iron, Iodine and vitamin A deficiency are the major public health problems. According to National Institute of Nutrition (NIN) Hyderabad, in India prevalence of anaemia among women varies from 80 percent in Delhi to 60 percent in

Hyderabad, 45 percent in Madras and 85 percent of preschool children are anaemic. **(Srilakshmi, 2000)**. Pre-school and school going children are extremely vulnerable to iron deficiency anaemia (IDA) and it is a problem of serious concern as it has impact on physical and mental performance. Iron deficiency anaemia occurs when there is derangement of iron balance either due to inadequate dietary intake or poor bioavailability of iron accompanied by parasitic infestations which impairs absorption and increases the requirement **(Jyoti et al. 2001.)** Poor iron stores carried from infancy due to prolonged breast feeding without weaning and repeated gastrointestinal (GIT) and respiratory infections also increase the risk of developing IDA in pre-school children.

Moderate anaemia is a common feature of protein–energy malnutrition (PEM). According to National Family Health Survey (NFHS) 2000, 48 percent young children in India are suffering from malnutrition. It is expected that the problem of underweight and anaemia is more severe in rural areas as about half of the children in the developing world live in rural areas. Data on prevalence of anaemia in rural and urban children of Uttar Pradesh (U P) are limited. Hence the present study was conducted to assess the extent of anaemia and PEM among rural and urban children of Allahabad District.

MATERIALS AND METHODS:

The prevalence of anaemia and nutritional status of children were assessed in two rural blocks ((*Gauspur* and *Phaphamau*) and two urban wards (*Attarsuia* and *Church lane*) of Allahabad district because no such study has been carried out here and U.P. has one of the highest prevalence of anaemia compared to other states of India.

Total of 110 children, 50 from two blocks of rural area and 60 from two wards of urban area aged between 4-6 years were selected. Simple random sampling procedure was adopted to select the children and their mothers were the main respondents to collect the information. The assessment of anaemia was done on the basis of laboratory examination of the blood. Haemoglobin levels of subjects were analyzed by cyanmethaemoglobin method **(Dacie and Lewis 1984)**. Children having haemoglobin levels less than 11g/100ml were classified as anaemic.**(WHO, 1968)**.

General information and data related to anthropometric measurements, clinical assessment, dietary pattern and awareness were collected with the help of pre-tested schedule. Anthropometric measurements suggested by **Gibson (1990)** was used to measure height (cm), weight (kg) and mid upper arm circumference (MUAC in cm)of each child. Twenty-four hours dietary recall was done for three days and average nutrient intake per day was calculated.

RESULTS AND DISCUSSION

The overall prevalence of anaemia among 110 children from rural and urban areas of Allahabad was 26.36 per cent as presented in *Table 1*. Prevalence of anaemia was higher among rural children (38%) than urban (16.67%). When the severity of anaemia was compared it was found that majority (60-63%) were suffering from moderate anaemia in both the areas.

Table -1 : Prevalence of anaemia among per-school children according to Hemoglobin level.

Area	**No. of Preschool children**	**Non-Anaemic Hb>11g%**		**Anaemic Hb>11 g%**		**Degree of Anaemia**					
						Mild (10-10.9) g%		Moderate (7-10g%)		Severe (< 7 g%)	
		N	%	N	%	N	%	N	%	N	%
Rural	50	31	62	19	38	5	26.32	12	63.15	2	10.53
Urban	60	50	83.33	10	16.67	4	40	6	60	-	-
Total	110	81	73.64	29	26.36	9	31.03	18	62.06	2	6.91

F = 0.7469, non significant at p = .05

When analysis of variance *(ANOVA Table)* was applied, it was found that the there was no significant difference between the prevalence rate of anaemia between rural and urban pre-school children.

Rai et al. (1999) has also reported that in India, 40-60 per cent of preschoolers suffer from anaemia with a lower prevalence in urban area than rural area. They further stated that lack of various nutrients like iron, folic acid, vitamin B_{12}, vitamin C and proteins in the diet of children could be the cause of anaemia as these nutrients are required for blood formation. **Singh (2002)** has reported that mild to moderate anaemia is usually due to iron and folic acid deficiency, through recurrent/chronic malaria, dysentery and worm infestation, which could be important contributory factors.

Jyoti et al. (2001) stated that the prevalence of anaemia according to haemoglobin level was found to be 99 percent among rural pre-school children (1-5 years) of Mysore city.

Brahman et al. (2003) reported that IDA is a major nutritional problem of developing world including India. They reported that estimation of haemoglobin by cyanmethaemoglobin method revealed that about 82 percent of the pre-school children were anaemic.

Table 2 shows the comparison of mean height of boys and girls with the NCHS standards in both rural and urban areas. It is evident that the mean height of rural and urban preschool children were less than the NCHS standards but the difference was greater among rural preschool boys. Mean height of rural and urban girls at 6 years age were less than the NCHS standard of same age group and the difference was greater than any age. **Verma *et al.* (2001)** reported that the mean heights of Punjab boys were between 91.6 percent and 91.9 percent of the 50th percentile of NCHS standards at six years of age whereas the mean height of Andhra-Pradesh and Karnataka boys were between 88 percent and 88.8 percent of NCHS at same age. However, they reported poor growth performance of rural and tribal girls from different regions of India. The mean height growth curves of girls of all series deviated downwards the 3rd percentile of NCHS standards from 15th months onwards at all age levels. When the height of rural preschool children was compared with urban preschool children, the difference was found to be non significant ($p < .05$).

Table 2:- Mean height of rural and urban preschool children.

Subject	**Age in years**	**NCHS std. in cm**	**Average height in cm**			
			Rural (n=50)		**Urban (n=60)**	
			Observed ht	**Difference from NCHS standard**	**Observed ht**	**Difference from NCHS standard**
Boys	4	106.6	93.87	-12.73	100.56	-6.04
	5	113.1	99.39	-13.71	110.43	-2.67
	6	119.0	114.94	-4.06	114.08	-4.92
Girls	4	105.0	99.92	-5.08	95.23	-9.77
	5	111.6	107.25	-4.35	103.75	-7.25
	6	117.6	114.13	-3.47	100	-17.6

F table =1.89, Non significant at p = .05

Similarly, the mean weight of rural preschoolers was less than the NCHS standards and urban preschool children had also lesser weight than the standard in almost all groups except boys in the 6 years age group *(Table 3)*. When the weight of rural preschool children was compared with urban preschoolers, the difference was non-significant. **Verma et al. (2001)** reported that the mean weight of growth curves of Haryana, Karnataka and Andhra Pradesh boys and girls were just on the 3rd percentile of NCHS at 12 months but subsequently deviated downward, upto 72 months.

Table - 3: Mean weight of rural and urban pre-school children.

Subject	Age in years	NCHS std. in kg	Average weight in kg			
			Rural (n=50)		Urban (n=60)	
			Observed	Difference from NCHS standard	Observed	Difference from NCHS standard
Boys	4	17.7	12.23	-5.47	14.21	-3.49
	5	19.7	13.05	-6.65	17.17	-2.53
	6	21.7	17.6	-4.1	22.5	+0.8
Girls	4	16.8	12.33	-4.47	13.82	-2.98
	5	18.6	12.5	-6.1	15.85	-2.75
	6	20.6	17.87	-2.73	16.3	-4.3

F Cal = 0.85 ,Non significant at p = .05

Classification of children on the basis of MUAC shows that almost half of the subjects in urban area were mild to moderately undernourished *(Table 4)*. Forty per cent of urban children were normal and 10 percent were severely malnourished. In rural area maximum respondents (58%) were mild/ moderately under nourished, some were (28%) normal and few (14%) were severely undernourished. Test of significance shows that there was no significant difference between rural and urban pre-school children regarding the percent prevalence of malnutrition. Severe malnutrition among 10 percent of urban and 14 percent of rural children can be justified with the observed mean nutrient intake of children. Since the calorie intakes in both rural and urban pre-school children were less than the RDA, it is expected that children may suffer from malnutrition.

Table 4 : - Frequency distribution of sample according to MUAC.

Area	Mid Upper Arm Circumference (MUAC)					
	>13.5 cms Normal Nutrition		13.5-12.5 cm Mild/Moderately undernourished		< 12.5 cm severely undernourished	
	N	%	N	%	N	%
Rural	**14**	**28**	**29**	**58**	**7**	**14**
Urban	**24**	**40**	**30**	**50**	**6**	**10**

t = .003, non-significant P =.05

Sen et al. (1996) also reported that the overall prevalence of PEM was 51.11 percent using IAP classification among preschool children residing in rural areas of eastern U.P. They reported that 9.17 percent subjects of age group 1-5 years had MUAC less than 12.5 cms. Subjects having birth order greater than or equal to 3 and those not immunized had significantly higher prevalence of PEM.

Table 5 shows that the nutrient intake of rural pre-school children was less than the ICMR RDA values except for fat and vitamin C. It was observed that intake of protein and calcium was above the RDA values in urban preschool children though energy intake in both rural and urban pre-school children was less than the recommended allowances. Studies conducted by **Aggarwal and Singh (2002)** on preschool children of Delhi also indicated that though the consumption of protein was above the RDA level, yet children were calorie deficient. They concluded that calorie deficiency was more marked in preschool children than protein deficiency and the intake of protein and calcium above the RDA level may be due to the higher per capita income in Delhi.

Iron intake was less than the RDA among rural pre-school children and satisfactory among urban pre-school children. The intake of calories, iron and calcium was significantly lower in rural pre-school children than the urban children.

From the results it is clear that the mean intake of protein and calcium was less than the RDA among rural pre-school children whereas intake of these nutrients was adequate in urban pre-school children. Iron deficiency decreases the percentage of haemoglobin in the blood leading to anaemia. Similar results have been reported by **Laxmaiah et al. (2002)** who stated that in Punjab a higher proportion of pre-school children were consuming diets which were inadequate with respect to energy, fat, iron, riboflavin, vitamin A and vitamin C.

Table 5 :- Mean Nutrient Intake of rural and urban pre-school children.

	Energy Kcal	Protein g/d	FAT g/d	Calcium mg/d	Iron mg/d	Vitamin C mg/d
Rural Avg. intake of nutrient + SD	970.03 ±131.64	29.05 ± 4.34	29.39 ± 3.92	321.23 ± 39.82	7.83 ± 1.66	69.003 ± 15.12
RDA	1690	30	25	400	18	40
Difference	719.97	-0.95	+4.39	-78.77	-10.17	+29.003
Urban Avg. intake of nutrient + SD	1098.91 ± 98.64	37.24 ± 5.01	46.13 ± 5.57	591.21 ± 79.30	21.95 ± 5.99	100.25 ±18.80
RDA	1690	30	25	400	18	40
Difference	-591.09	+7.24	+21.13	+191.21	+3.95	+60.25
Z Cal	3.14*	0.72	3.99*	4.95*	2.47*	1.51

*Significant at p = .05

Thus it was concluded from the present study that the prevalence of anaemia was higher among rural preschool children of Allahabad district and their diet was deficient in protein, calcium and iron.

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Technological knowledge gap assessment of fish farmers in Allahabad District of Uttar Pradesh

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ABSTRACT

The present study was conducted in Allahabad district of U. P. Eighty respondents were interviewed for data collection. The finding shows that 55 per cent had moderate level of knowledge regarding fish production technology. Knowledge gap was high of the respondents, about nursery pond management, record keeping, water quality of fish pond, emergent problem in fish culture and precautions measures to avoid fish disease. Need to train the fish farmer about these topics were directly felt.

INTRODUCTION

The Allahabad district has vast potential of fish farming with 3463 ponds covering 3381 hectare of water area. However, there is major gap between potential yield and actual yield of fish, which may be due to improper knowledge of fish farmers about modern technology in the area. Taking into account this point of view, the present study was undertaken with the following specific objectives:

1. To find out the knowledge level of fish farmers about improved practices of fish in the study area.
2. To find out the practice wise knowledge gap of scientific fish production technology.

MATERIALS AND METHOD

The present study was conducted in purposely selected Karchhana, Meja, Kauhdhiyara and Jasra blocks of Allahabad district of U. P. during 2002, as these blocks possessed large number of fish farmers. From these blocks, eighty fish farmers were randomly selected.

Knowledge is the factual information possessed by fish farmers regarding scientific practices. Fourteen important scientific practices were identified to measure

the knowledge level of fish farmers. A score of one was assigned to each practice known correctly and zero for no knowledge or information. The maximum score was 14 the scores obtained by respondents were summarised up and finally the knowledge index was worked out as-

$$\text{Knowledge Index} = \frac{\text{Summation of scores obtained by a respondent}}{\text{Maximum obtained score}} \times 100$$

Knowledge index was operationalized as the mean knowledge score expressed in percentage of possible maximum obtainable score on knowledge. Knowledge scores were categorized as Poor/Low (0–40), Moderate/Medium (41–60) and Excellent/High (61-100) on the basis of range.

Practice wise knowledge were subjected to analysis with the help of MPS (Mean Percentage Score) and knowledge gap were also calculated.

RESULT AND DISCUSSION

(1) Knowledge level of fish farmers

Data incorporated in *Table-1* reveal that more than half of the respondents, i.e. 55 per cent had moderate level of knowledge regarding fish production technology. It was followed by exactly 1/4th of them (25 per cent) having poor and 20 per cent had relatively excellent knowledge of fish farming practices.

Findings are in line with the findings of **Sundara Swamy** and **Bavalatni (1991)** and **Meena (1999)**, they found that majority of respondents belonged to medium knowledge level category.

Table - 1: Distribution of respondents on the basis of their level of knowledge about fish farming

Sl. No.	Level of knowledge	No. of farmers	Percentage
1.	Poor / Low	20	25
2.	Moderate / Medium	44	55
3.	Excellent / High	16	20
	Total	**100**	**100**

(2) Practice wise knowledge and knowledge gap in fish farming

Data shown in *Table – 2* reveal that all selected fish farmers had full knowledge about stocking combinations for composite fish culture. It was followed by knowledge regarding aquatic weed management (MPS 87.5), pond fertilization (MPS 75.0) and E.U.S. Symptoms and control measures (MPS 72.5). 62.5 per cent had knowledge regarding maintenance of old pond bandh and 60.0 per cent were found having knowledge about supplementary feed. Less than half of the respondents (MPS 37.5) were found possessing knowledge about use of lime and doses in pond followed by their knowledge of oxygen depletion and credit and subsidy (MPS 35.0 each).

The knowledge gap (percentage) of the respondents about nursery pond management, record keeping, water quality of fish pond, emergent problems, precaution measures to avoid disease were 87.5, 87.5, 86.0, 75.0 and 72.5 respectively.

Table – 2 : Practice wise knowledge of respondents about fish farming

Sl. No.	Practices	MPS	Knowledge gap
1.	Nursery pond management	12.5	87.5
2.	Maintenance of old pond bundh	62.5	37.5
3.	Stocking combination for composite fish culture	100.0	0.0
4.	Emergent problem in fish culture	25.0	75.0
5.	Aquatic weed management	87.5	12.5
6.	Pond fertilization	75.0	25.0
7.	Use of lime and doses	37.5	62.5
8.	Water quality of fish ponds	15.0	85.0
9.	Precaution measures to avoid fish disease	27.5	72.5
10.	Supplementary feed	60.0	40.0
11.	Oxygen depletion – cause and remedy	32.5	67.5
12.	EUS Symptoms and control measures	72.5	27.5
13.	Credit and subsidy	35.0	65.0
14.	Record keeping	12.5	87.5

MPS = Mean Percentage Score

The result show that the respondents possessed fairly excellent knowledge regarding those practices, which are being traditionally followed while they lack knowledge about some management practices which are new to them.

The farmer having lower level of initial knowledge had larger scope of improvement in their knowledge through training **(Verma et. al., 1984)**.

CONCLUSION

It may be concluded that knowledge gap could be bridged up by way of intensive training programmes, field days, front line demonstration, study tour and group discussion.

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Training needs of Rural Girls

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ABSTRACT

In India Agriculture is the main occupation of rural people. All family members work together on farm to earn they bread and butter. Present study was conducted to find out extent of participation of rural girls in various farm operations and to identify their training needs, the 120 girls of age group 6-14 were selected and it is seen that almost all were literate and the respondents with varying level of participation in various agricultural operations. They need training in areas like Care before taking Spraying, Dusting. Application of fertilizer through irrigation, Preparation of insecticide and pesticide, Methods of threshing and Methods of storage for grains. Krishi Vigyan Kendras or farm science centers sponsored by Indian Council of Agricultural Research, New Delhi have provision to impart non formal education and functional trainings appropriate for the farming population. Thus the needs expressed by the rural girls can be appropriately accommodated in the curriculum of Krishi Vigyan Kendras.

INTRODUCTION

Farming in India is whole family affair. Even though farmers have been highlighted as sole workers on the farm front, the reality is otherwise Women had been part and parcel of farming from time immemorial. The work and involvement of women in farming has been neglected for a long time. It is only now that scientists, administrators, and policy makers have started documenting the contribution of women and children in development of agriculture as well. It is well known fact that the rural girls in the age group of 6-14 years help in works of farm and home. As a result they may attend the school partially or completely. The social environment of the poor and their economic needs compel them to engage children in day to day activities of farm and home. This not only helps in family income but also provide opportunities of socialization for younger ones. While engagement of children at farm prohibits them from attending schools it can not be avoided by the poor. Thus opportunities have to be found out to combine this

with formal or non formal learning. Keeping this in view the study was undertaken with the following specific objectives.

- To know personal and socio-economic characteristics of respondents.
- To find out various activities carried out by rural girls.
- To assess training needs of rural girls.

METHODOLOGY

The study was conducted in Karveer tehsil of Kolhapur district. Out of Six villages selected randomly for the study. Twenty respondents are selected randomly from each village. In all one twenty girls parents were personally interviewed with the help of structured interview schedule.

RESULT AND DISCUSSION

It is seen from *Table – 1* that 31.66% of the respondents were up to nine years of age. 40.83% and 27.51% were in the age group of 10 – 12 years and 13 years and above respectively.

It is observed that 0.83% were illiterate and 12.50% had up to 2nd standard education. 46.67% having 3rd – 5th standard education level. 40.00% were having 6th standard and above education.

As regards possession of land it was found that 66.36% of the respondents possessed upto 1.00 ha land while 25.31% of the respondents had land 1.01 ha to 2.00 ha land and 8.41% had 2.01 ha and above land.

It is clear from the table that 39.17% have up to Rs. 20,000 income, while 38.33% respondents belonged to Rs. 20,001 to Rs. 40,000 income group, 10.00% having Rs.40,001 to Rs. 60,000 income and 12.50% had Rs. 60,001 and above annual income. It is seen from *Table – 1* that majority of respondents are school going having small land holding less than 1.00 ha, and falls under medium income group.

Table – 1. Distribution of the respondents by their socio economic and socio-personal characteristics.

S.No.	Particulars of characteristics	No. of respondents	Percentage to the total
1.	**Age :**		
	i) Upto 9 years	38	31.66
	ii) 10-12 years	49	40.83
	iii) 13 and above	33	27.51
2.	**Level of Education :**		
	i) Illiterate	1	0.83
	ii) upto 2nd standard	15	12.50
	iii) 3rd – 5th standard	56	46.67
	iv) 6th standard and above	48	40.00
3.	**Land Holding :** (N=107)		
	i) Upto 1.00 ha	71	66.36
	ii) 1.01 to 2.00 ha	27	25.23
	iii) 2.01 ha and above	9	8.41
4.	**Annual family income :**		
	i) Upto Rs. 20,000	47	39.17
	ii) 20,001 to 40,000	46	38.33
	iii) 40,001 to 60,000	12	10.00
	iv) 60,001 and above	14	12.50

It was revealed from *Table – 2* that about 18.33% respondents had always participated in 'Storage and drying of grains' followed by 'Marketing vegetables' (13.33%), 'harvesting, threshing and interculturing operation' (2.50%) respectively. 'Sowing and planting seeds' and 'Applying fertilizer to crops' (1.67%) 'Filling of compost' and 'spreading of compost in farm' respectively.

However majority of the respondents reported that they frequently participated in farming operation such as 'uplifting/removal/collection of stubbles' (62.50%) followed by 'Harvesting' (59.17%), 'Threshing' (53.33%), 'Storage and drying of grains' (45.00%), 'Sowing and planting of seedling' (40.00%), 'Interculturing operation' and 'Applying fertilizer to crops' (39.00%) respectively and 'Helps in digging of compost'

and 'Marketing of vegetables' (31.67%) respectively, 'Spreading compost in farm' (25.00%) and 'Filling of compost pits' (7.50%).

While majority of the respondents reported that they not at all participated in some farming operations such as 'Filling of compost pits' (91.67%) followed by 'Spreading compost in farm' (74.17%), 'Helps in digging of compost' (68.33%),

Table – 2. Distribution of the respondents as per the participation in farming. Operation

S. No.	Particulars of farming work	On own farm N=120		
		Always	**Frequently**	**Not at all**
1.	Uplifting/Removal/collection of stubbles	-	75 (62.50)	45 (37.50)
2.	Helps in digging of compost	-	38 (31.67)	82 (68.33)
3.	Filling of compost pits	1 (0.83)	9 (7.50)	110 (91.67)
4.	Spreading of compost in farm	1 (0.83)	30 (25.00)	89 (74.17)
5.	Sowing and planting of seedling	2 (1.67)	48 (40.00)	70 (58.33)
6.	Interculturing operation	3 (2.50)	39 (32.50)	78 (65.00)
7.	Applying fertilizer to the crops	2 (1.67)	39 (32.50)	79 (65.33)
8.	Harvesting	3 (2.50)	71 (59.17)	46 (38.33)
9.	Threshing	3 (2.50)	64 (53.33)	53 (64.17)
10.	Storage and drying of grains	22 (18.33)	54 (45.00)	44 (36.67)
11.	Marketing of vegetables	16 (13.33)	38 (31.67)	66 (55.00)

'Applying fertilizer to crops' (65.83%), 'Threshing' (64.17%), 'Interculturing operation' (65.00%), 'Sowing and planting of seedling' (58.33%), 'Marketing of vegetables' (55.00%), 'Uplifting/removal/collection of stubbles' (37.50%).

'Harvesting' (38.33%) and 'Storage and drying of grains' (36.67%). It noticed from *Table – 2* that most of the respondents frequently engaged in Uplifting/removal/ collection of stubbles, Harvesting, Threshing and Storage and drying of grains operations.

It was observed from *Table – 3* that majority of respondents reported that Methods of storage grains' (15%) is most essential training need followed by 'Methods of threshing (8.23%), 'Preparation of insecticide and pesticide' (7.50%), 'Dusting' (6.67%), 'Care before taking spraying' (5.83%) and 'Application of chemical fertilizers' (5.00%).

However majority of the respondents reported training in area 'Care before taking spraying' (75.83%) as essential followed by 'Dusting' (71.67%), 'Application of fertilizers through irrigation' (71.67%), 'Preparation of insecticide and pesticide' (70.00%), 'Methods of threshing' (67.50%) and 'Methods of storage of grains' (63.33%). 'Methods of threshing' (24.17%) was found as non-essential by majority followed 'Application of fertilizers through irrigation' (23.33%), 'Preparation of insecticide and

Table – 3. Distribution of the respondents according to their training needs.

S. No.	Particulars of training component	Respondent category N=120		
		Most Essential	**Essential**	**Not Essential**
1.	Care before taking spraying	7 (5.83)	91 (75.83)	22 (18.34)
2.	Dusting	8 (6.67)	86 (71.67)	26 (21.66)
3.	Application of fertilizer through irrigation	6 (5.00)	86 (71.67)	28 (23.33)
4.	Preparation of insecticide and pesticide	9 (7.50)	84 (70.00)	27 (22.50)
5.	Methods of threshing	10 (18.23)	81 (67.50)	29 (24.17)
6.	Methods of storage for grains	18 (15.00)	76 (63.33)	26 (21.67)

pesticide' (22.50%), 'Methods of storage of grains' (21.67%), 'Dusting' (21.66%) and 'Care before taking spraying' (18.34%). The table clearly indicate that most of items fall under essential followed by non-essential and only a small percentage of respondents found the items as most essential.

CONCLUSION

It was found that almost all were literate and the respondents with varying level of participation in various agricultural operations. They need training in areas like 'Care before taking spraying, Dusting, Application of fertilizer through irrigation, Preparation of insecticide and pesticide, Methods of threshing and Methods of storage for grains.

IMPLICATIONS

Krishi Vigyan Kendras or farm science centers sponsored by Indian Council of Agricultural Research, New Delhi have provision to import non formal education and functional trainings appropriate for the farming population. Thus the needs expressed by the rural girls can be appropriately accommodated in the curriculum of Krishi Vigyan Kendras.

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Prevention of Tribolium Castaneum Herbst. in Coarse Wheat Flour

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ABSTRACT

Rust red flour beetle (*Tribolium castaneum* Herbst.) is responsible for enormous spoilage of milled products and spices. From the studies it is seen that among the foods the multiplication of this insect is highest in coarse wheat flour. The present study seeps into determining the cheap, effective and safer method for the prevention of the insect in coarse wheat flour. Nine treatments viz., Turmeric powder, chilli powder, asafoetida, camphor, dry ginger, slaked lime, black pepper, calcium carbonate and mercury tablet each at 3 doses were evaluated for the percentage of larvae pupated, larval mortality and larvae becoming adults. The camphor at the rate of 0.2g/kg food material was found to be the most effective in reducing the viability of the insect in the food and it was followed by chilli powder, asafoetida, slaked lime and black pepper at the same dose. Calcium carbonate was found to be the least effective treatment.

INTRODUCTION

Insect pests especially those frequenting the household have assumed most unexpected importance due to the increased problems created by them. Tribolium, the first pest to arrive on stored food increases its number very rapidly and its population becomes established. The major problem with infestation by their species is contamination rather than actual food weight loss. This is a serious pest of prepared cereal products such as “atta”, “maida” etc. and is found in abundance in flour mills. In case of heavy infestation, food turns grayish yellow and subsequently becomes mouldy and emits pungent smell.

The control of storage pests by chemicals and other methods is being explored to affect further improvement in stored pest control technique. Chemicals have proved to give effective control of various pests infesting the stored products but simultaneously they also create several problems such as appearance of the resistant strains of pests and toxic hazards due to chemical residues. Hence the present study has been taken up to determine the cheap, effective and safer method for the prevention of T. castaneum Herbst. in coarse wheat flour.

MATERIALS AND METHODS

Test Insect : The rust red flour beetle commonly known as '*Sursali*' or '*Lalsur*i' was selected as a test insect because it inflicts heavy infestation in stored commodities like Wheat flour, *Suji, Maida,* Cotton, Spices, Groundnuts, etc. at household level as well as in godowns. All stages of this pest are visible and the life cycle is completed in a short duration.

Obtaining Known Aged Larvae of *T. castaneum* : The adults were obtained from the culture already maintained in the Department of Entomology, C. S. Azad University of Agriculture & Technology, Kanpur containing sterilized '*Maida'* as food. 25 g of sterilized wheat flour (*Maida*) was kept in a specimen glass tube (10cm x 4cm) and ten pairs of newly emerged beetles were released into the specimen tube and mouth was covered with muslin cloth held with rubber band. After four days, the flour was again passed through 140 mesh sieve to retain eggs. The eggs obtained were shifted to other labelled specimen tube and kept for proper hatching. After 4 days eggs were hatched out and newly hatched grubs of 0 to 24 hrs were taken for the experimental purposes.

Prevention of T. castaneum : The experiment was conducted by selecting nine non-hazardous treatments *(Table 1)* each at three doses (D_1, D_2 and D_3) on coarse wheat flour which was highly preferred food by T. castaneum along with one untreated control (T_{10}). The treatments in the required quantity were mixed in powder form with the food except the mercury tablets. 20 known aged larvae (0-24 hrs old) were released in each container. The mouth of the containers was covered and kept in the laboratory under ambient conditions for further development where the temperature and r.h. varied from 35°C to 38°C and 70-80 per cent, respectively during the experiment. The experiment was replicated thrice. After a duration of 10 days and subsequently on alternate day, observations were recorded for the pupation and adult emergence to calculate the percentage of larvae pupated, larval mortality and larvae becoming adults.

Table 1: Treatments used for prevention of Tribolium castaneum in Coarse Wheat Flour.

S.No.	Name of the Food Treatment	Form	Doses (g/Kg)			Symbol Used
			D_1	D_2	D_3	
1.	Turmeric powder	powder	0.05	0.1	0.2	T_1
2.	Chilli powder	powder	0.05	0.1	0.2	T_2
3.	Asafoetida	crystal	0.05	0.1	0.2	T_3
4.	Camphor	Crystal	0.05	0.1	0.2	T_4
5.	Dry ginger	powder	0.05	0.1	0.2	T_5
6.	Slaked lime	powder	0.05	0.1	0.2	T_6
7.	Black pepper	powder	0.05	0.1	0.2	T_7
8.	Calcium Carbonate (Chalk powder)	powder	0.05	0.1	0.2	T_8
9.	Mercury tablets	tablet	0.05	0.1	0.2	T_9
10	Control	-	-	-	-	T_{10}

· **Observations Recorded:** The following observations were recorded-

- Percentage of larvae pupated
- Percentage of larval mortality
- Percentage of larvae becoming adult

· **Statistical analysis :** Complete Randomised Design was applied for evaluating the variations. It is calculated using the formula-

$$F = \frac{\text{M. S. between treatments}}{\text{M. S. with in treatments}}$$

RESULTS AND DISCUSSION

The results of the experimental findings are given under the following heads and are discussed with the available literature.

A. Effect of treatments on the pupation of *T. castaneum*

When the coarse wheat flour was treated with T_4(camphor), it was found

Table 2 : Effect of Foods and Containers on the Pupation of Tribolium castaneum Herbst.

Doses / Treatments	D_1 0.05g/kg	D_2 0.1g/kg	D_3 0.2g/kg	Mean
T_1	58.34 (49.80)	53.33 (46.91)	48.32 (44.04)	53.33 (46.92)
T_2	43.32 (41.16)	38.31 (38.24)	36.65 (37.26)	39.43 (38.89)
T_3	43.32 (41.16)	38.31 (38.24)	33.21 (35.25)	38.28 (38.22)
T_4	24.88 (29.92)	21.62 (27.71)	18.26 (25.30)	21.59 (54.87)
T_5	51.67 (45.96)	46.67 (43.09)	43.32 (41.16)	47.22 (43.40)
T_6	33.31 (35.25)	31.64 (34.23)	26.63 (31.07)	30.53 (33.52)
T_7	33.31 (35.25)	31.67 (34.23)	28.30 (32.14)	31.08 (33.87)
T_8	61.67 (51.75)	56.66 (48.33)	51.67 (45.96)	56.67 (48.85)
T_9	36.65 (36.27)	34.99 (34.27)	31.64 (34.23)	34.43 (35.92)
Mean	42.94 (40.72)	39.24 (38.42)	35.33 (36.27)	39.17 (38.58)
Control Mean (T_{10})	61.14 (51.44)	60.07 (50.81)	59.00 (50.18)	60.07 (50.81)

Figures in parenthesis indicate Angular transformed values.

	S.E. (m)	C.D. at 5 %
Treatment (T)	± 0.84	1.69
Doses with in Treatment	± 1.46	2.94
Treat. Vs Control	± 1.79	3.60

significantly most effective in reducing the pupation as only 18.26 per cent larvae could be pupated at the highest dosage level (D_3). The response of T_2 & T_3 and T_6 & T_7 was found to be at par with one another. But how ever, T_8 (Calcium carbonate) was found to be least effective showing the increased pupation (61.67%) in coarse wheat flour *(Table 2)*.

B. Effect of treatments on the larval mortality of *T. castaneum*

The response of T_4 (camphor) at D_3 level was recorded superior (73.36%) to rest of the treatments in causing the larval mortality. The treatments T_2 (chilli powder) and T_3 (Asafoetida) were found at par resulting in 50-55 per cent of the larval mortality. All treatments were found significantly superior to control. How ever, T_8 (calcium carbonate) did not exert good effect as it recorded the mean larval mortality of 27.18 per cent in the treated foods. Irrespective of treatments the difference in mean larval mortality of the three dosages were found significantly different to each other. *(Table 3)*.

C. Effect of treatments on the adult emergence of *T. castaneum*

Only 26.63 per cent larvae of T. castaneum could reach the adult stage, when the foods were treated with T_4 (Camphor)at D_3 level, it was found significantly superior to rest of treatments. The response of T_2 (Chilli powder), T_3 (Asafoetida) in coarse wheat flour was found at far showing only 50 per cent larvae reaching to adult stage. When the flour was treated with calcium carbonate the adult emergence was 72.81 per cent being at par with the untreated control. Irrespective of treatments, the three dosages significantly varied with each other in per centage of larvae becoming adults *(Table 4)*.

The findings also showed that the use of camphor @0.2g/kg of food significantly reduced the pupation, increased the larval mortality and decreased the emergence of T. castaneum. Similar results were obtained by **Oforoi** and **Reichmuth (1997 & 1999)** who observed the biological activity of camphor with the treated filter paper, checked the development of eggs, immature stages and adult emergence. **Pemonge et al., (1997)** reported that the seeds of Azevine were found moderately toxic to the young larvae of T. castaneum and showed the decreased fecundity and fertility of adults.

Powder of turmeric and black pepper @o.5 to 2.5g/50g seeds were found effective in giving the maximum protection of pulses against the pulse beetle, Callosobruchus chinensis **(Pranata, 1986 and Shivanna, et al., 1994)**. The use of dry chilli pepper fruits (Capsicum annum) also reduced the damage caused by **C. chinensis (Ofuya, 1986)**.

Table 3:- Effect of treatments on the percentage larval mortality of Tribolium castaneum Herbst. in coarse wheat flour

Doses / Treatments	D_1 0.05g/kg	D_2 0.1g/kg	D_3 0.2g/kg	Mean
T_1	31.64 (34.23)	33.31 (35.25)	38.31 (38.25)	34.42 (35.91)
T_2	41.66 (40.20)	43.32 (41.16)	50.00 (45.00)	44.99 (42.12)
T_3	41.66 (40.20)	43.32 (41.16)	50.00 (45.00)	44.99 (42.12)
T_4	58.34 (49.80)	65.05 (53.76)	73.36 (58.93)	65.58 (54.16)
T_5	33.31 (35.25)	38.31 (38.24)	43.32 (41.16)	38.31 (38.21)
T_6	48.32 (44.04)	56.66 (48.83)	61.67 (51.75)	55.55 (48.21)
T_7	51.67 (45.96)	56.66 (48.83)	65.05 (53.76)	57.79 (49.52)
T_8	26.63 (31.07)	28.30 (32.14)	30.00 (33.21)	28.31 (32.14)
T_9	44.98 (42.12)	48.33 (44.04)	53.33 (46.91)	48.14 (44.36)
Mean	42.02 (39.06)	45.92 (42.60)	51.67 (45.99)	46.54 (42.97)
Control Mean (T_{10})	28.30 (27.71)	23.28 (28.85)	19.99 (26.56)	23.86 (27.71)

Figures in parenthesis indicate Angular transformed values.

	S.E. (m)	C.D. at 5 %
Treatment(T)	± 0.93	1.87
Doses with in T	± 1.61	3.24
Treat. Vs Control	± 1.98	3.97

Table 4:- Effect of treatments on the percentage larvae of Tribolium castaneum Herbst. becoming adults in coarse wheat flour

Doses / Treatments	D_1 0.05g/kg	D_2 0.1g/kg	D_3 0.2g/kg	Mean
T_1	68.36 (58.77)	66.69 (54.75)	61.67 (51.75)	65.57 (54.09)
T_2	58.34 (49.80)	56.66 (48.83)	50.00 (45.00)	55.00 (47.88)
T_3	58.34 (49.80)	56.66 (48.83)	50.00 (45.00)	55.00 (47.88)
T_4	41.80 (40.20)	34.95 (36.24)	26.63 (31.07)	34.41 (35.84)
T_5	66.69 (54.75)	61.67 (51.75)	56.66 (48.83)	61.67 (51.78)
T_6	51.67 (45.96)	43.32 (41.16)	38.31 (38.24)	44.43 (41.79)
T_7	48.32 (44.04)	43.32 (41.16)	38.31 (36.24)	34.95 (40.48)
T_8	73.36 (58.93)	71.70 (57.86)	70.00 (56.79)	71.69 (57.86)
T_9	55.02 (47.88)	51.67 (45.96)	46.67 (43.09)	51.12 (45.64)
Mean	57.97 (49.69)	54.07 (47.39)	48.32 (44.00)	53.46 (47.02)
Control Mean (T_{10})	81.72 (64.69)	83.39 (65.95)	78.38 (62.29)	81.16 (64.31)

Figures in parenthesis indicate Angular transformed values.

	S.E. (m)	C.D. at 5 %
Treatment(T)	± 0.93	1.87
Doses with in T	± 1.61	3.24
Treat. Vs Control	± 1.98	3.96

CONCLUSION

To find out the cheap, effective and non hazardous treatment for the prevention of T. castaneum, 9 treatments in 3 doses, including the control were evaluated for the percentage of larvae pupated, larval mortality and larvae becoming adults. It was found that Camphor at 0.2g/kg was most effective in decreasing larval pupation and calcium carbonate at the same level was least effective. In the same manner when the food was treated with camphor at 0.2g/kg the larval mortality was more and percentage of larvae becoming adults was less compared to all the other treatments. In both the cases calcium carbonate was found to be the least effective.

The camphor at the rate of 0.2g/kg food material was found to be the most effective in reducing the viability of the insect in the food and it was followed by chilli powder, asafoetida, slaked lime and black pepper at the same dose. Calcium carbonate was found to be the least effective treatment.

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Seasonal incidence of mustard aphids (*Lipaphis erysimi* Kaltenbach) and its natural enemies

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ABSTRACT

An investigation was carried out at Central Research Farm, Allahabad Agricultural Institute-Deemed University, Allahabad to know the seasonal incidence of mustard aphid and its natural enemies in the field conditions. Observations on the incidence of mustard aphid, its natural enemies and weather parameters were recorded at weekly intervals. Aphid incidence appeared in the 2nd week of January, reached its peak in the 2nd week of March and declined gradually and disappeared in the 3rd week of April. The correlation coefficient values indicates that the rainfall (r=0.674) and wind velocity (r=0.525) were positively significantly correlated, while minimum (r=0.136) and maximum (r=0.0763) temperature, morning (r=0.140) and afternoon (r=0.068) relative humidity and sunshine hours per day (r=0.178) were non significantly correlated. Decline of the aphid population was not much depended on weather parameters but was influenced by the maturation of the crop. With respect to natural enemies, it was observed that weather parameters did not have much influence on population buildup but increased with increase in population of aphids ie., synchronized with the prey population.

Brassica oilseed crops are collectively referred to as rapeseed-mustard and are the major rabi oilseed crops of India. They occupy a prominent place, being next in importance to groundnut both in area and production meeting the fat requirements of about 50% of the population in the North Indian states. Mustard is grown in India with a production of 1.62 million tonnes accounting for 18 percent of total oilseed production in India. The cultivated species of the genus *Brassica* are highly prone to the attack of insect pests and diseases, of which mustard aphid *Lipaphis erysimi* Kaltenbach is the most important and serious pest causing heavy losses **(Sharma, 1988)** and major limiting

factor in realizing the yield potential **(Mahal *et al.*, 1990 and Desh Raj *et al.*, 1998)**. In different agro-climatic conditions grain yield losses due to this pest varied from 27.5 to 90.9 percent in rape seed mustard **(Bakhetia, 1984)** and 42.1 to 65.7 percent in sarson **(Suri *et al.*,1988)**. Several meteorological factors have been found to govern their population build up and outbreaks under different agro-ecological conditions **(Bakhetia and Sidhu 1993, Nirmala Devi *et al.*, 1995, Singh and Malik 1998)** and mostly its infestation is confined to winter season **(Mathur and Singh 1986)**.

Among the natural enemies, coccinellid beetles and syrphids are very important and key biotic factors in regulating the aphid populations in the field conditions. Hence, a continuous monitoring of this pest and its natural enemies under field conditions is essential for timely prevention of sudden outbreak of epidemics and for devising the suitable pest management strategies. These considerations necessiated us to generate information on population build up of mustard aphid and its natural enemies vis-a-vis abiotic factors in Allahabad conditions to formulate an effective pest management strategy of this pest.

MATERIALS AND METHODS

The present investigation was carried out at Central Research Farm of Allahabad Agricultural Institute-Deemed University, Allahabad during rabi season 2004-2005. All recommended practices were followed in raising the crop except plant protection measures to allow the pest and natural enemies to build up under natural conditions. The experiment was laid in randomized block design with three replications. The aphid population was recorded on 10 cm central twig, on 10 selected plants in each plot in 10 plots at weekly intervals. The adults and immature stages of natural enemies were recorded on the same plants. The data pertaining to weather parameters were collected from meteorological observatory A.A.I.-DU, Allahabad and correlated with aphids and its natural enemies populations.

RESULTS AND DISCUSSION

The correlation between mustard aphid, its natural enemies and weather parameters are presented in *Table 1 & 2*. It was observed that the aphid population appeared in the second week of January (3rd standard week) and continued to increase in number upto 2nd week of March (10th standard week) there after aphids declined with maturation of crop. A maximum of 20.8 to 33.0 ^{0}C and a minimum of 7.6 to 16.9 ^{0}C was found favourable for the multiplication of aphids on mustard aphid. **Abu Manzar (1998)** reported a temperature range of 12.62 to 25.52 ^{0}C was found conducive for rapid

Table 1: Seasonal incidence of mustard aphid and its natural enemies.

Standard week	No. of aphids	syrphids	coccinellids	Temp. ^{0}C		RH (%)		Rainfall (mm)	Wind Velocity (KMPH)	Sunshine (hr/day)
				Min.	Max.	morning	afternoon			
Dec 2004										
52	0	0	0	7.4	22.6	91	41	0	2.33	3.07
Jan 2005										
1	0	0	0	10.4	24.6	92	44	0	2.45	2.8
2	3.68	0	0	8.5	25.4	93	40	0	2.66	6.5
3	5.32	0	0	8.1	23.7	95	52	5.5	2.99	4.02
4	17.48	0.2	0.12	8.1	20.8	96	57	9.2	3.88	2.78
Feb 2005										
5	10.56	0.17	0.08	7.6	21.4	93	58	8.2	3.35	2.4
6	18.92	0.074	0.14	10.7	26.2	94	56	1.6	1.84	4.6
7	16.2	0.08	0.06	13.4	29.6	92	36	0	3.47	8.1
8	20.8	0	0.04	12	29.8	84	34	0.3	5.6	6.5
Mar 2005										
9	28.6	0	0.6	15.5	32.7	83	32	2.2	6.2	9.2
10	60.8	0	1	16.9	33	83	36	13.4	3.94	8
11	15.2	0.2	1.2	16.5	32.5	85	34	0	1.9	8.9
12	6.41	0.04	0	20.7	38.5	75	26	1	2.37	9.1
Apr 2005										
13	4.32	0.01	0	18.7	36.1	73	35	0	2.83	9.2
14	2.84	0	0	18	38.2	66	24	0	2.44	9.4
15	0.6	0	0	20.1	38.3	56	15	0	2.08	9.3

Table 2: Correlation analysis between weather parameters, aphids and natural enemies

Aphids	Syrphids	Coccinellids	Temp. ^{0}C		RH (%)		Rainfall (mm)	Wind Velocity (m/hr)	Sunshine (hr/day)
			Min	Max	morning	evening			
		r	0.28085368	0.200146	0.024062	-0.11413	0.328676	0.159876	0.338544
		t	1.09492844	0.764343	0.090057	-0.42983	1.302135	0.605997	1.346207
	r		-0.22149503	-0.34002	0.359258	0.466003	0.293827	-0.12148	-0.26858
	t		-0.84986798	-1.35285	1.440382	1.970682	1.150172	-0.45794	-1.04327
r	0.062647	0.691266	0.136947	0.076334	0.14087	0.068475	0.674465	0.525337	0.178776
t	0.234863	3.579408	0.517283	0.286452	0.532395	0.256814	3.418116	2.310077	0.679872

multiplication aphid on mustard. The coefficient of correlation studies showed that both maximum (r=0.20) and minimum (r=0.280) temperatures had non-significant positive correlation on the aphids built up. **Singh and Malik (1998)** also reported that the minimum and maximum temperature has a non significant positive correlation with aphids. Similar findings are also reported by various authors from different parts of our country. **Harvir Singh *et al*., (1986), Singh and Ram Singh (2000)** and **Chaudhary *et al*., (2001)**. However **Ahuja (1990)** found that the aphid population was negatively correlated to the mean and maximum atmospheric temperature. **Gami *et al*., (2002)** also reported the aphid population had significant negative correlation with maximum and minimum temperature. The variation in the findings may be due to the localized macroclimate present in the particular cases.

The relative humidity was the other vital factor influencing aphid population. It was observed that higher relative humidity was conducive for the incidence and build up of aphids and as the relative humidity decreases, it had a detrimental effect on the aphids which led to the drastic reduction in aphid population. In the present study it was observed that a high morning relative humidity (85-95 percent) and a low afternoon humidity (36-56) were found favourable for the multiplication of aphids. **Abu Manzar (1998)** reported that relative humidity of 73.28 percent found conducive for rapid multiplication of aphids. The correlation coefficients of morning and afternoon relative humidity are 0.1408 and 0.0684 which were positively non significantly correlated with the aphid population. However, **Gami *et al*., (2002)** reported that the morning relative humidity showed non significant while afternoon relative humidity showed significantly positive correlation with aphid population.

Rainfall is considered as one of the most important factor regulating the insect population. The correlation coefficient (r=0.6744) indicated a significant positive correlation between rainfall and aphids. However **Harvir Singh *et al*., (1986)** reported that the rainfall had a negative effect. Similar results were reported by **Singh and Malik (1998), Singh and Ram Singh (2000)**, which are in contradictory to the present findings. Observing the data it is evident that light rainfall dose not have any negative impact on the aphid population but moderate to high rainfall had a negative impact on aphid population. A drastic reduction in aphid population in 10th standard week may be attributed to the heavy rainfall.

Wind velocity has a positive significant influence on the aphids (r=0.525). However, **Indira Dogra (2001), Gami *et al*., (2002)** indicated the non significant influence of wind velocity on aphids. Sunshine hours showed a non-significant positive

influence on aphid population build up. Similar results were also reported by **Harvir Singh *et al.*, (1986)** where as **Gami *et al.*, (2002)** reported a non significant correlation with aphid population.

In the later part of the crop period the aphid population had suddenly declined with no major shift in the weather parameters, this might be due to hardening of the plant cells due to maturation. This might induce development of alate forms which might migrate to other areas where vegetation available. This is in conformity with **Sethi and Atwal (1964)** who also reported that even in the absence of predators aphid population will decline when leaves mature and tissue hardened.

SEASONAL INCIDENCE OF NATURAL ENEMIES ON MUSTARD.

Three natural enemies viz. two coccinellid beetles C*occinella septumpunctata* and C. *transversalis,* a syrphid fly, *Syrphus* sp. were observed predating on aphids. It was observed that the incidence of coccinellids started from 4th week with 0.12 coccinellids and reached its peak of 1.2 coccinellids per plant in 11th week and then the population has disappeared from the field. Correlation studies showed that minimum (r=0.28) and maximum temperatures (r=0.20) and morning relative humidity (r=0.24) has a positive non-significant influence, while afternoon relative humidity had a negative non-significant (r=-0.11) influence on the coccinellids. Other weather parameters *viz.*, rainfall (r=0.32), wind velocity (r=0.15) and sunshine hours per day (r=0.33) showed non-significant positive correlation on the coccinellids.

The weather parameters minimum (r=–0.22) and maximum temperatures (r=-0.34), and wind velocity (r=-0.12) and sunshine per day (r=–0.26) were negatively and non-significantly correlated with syrphid *Syrphus* sp., while morning (r=0.359) and afternoon relative humidity (r=0.466) and rainfall (r=0.293) were positively non-significantly correlated with the syrphid population.

It was observed that though the incidence of the coccinellids and syrphids depended on the aphids, coccinellids exercised much control on aphids which was evident from the correlation coefficient (r=0.691), but syrphid could not exercise much control over aphids (r=0.062).

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Relative toxicity of certain insecticides against mustard aphid (*Lipaphis erysimi* Kaltenbach)

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ABSTRACT

Relative toxicity of certain commonly used insecticides and the levels of resistance developed to field recommended concentrations were determined against mustard aphid in the laboratory conditions. The order of toxicity of insecticides to *L. erysimi* at LC_{50} level was acetamiprid > imidacloprid > quinalphos > monocrotophos > endosulfan > chlorpyriphos > dimethoate > spinosad > cypermethrin. At LC_{90} level the order of toxicity was acetamiprid > imidacloprid > monocrotophos > quinalphos > chlorpyriphos > endosulfan > dimethoate > spinosad > cypermethrin, The Allahabad strain has developed 6.54X, 2.504X, 2.94X and 29.71X folds of resistance to dimethoate, chlorpyriphos, endosulfan and cypermethrin when LC_{90} values were compared with field recommended concentrations. Among the insecticides acetamiprid was highly toxic followed by imidacloprid and can be recommended for managing *L. erysimi*.

Brassica oilseed crops are collectively referred to as rapseed-mustard. The cultivated species of the genus Brassica are highly prone to the attack of insect pests and diseases. Among the various insect pests attacking the mustard, the aphid, *Lipaphis erysimi* Kaltenbach is the most important and serious pest causing heavy losses **(Sharma, 1988)**. In different agro-climatic conditions grain yield losses due to this pest varied from 27.5 to 90.9 percent in rapeseed mustard **(Bakhetia, 1984)** and 42.1 to 65.7 percent in sarson **(Suri *et al.*,1988).**

Use of different insecticides belong to chlorinated hydrocarbons and organophosphates have been recommended from time to time to contain this serious pest in the field. One of the consequences of the large-scale use of insecticides has been the development of resistance in the target pests. More than 500 species of arthropods

have developed resistance to pesticides **(Georghiou and LagunesTajeda, 1991). Dhingra, (1991)** reported that chlorpyriphos, dimethoate and methyl parathion were 11.92, 7.56 and 3.79 times toxic than lindane. Other chemicals viz., quinalphos, malathion and endosulfan were 0.95, 0.84 and 0.58 times less toxic than lindane. A comparison of LD_{50} values for commonly used and recommended insecticides determined periodically for 25 years revealed that a pronounced shift in the levels of susceptibility of mustard aphid to methyl parathion, dimethoate, malathion and endosulfan was observed. **Udeaan and Narang (1986)** also indicated that the level of susceptibility of this important pest to commonly recommended insecticides has changed in some parts of Punjab and reported that this pest has developed 24 fold tolerance to endosulfan, 4 to 6 fold tolerance to malathion and dimethoate. It clearly indicates that the development of resistance in insect pests to commonly used insecticides is a regular phenomenon and it is mandatory to periodically check the susceptibility status of pest before the resistance finally appears in the field. These considerations necessitated to generate information on the levels of susceptibility of the mustard aphid population to different commonly used insecticides in Allahabad region so that management can be formulated effectively.

MATERIALS AND METHODS

For evaluating the relative toxicity, aphids were collected from untreated mustard field from Central Research Farm, Allahabad Agricultural Institute-Deemed University, Allahabad and were directly used in the experiments. The aphids were exposed to graded concentrations of endosulfan, dimethoate, monocrotophos, quinalphos, chlorpyriphos, cypermethrin, imidacloprid, acetamiprid, spinosad (biological insecticide composed of macrocyclic lactones and spinosyns extracted from *Saccharopolyspora spinosa)* following leaf dip method, **(F.A.O., 1979)**. The leaves were held in glass specimen tubes of 25 ml capacity at the rate of one leaf per tube, allowing the petiole to project out of the tube. The cut end of the petiole was wrapped in a moist cotton swab for maintaining the turgidity. Ten apterous, fully grown adult aphids were transferred to each tube with the help of fine brush. In control the leaves were dipped in distilled water and each treatment was replicated thrice. The experiment was repeated with variable concentrations till the mortality in the range of 5 to 90 percent was recorded for each of the test insecticides. If the mortality in the control was less than 20 percent, the treatment mortality data was corrected using Abbott's formula. If the mortality in control exceeds 20%, the experiment was repeated again. Mortality was recorded 24 hours after treatment and data was subjected to probit analysis **(Finney, 1971)** and the LC_{50} and LC_{90} values were calculated. The relative toxicity was calculated by comparing with monocrotophos

as unit. The degree of resistance acquired at LC_{90} was determined by comparing with the field recommended concentrations **(Chalam *et al.*, 2003)**.

RESULTS AND DISCUSSION

The order of toxicity of insecticides to *L. erysimi* at LC_{50} level was acetamiprid (0.00025%) > imidacloprid (0.00032%) > quinalphos (0.0014%) > monocrotophos (0.0075%) > endosulfan (0.01%) > chlorpyriphos(0.0134%) > dimethoate(0.0264%) > spinosad (0.0314%) > cypermethrin(0.045%). At LC_{90} level the order of toxicity was acetamiprid (0.00633%) > imidacloprid (0.015%) > monocrotophos (0.0162%) > quinalphos (0.036%) > chlorpyriphos (0.1252%) > endosulfan (0.206%) > dimethoate (0.3274%) > spinosad (0.4341%) > cypermethrin (0.5943%) *(Table 1)*. Acetamiprid, imidacloprid and monocrotophos were more effective against mustard aphids since the LC_{90} values of these insecticides were lower than the recommended concentrations and could able to control more than 90% of the aphid population in the field conditions. Imidacloprid and acetamiprid are new insecticides and are very effective in managing even other species of aphids **(Michaelraj, 2000 and Chalam *et al.*, 2003)**. Monocrotophos, though in use for a long period it is still effective. These findings are in conformity with **Naik and Verma (1992), Kumar *et al.* (1996)**.

It was observed that dimethoate, chlorpyriphos, endosulfan and cypermethrin were less effective against the aphids, since the LC_{90} values of these insecticides were higher than the recommended concentrations. It was found that spinosad was least effective chemical. Since this particular chemical was in use for a less period, it seems that this chemical is not effective against aphid due to reasons other than the development of resistance.

The relative toxicity of insecticides were assessed considering the toxicity of monocrotophos as unit. It was observed that at LC_{50} level the chemicals quinalphos (5.36 X) imidacloprid (23.44 X) and acetamiprid (30.0 X) were found to be more toxic, while at LC_{90} only imidacloprid (1.08 X) and acetamiprid (2.56 X) are more toxic than monocrotophos. The positional variation of the chemicals might be due to inherent nature of the chemicals, exposure of insect to that chemical and dosage and frequency of application of that chemical in the field.

Table. 1: -Relative toxicity of different insecticides at LC_{50} and LC_{90} against L.erysimi

Insecticide	Regression equation	Degrees of freedom	χ^2	Toxicity at		Relative toxicity at	
				LC_{50}/ Fiducial limits	LC_{90}	LC_{50}	LC_{90}
Monocrotophos	Y=7.99+0.96X	7	3.41	0.0075 (0.00005 - 0.0012)	0.0162	1.00	1.00
Quinalphos	Y=7.600+0.91X	7	1.37	0.0014 (0.00087-0.0025)	0.036	5.36	0.45
Dimethoate	Y=6.85+1.17X	7	7.43	0.0264 (0.018 - 0.039)	0.3274	0.28	0.05
Chlorpyriphos	Y=7.47+1.32X	7	2.58	0.0134 (0.0092 - 0.019)	0.1252	0.56	0.13
Endosulfan	Y=6.95+0.97X	7	4.82	0.01 (0.006 - 0.018)	0.206	0.75	0.08
Cypermethrin	Y=6.54+1.15X	8	4.39	0.045 (0.029 - 0.072)	0.5943	0.17	0.03
Spinosad	Y=6.68+1.124X	7	5.16	0.0314 (0.020 - 0.049)	0.4341	0.24	0.04
Imidacloprid	Y=7.77+0.89X	7	2.65	0.00032 (0.00019 - 0.00057)	0.015	23.44	1.08
Acetamiprid	Y=8.49+0.97X	7	3.85	0.00025 (0.00015 - 0.00043)	0.00633	30.00	2.56

The resistance factor calculated by comparing LC_{90} values with the recommended concentration of the insecticides revealed the acquisition of resistance by mustard aphid to four insecticides used in the present study. *L. erysimi* developed resistance to dimethoate (6.54 X), chlorpyriphos (2.504 X), endosulfan (2.94 X) and cypermethrin (29.71 X) *(Table 2)*. The development of the resistance to these chemicals, more so to cypermethrin might be due to their intensive use in the not only on the mustard crop, but also on other crops grown in this region on which *L. erysimi* is a pest. The observations were in tune with the findings of **Chalam *et al.*, (2003)** who also reported that the cotton aphid *Aphis gossypii* had acquired resistance to enodosulfan (14.02X), dimethoate (8.57X), monocrotophos (1.11X) and cypermethrin (51.12X)The resistance to cypermethrin might be due to the fact that even though it was not directed against sucking pests, yet there was a tendency of aphid to acquire resistance to the insecticides because of longer period of infestation **(Padhee *et al.*, 2002)**.

Table. 2: Levels of resistance developed by L. erysimi to insecticides with respect to recommended concentrations

Insecticide	Recommended concentration	LC_{90}	Resistant factor
Dimethoate	0.05[1]	0.3274	6.54
Chlorpyriphos	0.05[1]	0.1252	2.504
Endosulfan	0.07[2]	0.206	2.94
Cypermethrin	0.02[3]	0.5943	29.71

(1. Sonkar and Desai, 1998; 2. Gami *et al.,* 2002; 3. Gour and Pareek, 2003)

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Assessment of genetic variability, heritability and genetic advance for yield and its contributing characters in early maturing rice genotypes

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ABSTRACT

An investigation including 64 rice genotypes was under taken during kharif, 2004 to study the genotypic and phenotypic coefficient of variation (GCV and PCV) heritability (broad sense) and genetic advance for grain yield and nine other yield contributing characters. Significant differences were observed among 64 genotypes for all 10 characters studied. The estimates of GCV were smaller than PCV for all the characters, suggesting the little influence of environment in the expression of the characters. High heritability coupled with high genetic advance recorded for grain yield per plant indicating that the character predominantly governed by additive gene action. High heritability with moderate to low genetic advance for 1000-grain weight, plant height, harvest index and flag leaf length, suggesting that the predominant role of non-additive gene action in their inheritance.

INTRODUCTION

Rice is the staple food for more than 65 percent of the people of India. Rice production was around 87 million tonnes in 2003-2004 in India **(Pasalu and Katti, 2004)** and the demand of rice is projected as 128 million tonnes by the year 2012. For bringing about genetic improvement of yield and other component characters, knowledge of nature and magnitude of variation in the available germplasm is important. Since the estimates of genotypic and phenotypic coefficient of variation, heritability and expected genetic advance are useful in designing an effective breeding programme. The present study, is aimed to estimate the extent of variability for yield and different yield contributing characters in rice for increasing yield.

MATERIALS AND METHODS

The experimental material comprised 64 early maturing rice genotypes, grown in a randomized complete block design with three replications at the Central Research Farm, Department of Genetics and Plant Breeding, Allahabad Agricultural Institute, Allahabad in *kharif*, 2004. Each genotype was grown in 5 x 2 m plot with inter and intra-row spacing of 20 x 15 cm respectively. Data on plant height (cm), number of tillers/ plant, number of panicles/ plant, panicle length (cm), flag leaf length (cm), flag leaf width (cm), number of spikelets/ panicle, 1000-grain weight (g), harvest index (%) and grain yield/ plant (g) were collected from five randomly selected plants in each replication. The mean values are used for analysis of variance **(Panse and Sukhatme, 1967)** Genotypic and Phenotypic coefficient of variation (GCV and PCV) were calculated by following the method given **Burton (1952)**. Broad sense heritability and expected genetic advance as per cent of mean were estimated as suggested by **Johnson *et al.* (1955)**.

RESULTS AND DISCUSSION

Analysis of variance for grain yield and other nine yield contributing characters revealed that the 64 genotypes differed significantly, indicating the presence of enormous variability among them for all characters studied *(Table 1)*. The wide spectrum of variability noticed in these characters would offer scope of selection for evolving the promising lines. The higher magnitude of GCV and PCV were recorded for number of panicles/ plant, number of tillers/ plant, grain yield/ plant, number of spikelets/ panicle and flag leaf length, suggesting the possibility of yield improvement through selection for these traits *(Table 2)*. These findings were in agreement with **Nayak *et al*. (2002)** and **Vivek *et al*. (2004)**.

Table 1. Analysis of variance for 10 characters of rice germplasm

Characters	Mean sum of square		
	Replication d. f. = 2	Treatment d. f. = 63	Error d. f. = 126
Plant height (cm)	24.847	518.677**	20.623
No. of tillers/ plant	3.983	27.571**	4.685
No. of panicles/ plant	2.627	25.264**	4.408
Panicle length (cm)	14.326	6.773**	2.459
Flag leaf length (cm)	8.431	67.846**	7.906
Flag leaf width (cm)	0.008	0.050**	0.010
Spikelets/ panicle	2071.206	3194.852**	438.693
Test weight (1000-grain) (g)	4.630	29.678**	1.134
Harvest index (%)	96.346	93.441**	8.924
Grain yield/ plant (g)	40.898	187.166**	12.192

** Significant at 1% level of significance

Heritability is a measure of the extent of phenotypic variation caused by the action of genes. High heritability combined with high genetic advance is desirable for the selection-based genetic improvement of a character **(Johnson *et al.*, 1955)**. In the present investigation, high heritability estimates were obtained for 1000-grain weight, plant height, grain yield per plant, harvest index and flag leaf length *(Table 2)*. High heritability coupled with high genetic advance observed for grain yield/ plant indicating that this character predominantly governed by additive gene action. This character could be improved by mass selection and other breeding methods based on progeny testing. Similar results were also reported by **Patil *et al.* (2003)** and **Vivek *et al.* (2004)**.

Medium heritability was observed for number of spikelets/ panicle, number of tillers/ plant, number of panicles/ plant and flag leaf width, suggesting that selection would be more meaningful if genetic advance is also taken into consideration simultaneously. Out of these characters, number of tillers per plant and number of panicles per plant showed moderate heritability estimates along with high genetic advance as

Table 2. Estimates of components of variance and genetic parameters for 10 quantitative characters in 64 genotypes of rice.

Characters	Phenotypic variance	Genotypic variance	Environmental variance	Coefficient of variation (%)		Heritability (%) (broad sense)	Genetic advance as percent of mean
				Phenotypic	Genotypic		
Plant height (cm)	186.64	166.02	20.62	11.65	10.98	29.0	21.34
No. of tillers/ plant	12.32	7.63	4.69	28.07	22.09	61.9	35.82
No. of panicles/ plant	11.36	6.95	4.41	28.48	22.28	61.2	35.91
Panicle length (cm)	3.89	1.44	2.45	7.79	4.73	36.9	5.92
Flag leaf length (cm)	27.88	19.98	7.9	60.08	13.61	71.6	23.73
Flag leaf width (cm)	0.024	0.013	0.011	13.34	9.93	55.5	15.24
Spikelets/ panicle	1357.41	918.72	438.69	19.59	16.11	67.7	27.31
Test weight (1000-grain) (g)	10.65	9.52	1.11	13.17	12.45	89.3	24.25
Harvest index (%)	37.09	28.17	8.92	12.80	11.16	75.9	20.03
Grain yield/ plant (g)	70.50	58.31	12.19	25.72	23.39	82.7	43.82

percent of mean *(Table 2)*. These results suggest the possibilities of improvement of these characters through rigorous selection. High heritability associated with moderate to low genetic advance was also observed for 1000-grain weight, plant height, harvest index and flag leaf length, suggesting the greater role of non-additive gene action in their inheritance. Similar results for 100-grain weight were reported earlier by **Das *et al*. (2001)**.

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Standardization and evaluation of drying techniques in Rose (*Rosa spp*.) cv. First Red.

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ABSTRACT

An experiment was conducted in the Department of Horticulture, Allahabad Agricultural Institute Deemed University Allahabad, during March-April 2004 on the topic "Standardization and evaluation of drying Techniques in Rose *(Rosa spp.)* cv. First Red". Application of different drying techniques were done to dry the rose flowers. Firstly rose flowers were subjected to different earthen pots (20 cm.) containing medium of sand dust, borax and sand in the ratio of 2:1 and silica gel. The best method to dry flowers was found (silica gel in microwave oven) followed by T6 (silica gel) and T5 (mixture of borax and sand).

INTRODUCTION

The concept of dry flower is an age –old process. The idea of using dry flowers developed gradually due to some valid reasons. All types of flowers are not available throughout the year. Vase life of cut flowers is very limited. Some flowers were identified which could be easily dried, preserved and processed in nature.

Dehydrated or dried ornamental plant parts are generally inexpensive and are sought for their everlasting and attractive appearance. The charm of dried ornamental plant parts can be maintained from few months to years with lesser cost, if protected form the damage of high humidity as in dried flowers the microbial form damage due to high humidity is possible. The main characteristics of dried flowers include novelty, longevity, aesthetics, flexibility and year-round availability **(Joyce,1998)**.

The techniques has tremendous importance in social development in terms of employment generation and has commercial potentiality both for domestic and export market.

Indian, floriculture trade dominated by export of dry flowers, therefore, can be explored and the possibility of large scale drying of Indian rose cultivars for export potentiality.

Considering the above points in view the investigation entitled" "Standardization and Evaluation of drying Techniques in Rose *(Rosa spp*), cv. First Red" was undertaken in the department of Horticulture, Allahabad Agriculture Institute- Deemed University, Allahabad during the year 2003-2004 with the following objectives:

(1) To evaluate the best method of drying of rose.
(2) To standardization of the drying techniques of rose.
(3) Economic feasibility of drying techniques.

MATERIALS AND METHODS

The present study was conducted on "Standardization and Evaluation of drying Techniques Rose*(Rosa spp.*) cv. First Red" in the Department of Horticulture, Allahabad Agricultural Institute- Deemed University, Allahabad-211007 from March-April 2004.The experiment was laid out in a completely Randomized Block Design with seven treatments and three replications with the following mentioned treatments : T_0 (Control), T_1 (Sun drying) T_2 (Sand drying), T_3 (Saw dust drying), T_4 (Press drying), T_5 (Borax and sand drying), T_6(Silica gel drying), T_7 (Silica gel in Microwave oven drying).

Flowers were embedded in the media carefully in 20 cm. earthen pots and kept for drying. These treatments were performed at an interval of 60 sec, 90 sec, 120sec, 5 days and 10 days to record the changes in the parameters viz. weight, diameter, texture, shape, colour and appearance.

RESULT AND DISCUSSION

The use of media significantly affected the physical parameters of the rose flowers. Maximum loss in weight of rose flower (2.97 g) was found in T_7 (silica gel in microwave oven drying) followed by (3.64g) in T_6 (silica gel) and others. This is perhaps due to the microwaves which is embedded during drying little heat and maintaining a particular temperature agitating only the water molecules without damaging or affecting any part of the flower, whereas in other methods temperature is weather dependent **(J.C.Bhutani, 1990)**. The results found are shown in table 1.

Diameter of the rose flower was also affected when the flowers were subjected to these methods. The minimum change in the diameter was recorded (5.37 cm) in T_7 (Silica gel in microwave oven) followed by (3.64cm) in T_6 (silica gel) and others. Their reason being, silica gel absorbs moisture without affecting the form of the flower restricting the flowers to get shriveled due to embedding. Shrinkage occurs due to loss of turgor, such that the elastic components of shape and size are relaxed **(Joyee, 1998)**. *(Table No. -1)*

Significant change in the texture of the rose flowers was found when the treatments were applied. Maximum change in the texture brittleness was found in T_1 (sun drying) whereas minimum change in the texture(soft) was found in $T_{6(}$ Silica gel). The reason being sun drying is whether dependent, which changes the texture of the flower from soft to brittle. It evaporates the moisture from the flower that might have resultsed in the brittleness of the flowers **(Joyee, 1998)** the results are shown in *Table 1*.

Shape of the flower was affected when flowers were subjected to these treatments. Maximum change in the shape, *i.e.* wrinkleless was recorded in T_0 and T_1 (air drying and sun drying) on the other hand minimum change in shape was found in T6 and T5 (silica gel and a mixture of borax and sand). *(Table No. - 1)*

Table No. 1 Effect of different drying methods on various parameters of Rose flowers. cv. First Red.

Treatments	Flower weight (g)		Flower diameter (cm)		Flower texture		Flower shape		Flower colour	
	90 sec.	10 Days	90 sec.	10 Days	90 sec.	10 Days	90 sec	10 Days	90 sec.	10 Days
T_0 (Air Drying)	8.21	3.03	5.31	3.07	Soft	Hard and Brittle	Normal	Wrinkle	Red	Noble Red
T_1 (Sun Drying	8.54	3.14	5.13	3.14	Soft	Hard and Brittle	Normal	Wrinkle	Red	Noble Red
T_2 (Saw Dust Drying)	8.36	3.58	5.59	3.58	Soft	Hard and Brittle	Normal	Wrinkle	Red	Crimson Red
T_3 (Sand Drying)	8.20	3.67	5.89	3.67	Soft	Hard and Brittle	Normal	Wrinkle	Red	Crimson Red
T_4 (Press Drying)	22.10	8.88	4.79	8.88	Soft	Soft & Less Brittle	Normal	Flat	Red	Noble Red
T_5 (Borax and Sand Drying)	9.78	3.64	5.50	3.64	Soft	Soft & Less Brittle	Normal	Normal	Red	Crimson Red
T_6 (Silica Drying)	10.14	3.64	5.97	3.64	Soft	Soft & less Brittle	Normal	Normal	Red	Crimson Red
T_7 (Silica gel microwave oven)	2.97	0	5.37	0	Soft & Brittle	Burnt	Normal	Normal	Crimson Red	Burnt
S.E. (±)	**0.408**	**0.237**	**0.151**	**0.120**						
C.D. at 5%	**0.850**	**0.493**	**0.315**	**0.250**						

Colour of the rose flower changed to a fairly large extent. Minimum change in the colour of the flower was found in T_6 (silica gel) followed by T_5 (Borax and sand drying). Maximum change in the colour of the flower was found in T_1 (Sun drying). The colour changes due to elevating temperature, hence the sun drying method fails to retain the original colour of the flower. While silica gel, which acts as a desiccant absorbed moisture without affecting the colour of the flower The flower tends to discolor due to oxidation reactions associated with loss of compartmentation within the cell during the desiccation of the tissue **(Lubaina, *et.al* 2002, Joyee 1998)**.

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Correlation studies and Path coefficient analysis in Bottle Gourd (*Lagenaria siceraria*(Mol) Stand L.)

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ABSTRACT

The present investigation included twenty four lines comprising of genetically diverse germplasm was carried out to study character association and path coefficient analysis in thirteen quantitative character. Character association studies indicated the strong positive correlation of fruit weight, number of fruits per vine, fruit length with yield and also among themselves. Path coefficient analysis revealed the importance of fruit weight number of fruits per vine, fruit length, vine length in formulating selection criterion for effective improvement of fruit yield.

INTRODUCTION

Bottle Gourd (*Lagenaria siceraria*(Mol) Stand L.) is an important vegetable crop grown extensively all over India. Its cross pollinated nature and monoecious behaviour have resulted in a large variation in qualitative and quantitative characters and is more suitable for the exploitation of heterosis. A programme of breeding on high yielding not only requires information of the nature and magnitude of variation in the available material but also the information of association of characters with yield and among themselves so that a rational choice of the character in which selection is to be exercised can be made To understand the direct and indirect contribution of each character towards yield path coefficient analysis was studied which had revealed the importance of fruit weight, number of fruits per vine, vine length and fruit length in formulating selection criterian for effective improvement of fruit yield. An attempt was therefore, made in the present investigation to study the inter-relationships of quantitative traits and their direct and indirect effects contributing to yield, so as to assist the plant breeder informing a basis for selection.

MATERIALS AND METHODS

The present investigation included twenty four lines comprising of genetically diverse germplasm and were grown in randomised blocks with three replications at Horticultural garden, S. V. Agricultural College, Tirupathi during the year 1999-2000.

Observations were recorded on thirteen characters viz., days to female/male flowers, number of node at which first male/female flower appeared, fruit length, fruit diameter, fruit weight, number of seeds per fruit, seed weight, fruit flesh thickness, number of fruits per vine, yield per vine and vine length. The phenotypic and genotypic correlation coefficients arecaluculated based on variance and covariance components **(Johnson *et al,* 1955)** Path coefficient analysisas applied by **(Dewey and Lu 1959)** was used to partition genotypic correlation coefficient in to direct and indirect effects.

RESULTS AND DISCUSSION

The estimates of genotypic and phenotypic correlation between all possible pairs of characters showed that yield was found significantly associated both phenotypically and genotypically with fruit length, no. of seeds per fruit, fruit weight and no. of fruits per vine. The significant negative genotypic correlation of yield was found with fruit diameter. Length of fruit exhibited a positive and significant association with fruit weight number of seeds per fruit, number of fruits per vine both at phenotypic and genotypic levels. Fruit length exhibited a significant and negative correlation with fruit diameter and fruit flesh thickness. Fruit thickness and vine length at both phenotypic and genotypic levels and negative and significant correlation with number of fruits per vine. Positive and significant association of fruit weight was recorded with number of seeds per fruit and vine length and negative genotypic levels. It showed negative but a highly significant correlation with number of nodes at which first female flower appeared, days to first female flower, fruit diameter and fruit flesh thickness at genotypic level. Vine length showed a significant and positive association with many characters like number of nodes at which first male and female flower appeared, fruit diameter and fruit flesh thickness at both phenotypic and genotypic levels. It exhibited a negative association at both phenotypic and genotypic levels with fruit length and number of fruits per vine.

The interrelationship studies revealed that yield was strongly associated with fruit length, fruit weight, number of fruits per vine and number of seeds per fruit both phenotypically and genotypically i.e. as the magnitudes of above characters increased, yield also significantly increases. Similar kind of association was revealed by **(Varalakshmi and Reddy 1994)** in ridge gourd, **(Khattra *et al* 1994)** in bitter gourd.

Table 1 : Phenotypic and Genotypic correlation coefficients among thirteen characters in twenty four genotypes in bottle gourd

Character	No. of nodes at which first male flower appeared	Days to first male flower	First female flowering node	Days to first female flower	Fruit length	Fruit dia-meter	Fruit weight	No of seeds per fruit	Seed weight	Fruit flesh thick-ness	No of fruits per vine	Vine length	Yield per vine
No. of node at which first male flower appeared	-	0.6277**	-	0.6951	-0.1422	0.6096**	0.1948	0.1408	0.2883	0.6483**	-0.1721	0.7358**	-0.0803
Days to first male flower	0.5535**	-	0.5285**	0.8312**	-0.0592	0.6249**	0.1804	0.0944	0.4723*	0.5804**	-0.0124	0.5904**	-0.0475
First female flowering node	0.8367**	0.2722	-	0.7557	-0.2322	0.4790*	-0.0185	-0.0463	0.1657	0.5480**	-0.2810	0.5138**	-0.2747
Days to first female flower	0.6821**	0.6963**	0.6615**	-	-0.1529	0.5960**	0.1315	0.0360	0.3082	0.6008**	-0.1650	0.5314**	-0.1415
Fruit length	-0.2767	-0.3414	-0.4482*	-0.4980	-	-0.1518	0.5724**	0.4885*	0.3868	-0.2588	0.5749**	-0.0229	0.7408**
Fruit diameter	0.5502**	0.2407	0.1531	0.1484	-0.5395**	-	0.4988*	0.3348	0.4092*	0.9524**	-0.1505	0.6206**	0.1198
Fruit weight	0.0653	-0.1171	-0.2802	-0.1800	0.5528**	0.3787	-	0.7004**	0.4715*	0.3820	0.1951	0.4767*	0.7667**
No of seeds per fruit	0.0145	-0.2026	-0.2776	-0.3100	0.4489*	0.1329	0.6815**	-	0.1159	0.2676	0.2238	0.4142*	0.6006**
Seed weight /1000	0.1120	0.1703	-0.1678	-0.1191	0.3106	0.0362	0.3614	-0.0869	-	0.3816	0.2156	0.3124	0.3267
Fruit flesh thickness	0.5841**	0.2059	0.2938	0.2296	-0.6218**	0.9229**	0.1939	0.0533	0.0243	-	-0.2414	0.6060**	-0.0163
No of fruits per vine	-0.3648	-0.3680	-0.5824**	-0.6336	0.5608**	-0.6863**	0.0898	0.1289	0.0611	-0.7132**	-	-0.1855	0.7157**
Yield per vine	-0.2033	-0.3224	-0.4978*	-0.4811*	0.7347**	-0.1141	0.7649**	0.5717**	0.2455	-0.2742	0.7073**	0.1162	-
Vine length	0.7576**	0.6833**	0.5133*	0.6104**	-0.0658	0.7811**	0.4703*	0.3908	0.2828	0.6930**	0.2643		0.1521

Phenotypic (upper diagonal)

Genotypic (lower diagonal)

* Significant at 5% level

** Significant at 1% level

Table 2: Phenotypic Path Coefficient among fruit yield per plant and yield component in 24 genotypes of bottle gourd

Character	No. of nodes at which first male flower appeared	Days to first male flower	First female flowering node	Days to first female flower	Fruit length	Fruit dia-meter	Fruit weight	No of seeds per fruit	Seed weight	Fruit flesh thick-ness	No of fruits per vine	Vine length	Yield per vine
No. of node at which first male flower appeared	-0.0542	-0.1079	-0.0092	0.0332	-0.0019	0.0310	0.1331	-0.0036	-0.0162	-0.0742	-0.1013	0.0910	-0.08
Days to first male flower	-0.0340	-0.1719	-0.0058	0.0397	-0.0008	0.0318	0.1233	-0.0024	-0.0266	-0.0665	-0.0073	0.0730	-0.04
First female flowering node	-0.0455	-0.0908	-0.0109	0.0361	-0.0030	0.0244	-0.0126	0.0012	-0.0093	-0.0621	-0.1655	0.0635	-0.27
Days to first female flower	-0.0377	-0.1428	-0.0082	0.0477	-0.0020	0.0303	0.0899	-0.0009	-0.0173	-0.0689	-0.6972	0.0657	-0.14
Fruit length	0.0077	0.0102	0.0025	-0.0073	0.0131	-0.0077	0.3910	-0.0124	-0.0218	0.0297	0.3386	-0.0028	0.74**
Fruit diameter	-0.0330	-0.1074	-0.0052	0.0285	0.0020	0.0508	0.3407	-0.0085	-0.0230	-0.1092	-0.0886	0.0767	0.12
Fruit weight	-0.0106	-0.0310	0.0002	0.0063	0.0075	0.0254	0.6831	-0.0178	-0.0265	-0.0438	0.1149	0.0589	0.76**
No of seeds per fruit	-0.0076	-0.0162	0.0005	0.0017	0.0064	0.0170	0.4785	-0.0254	-0.0065	-0.0307	0.1318	0.0512	0.60**
Seed weight /1000	-0.0156	-0.0812	-0.0018	0.0147	0.0051	0.0208	0.3221	-0.0029	-0.0563	-0.0437	0.1270	0.0386	0.32
Fruit flesh thickness	-0.0351	-0.0997	-0.0059	0.0287	-0.0034	0.0484	0.2609	-0.0068	-0.0215	-0.1146	-0.1422	0.0749	-0.02
No of fruits per vine	0.0093	0.0021	0.0031	-0.0079	0.0075	-0.0077	0.1333	-0.0057	-0.0121	0.0277	0.5889	-0.0229	0.71**
Vine length	-0.0399	-0.1015	-0.0056	0.0254	-0.0003	0.0316	0.3257	-0.0105	-0.0176	-0.0695	-0.1093	0.1236	0.15

* Significant at 5% level

** Significant at 1% level

Table 3 : Genotypic Path Coefficient among fruit yield per plant and yield component in 24 genotypes of bottle gourd

Character	No. of nodes at which first male flower appeared	Days to first male flower	First female flowering node	Days to first female flower	Fruit length	Fruit dia-meter	Fruit weight	No of seeds per fruit	Seed weight	Fruit flesh thick-ness	No of fruits per vine	Vine length	Yield per vine
No. of node at which first male flower appeared	-0.0503	0.0476	0.1093	-0.1321	0.0516	-0.1452	0.0669	-0.0018	-0.0149	0.0368	0.2153	0.0441	-0.20
Days to first male flower	-0.0279	0.0859	0.0356	-0.1348	0.0636	-0.0635	-0.1210	0.0259	-0.0226	0.0130	0.2172	0.0398	-0.32
First female flowering node	-0.0421	0.0234	0.1307	-0.1281	0.0835	-0.040	-0.2873	0.0355	-0.0223	0.0185	-0.3435	0.0299	-0.49*
Days to first female flower	-0.0343	0.0598	0.0864	-0.1936	0.0928	-0.0392	-0.1846	0.0396	0.0158	0.0145	0.3739	0.0355	-0.48*
Fruit length	0.0139	-0.0293	0.0586	-0.0964	-0.1864	0.1424	0.5669	-0.0574	-0.0413	-0.0392	0.3310	0.0038	0.73**
Fruit diameter	-0.0277	0.0207	0.0200	-0.0287	0.1005	-0.2640	0.3883	-0.0170	-0.0048	0.0582	-0.4051	0.0455	-0.11
Fruit weight	-0.0033	-0.0101	-0.0366	0.0349	-0.1030	-0.1000	0.0255	-0.0871	-0.0480	0.0122	0.0530	0.0274	0.76**
No of seeds per fruit	-0.0007	-0.0174	-0.0363	0.0600	-0.0837	-0.0351	0.6988	-0.1278	0.0115	0.0034	0.0761	0.0227	0.57**
Seed weight /1000	-0.0056	0.0146	-0.0219	0.0231	-0.0579	-0.0096	0.3706	0.0111	-0.1329	0.0015	0.0361	0.0165	0.24
Fruit flesh thickness	-0.0294	0.0177	0.0384	-0.0445	0.1159	-0.2436	0.1989	-0.0098	-0.0032	0.0630	-0.4209	0.0403	-0.27
No of fruits per vine	-0.0184	-0.0316	0.0761	0.1227	-0.1045	0.1812	0.0921	-0.0165	-0.0081	-0.0450	-0.5902	-0.0154	0.70**
Vine length	-0.0381	0.0587	0.0671	-0.1182	0.0123	-0.2062	0.4823	-0.0499	-0.0376	0.0437	-0.1560	0.0582	0.11

,. * Significant at 5% level

** Significant at 1% level

The relationship between fruit length, fruit weight, number of fruits per vine and number of seeds per fruit is positive and significant at both phenotypic and genotypic levels i.e., as the length of the fruit increases fruit weight and number of seeds also increases significantly. Similarly **Singh et al., (1997)** reported positive and significant association between fruit length, fruit weight, number of fruits for vine and significantly with fruit flesh thickness, i.e. as flesh thickness increases diameter of the fruit also increases. Similar reports were made by **Krishnaprasad and Singh (1992)** in cucumber. Vine length showed a positive and significant correlation with most of the characters except for fruit length and number of fruits per vine. This may be due to more number of crooked and deformed fruits. These results were supported by **Sarkar *et al*(1999)** in pointed gourd.

In the present study, the characters fruit weight, number of fruits per vine and vine length exhibited positive direct effects on yield revealing that there are major yield contributing traits in bottle gourd. These findings are in agreement with the reports made by **Vijay (1987)** in musk melon and **Rao (1997)** in ridge gourd. The characters fruit length, fruit diameter, fruit flesh thickness and number of fruits per vine showed highest positive indirect effects on fruit yield. Similarly positive indirect effects of other characters viz., fruit length and fruit weight through number of fruits per vine were also observed. Similar findings were documented by **Krishna Prasad and Singh (1992)** in cucumber.

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Influence of rhizobium inoculation on growth, yield and biochemical composition of Chickpea (*Cicer arietinum* L.)

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ABSTRACT

A pot experiment was conducted at Allahabad Agricultural Institute Research Farm", Department of Biochemistry, Allahabad, during rabi season 1998-99 to evaluate the effect of sources ($NaCO_3$, $NaHCO_3$, Nacl, $Cacl_2$ and $Mgcl_2$) and levels of saline water (0,5 and 10 meL^{-1}) in conjunction with SAR irrigation water levels (0,5 and 10 me L^{-1}) on chickpea (*Cicer arietinum* L.). The result revealed an increase in grain yield and biochemical constituents.

INTRODUCTION

On a global basis, chickpea (*Cicer arietinum* L.) is the third most important pulse crop, but its production remained static for the past two decades. Chickpea is seen as an important component of Indian diet and source of cheap protein to vegetarians. These proteins are synthesized on the endoplasmic reticulum and transported to vesicles to form protein bodies in the seed. On the basis of sedimentation coefficient, they are classified into legumin (115) and vicilin (75%) protein. Legumin is a heterogeneous protein consisting of six acidic and six basic polypeptide molecules **(Casey *et al.*, 1986)** and encoded by a clarely related family of genes **(Shotwell and Larkins, 1989)**. Legumes are normally heavy feeder of phosphorus. In legume plant, phosphorus exists as pi or organic phosphorus such as glucose-6-phosphate, ATP, phospholipids, DNA, RNA and phytic acids. It is needed for export of sugars from the chloroplast. Phosphorus is metabolically very active and is readily remobilized from older tissues **(Chesworth *et al.*, 1998)**. Nitrogen fixation in pulses is usually carried by rhizobium species and phosphorus increases the nodulation that results in increased yield of crop and decreases the cost of cultivation. Thus, the present study was undertaken to observe the nodulation and biochemical evaluation as affected by sources ($NaCO_3$, $NaHCO_3$, Nacl, $Cacl_2$ and $Mgcl_2$) and levels of saline and SAR irrigation water application in chickpea under pot conditions.

MATERIALS AND METHODS

The experiment was conducted field, in the research Department of Biochemistry, Allahabad Agricultural Institute – Deemed University U.P. Mostly the soils are alluvial in nature, low in clay percentage and high sand percentage.

The experiment was laid out in factorial randomized black design with three replications. Treatment levels of saline water (0,5 and 10 me l^{-1}) supplied by $NaCO_3$ and $NaHCO_3$ and levels of SAR irrigation water (0,5 and 10 me l^{-1}) supplied by Nacl, $Cacl_2$ and $Mgcl_2$. Both treatments were applied in basal dressing. Phosphorus content was estimated by olsen colorimetric method. Nitrogen content was determined by Kjeldhal method **(A.O.A.C., 1990)**. Protein percentage is calculated by using factor 6.25. The data was subjected to standard statistical analysis as described by **Panse and Sukhatme, 1954**.

RESULTS AND DISCUSSION

On examining the plants, total number of branches increased with an increase in age of plants. It was observed between 12.00-27.33 at 95 days after sowing (DAS) and 18.33-30.00 at 120 DAS *(Table 1)*. Maximum number of branches were found at 95 DAS in S_1B_1 treatment (27.33) followed by S_1B_0 treatment (26.33) and minimum number of branches were found in R_2B_1 treatment (12.00). In case of 120 DAS maximum number of branches were found in S_1B_1 treatment (30.00) followed by S_1B_0 treatment (27.66) and minimum number of branches 'were found in S_2B_0 treatment (18.33). The total fresh pods yields were found in range of 155.00-220.00g *(Table 1)*. While maximum total fresh pods yield "were found in R_2B_1 treatment (220.00) followed by R_1B_1 treatment (215.10g). The minimum total fresh pods yield were found in non-significant S_2B_0 treatment (155.00g). These results were in agreement with finding of **Ramesh *et al.*, (1998-99)** reported that an increased in the pod yield due to application of phosphorus.

Data indicated that non-significant difference in phosphorus content in seeds due to various levels of saline and SAR irrigation water application. The phosphorus in seeds were found in range of 03.65-15.24 mg/100g *(Table 1)*. Maximum phosphorus in seeds were found in non-significant S_0B_1 treatment (15.24 mg/100 g) followed by R_0B_1 treatment (12.76) and S_0B_0 control treatment (10.86 mg/100 g). The minimum phosphorus content in seeds were found in S_2B_1 treatment (03.65 mg/100g).

The data indicated that nitrogen content in seeds was found in ranged from (03.25-03.32 per cent). While maximum Nitrogen content were found in S_1B_0 treatment (3.32%) followed by R_2B_1 treatment (03.31 per cent) and minimum Nitrogen, was found

Table 1: Effect of rhizobium inoculation on Quality and biochemical constituents of chickpea.

Treatment	No. of branches		Total fresh yield (g)	Phosphorus in seed (mg/100g)	Nitrogen in seed (%)	Protein in in fresh seed (%)
	95 DAS	120 DAS				
R_0B_0	23.00	24.33	175.00	12.76	03.29	20.58
R_0B_1	14.33	18.66	175.00	04.43	03.29	20.91
R_1B_0	22.00	25.66	200.00	05.37	03.30	20.72
R_1B_1	22.33	24.33	215.10	06.72	03.26	20.39
R_2B_0	23.00	24.00	175.00	07.00	03.28	20.54
R_2B_1	12.00	21.66	220.00	05.02	03.31	20.70
S_0B_0	18.33	21.66	180.00	10.86	03.30	20.64
S_0B_1	22.00	23.33	215.00	15.24	03.28	20.44
S_1B_0	26.33	27.66	215.00	06.45	03.32	20.74
S_1B_1	27.33	30.00	185.00	10.22	03.28	20.45
S_2B_0	15.33	18.33	155.00	10.81	03.30	20.65
S_2B_1	16.33	20.00	165.00	03.65	03.25	20.33
CD (P=0.05)	NS	NS	NS	NS	NS	NS

DAS : Days after sowing; CD at 5%

NS : Non-significant

Saline water levels : R_0(Control), R_1 (5 me L^{-1}) and R_2 (10 me L^{-1})

SAR irrigation water : S_0(Control), S_1 (5 me L^{-1}) and S_2 (10 me L^{-1})

Rhizobium levels : B_0(Control) and B_1 (treated Rhizobium culture)

in S_2B_1 treatment (03.25%). Combine response of SAR irrigation water and control level of Rhizobium culture were found in S_1B_0 treatment (3.32%) followed by R_2B_1 treatment (03.31 per cent) was found in non-significant at 5% level.

The protein content of fresh seeds was found in the rage of (20.33-20.91 per cent) in different cultivars *(Table 1)*. Maximum protein content were found in R_0B_1 treatment (20.91%) followed by S_1B_0 treatment (20.74%) and R_1B_0 treatment (20.72%). While minimum protein content was found in S_2B_0 treatment (20.33%). Protein in seeds were found in non-significant.

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Effect of Different Tillage Practices and Planting Techniques in Rice-Wheat Cropping System on Crop Productivity and Soil Fertility Under Mollisols of Pantnagar

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ABSTRACT

A field experiment was conducted at Govind Ballabh Pant University of Agriculture &Technology, Pantnagar during 1998-2000 to study the effect of various crop establishment methods both in rice and wheat on crop productivity and soil fertility. Direct seeded rice had significantly higher number of panicle than transplanted rice. But number of grains per panicles were more in the latter than former. Length of panicle and test weight were not affected by the method of crop establishment, green manure or deep tillage. Treatments of rice crop establishment had no significant influence on wheat yield and its attributes and the interaction between *kharif* tillage and *Rabi* tillage was not significant. Bulk density of zero tillage plots was found to be higher than all other treatments whereas infiltration rate was highest on bed planting of wheat than other treatments.

INTRODUCTION

Modern day research on rice-wheat cropping system includes various tillage practices and planting techniques along with residue management and green manure incorporation. This system is the most important cropping system in the world covering approximately 24 million hectares and feeds around one billion people in continent Asia **(Ladha *et al.*, 2000)**. During last three decades, rice-wheat production system has shown remarkable resilience in productivity growth. The scientists around the world are worried and concerned about the sustainability of this exhaustive cropping system.

But the system has proven itself as a successful one in Indo-Gangetic plains, especially in *Tarai* belt. *Tarai* soils are alluvial in nature having high moisture regimes or greater annual average moisture content. These are generally low to medium in available P, medium to high in available K and high in organic matter. Available sulphur is marginal in some pockets. Zinc deficiency in rice is widespread. A very high percentage of cropped area is irrigated and the fertilizer use is quite high, nearly 300 kg NPK/ ha/ year, which is quite high resulting in high productivity. There are short as well as long term issues related to tillage, crop establishment, nutrients and crop residue management.

MATERIAL AND METHODS

Experiment was laid out in strip plot design having four replications at Crop Research Center of GBPUA &T, Pantnagar. Rice (*var*. Pant Dhan 4) was sown during *Kharif* 1998 and 1999 followed by wheat (*var*. UP 2338) during *Rabi* season of both the years. For *Kharif* season four treatments of rice were taken viz., T_1: conventional puddling and transplanting; T_2: green manure (GM) + T_1; T_3: deep tillage + T_2 and T_4: deep tillage, direct seeding of rice, and in *Rabi* season four treatments for wheat were sown viz., T_1: conventional tillage (4 harrowings – planking – sowing by seed drill – planking); T_2: zero till drill; T_3: Strip till drill; T_4: Chinese drill.

Sesbania was sown in April 1998 for green manure in two rice treatments which was incorporated into soil after 55-58 days after sowing. Then, plots were flooded for the decomposition of green manure, after which it was puddled for rice transplanting. Sowing of direct seeded rice was done on June 5 during 1998 and 1999 and on the same day nursery was sown for the other three treatments. A uniform dose of 150 kg N and 60 kg P_2O_5 ha^{-1} along with 20 kg $ZnSo_4$ ha^{-1} was applied in all plots. Rice was harvested in the month of October.

Wheat was sown during the 1st fortnight of December as per treatments. Sowing got delayed due to unusual late rains during these two years. The plot being low-lying, remained wet. Uniform dose of 150 kg N and 60 kg P_2O_5 ha^{-1} was applied in all plots. Crop was harvested during 1st fortnight of May.

RESULTS AND DISCUSSION

(A) Biomass Production by *Sesbania* (Green Manure)

Sesbania crop raised before rice in summer in two treatments produced 5.75 and 6.02 t ha^{-1} during 1998 and 1999 respectively. **Choudhary *et al.*, 1995** reported similar results.

(B) Rice

Number of panicles was significantly higher in direct seeded rice than transplanted rice under conventional planting *(T_1, Table 1)*. Green manure increased the number of panicles but was non significant. Number of grains per panicle was nearly 11-16 per cent higher in transplanted crop compared to direct seeded crop in two years. Length of panicles and test weight was not affected by the methods of crop establishment, green manuring and deep tillage. Rice yield was highest (5822 kg ha^{-1}) in plots where deep tillage was done followed by *Sesbania* green manuring, puddling and transplanting. However, the treatment differences were not significant. Direct seeded and transplanted crops yielded at par. The effect of green manuring was not significant as the crop had received 150 kg N ha^{-1} as fertilizer (urea) nitrogen. It is evident that during the second season of rice *(Tables 1 and 2)*, there was a considerable decline in the yield which shows the productivity drop because of continuous cultivation of this cropping system on the same fields for many years.

Table 1: Yield and yield attributes of rice as influenced by tillage and planting treatments.

Treat-ments	No. of panicles/ m^2 at harvest		Panicle length (cm)		No. of grains/ panicle		Test weight (g)		Grain yield (kg ha^{-1})		Mean yield yield (kg ha^{-1})
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	
T_1	261	253	27.4	27.2	120	127	28.9	27.7	5628	5572	5600
T_2	280	275	27.1	27.9	121	130	30.0	29.2	5616	5657	5612
T_3	285	275	27.2	27.6	101	103	27.7	27.1	6011	5634	5822
T_4	310	290	26.8	27.0	103	114	28.3	28.6	5744	5432	5588
CD at 5%	35	30	ns	ns	ns	ns	ns	ns	ns	ns	-

(C) Wheat

Due to very late sowing, the growth and yield of the crop was relatively less *(Table 2)*. Treatments of rice crop establishment had no significant influence on yield and yield attributes and the interaction between *Kharif* tillage and *Rabi* tillage was not significant. **Singh (1992)** reported the same results from Pantnagar because of sandy

loam soil texture, whereas the results were contradicting with the findings of **Joshi (1976)** who conducted the similar experiment in silty clay loam soil.

However, during the second year, highest wheat yield was recorded in plots where rice was directly drilled and was less in plots where puddling was done in previous season. Plant height of the crop sown by strip till drill was lower than conventional and zero tillage. Other treatments were at par. Number of ears in unit area was also higher in plots sown with Chinese drill and Zero till drill and it was lowest with strip till drill. Number of grains per ear was not affected by tillage treatments. During 1999-2000 all the planting drills were similar in producing wheat yield. **Sen *et al.* (2002)** and **Huby (1989)** reported similar findings.

Table 2: Yield and yield attributes of wheat as influenced by different tillage and planting treatments.

Treatments	Plant height (cm)		No. of ears / m^2		No. of grains/ ear		Grain yield (kg ha^{-1})		Mean grain yield
	1998	1999	1998	1999	1998	1999	1998	1999	
Kharif tillage									
T_1	75.9	69.2	260	263	73.9	72.0	4123	3813	3968
T_2	73.7	66.3	265	279	75.2	77.0	3689	3813	3751
T_3	78.0	72.1	232	260	74.3	76.0	3902	3883	3892
T_4	80.0	70.6	280	293	77.3	82.0	4470	4032	4251
CD at 5%	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	
Rabi tillage									
T_1	78.6	67.7	276	257	74.0	68.0	4304	3878	4091
T_2	79.9	68.9	293	263	76.3	73.0	4442	4103	4272
T_3	76.0	67.0	263	260	69.0	70.2	3533	3687	3610
T_4	78.0	66.3	298	266	74.6	72.1	4254	4034	4144
CD at 5%	3.0	3.1	33	-	-	-	364	Ns	-

(D) Soil Physical Properties

Soil physical properties were recorded after harvest of wheat in all treatments. Bulk density in both the depths (0-8 cm, 8-16 cm) was highest in zero tillage treatment and lowest in conventional tillage *(Table 3)*. This was because of natural soil consolidation and minimum disturbance of soil by tillage operations in zero tillage. This effect was noted by several other workers **(Yoshida *et al.* 1991; Chanye and Lindwall, 1992)**. Infiltration rate was highest on beds due to loose elevated bed structure where roots occupy major area and lowest in strip till drill.

Table 3: Soil physical properties at wheat harvest.

Treatments	Bulk density (mg m^{-3}) Soil depth (cm)				Infiltration rate (cm hr^{-1})	
	0 – 8 cm		8 – 16 cm			
	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
T_1	1.29	1.31	1.34	1.39	1.50	1.46
T_2	1.53	1.49	1.56	1.53	2.66	2.55
T_3	1.42	1.44	1.43	1.48	1.10	1.18
T_4	1.42	1.40	1.46	1.43	1.40	1.16

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Nutritional and Biochemical Status of Kernels in Various Varieties of Indian Muskmelon (*Cucumis melo* L.)

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ABSTRACT

Seed kernel of eleven muskmelon genotypes were analysed for the biochemical constituents namely protein content, amino acid (Lysine, tryptophan and methionine) content, oil content, fatty acid composition and total mineral content. Among all the genotypes, Mau 5 x HM was found most superior regarding biochemical composition. The kernel oil of this strain contain 17.56 per cent linoleic acid which is an essential fatty acid and makes the oil suitable for culinary purposes.

INTRODUCTION

Muskmelon is a warm season vining crop, generally requires 80-120 days of warm conditions from seed to maturity. Best melon quality is obtained in areas with high temperature, high light intensity minimum rainfall and relatively low humidity during growing season. Ripen muskmelon fruit is high in moisture, vitamin A and vitamin C content, low in calories but energy providing source of coolness in summers **(Gopalan *et al.* 1999)**. Thus low protein, fat, carbohydrate content in the fruit makes it suitable for weight loss, diabetes, hypertension and cardiovascular disorders. Seed kernel is tasty and is consumed after removal of outer covering seed coat. They are used mainly in confectionaries sweet meats and snacks. It is highly rich in protein and fat content.

So in the light of highlighted qualities of muskmelon seed kernels, an experiment was conducted with an objective to determine the nutritional status of kernels and to access the fatty acid profile of the seed oil for screening out saturated and unsaturated fatty acid composition to detect the culinary quality of the oil.

MATERIALS AND METHODS

Seeds were collected from the ripen fruits grown at field trial, conducted in the year 2003 at Main Research Station (Vegetable Science) at Narendra Deva University

of Agriculture & Technology, Kumarganj, Faizabad. Eleven cultivars viz. DM-1, MM-28, MHY-3, MHY-5, Mau-5xHM, NDM-15, NDM-18, NDM-21, Punjab Sanehri, PMM-96-20 and PMM-97-10 were analysed.

Oil free powdered kernels were used for various biochemical analysis. Protein content was determined by **Lowry's method (1951)** using Folin ciocalteau's reagent. Essential amino acid methionine was analysed by the method of **Horn et al. (1946)** and tryptophan content was estimated by the method of **spies and Chamber (1949)**. Lysine content was determined by the method of **Felker *et al.* (1978)**. The oil content was estimated by soxhlet method as described in **A.O.A.C. (1970)**. The fatty acid profile was determined by gas liquid chromatography and methyl ester was prepared by method illustrated in "A Manual of Laboratory Techniques" published by NIN Hyderabad (A.P.), India. Total mineral content was analysed by the method as described by **Hart and Fisher (1971)**.

RESULTS AND DISCUSSION

The nutritional examination of muskmelon seed kernels were determined through exploring protein content, amino acid content, oil content, fatty acid profile and total minerals content.

The data presented in *Table-1* reveals that the protein content in kernel was found between 30.86 - 36.08 per cent. Maximum protein content was observed in defatted kernels of the hybrid Mau-5xHM (36.08%) while minimum protein content was found in the strain NDM-21 (30.86%). Similar results were observed by **Sharma *et al.* (1995), Bora *et al.* (2000)** and **Mello *et al.* (2001)**.

Table 1: Protein content in kernel of ripe fruits of different varieties/strain of muskmelon.

Varieties/Strains	Protein content (%) in seeds
DM-1	34.37
MM-28	33.83
MHY-3	31.39
MHY-5	34.11
Mau-5 xHM	36.07
NDM-15	34.07
NDM-18	31.71
NDM-21	30.86
Punjab Sunehri (Pb-5)	35.74
PMM-96-20	32.65
PMM-97-10	31.52

Fig 1: Protein content in ripen of different varieties/strains of muskmelon.

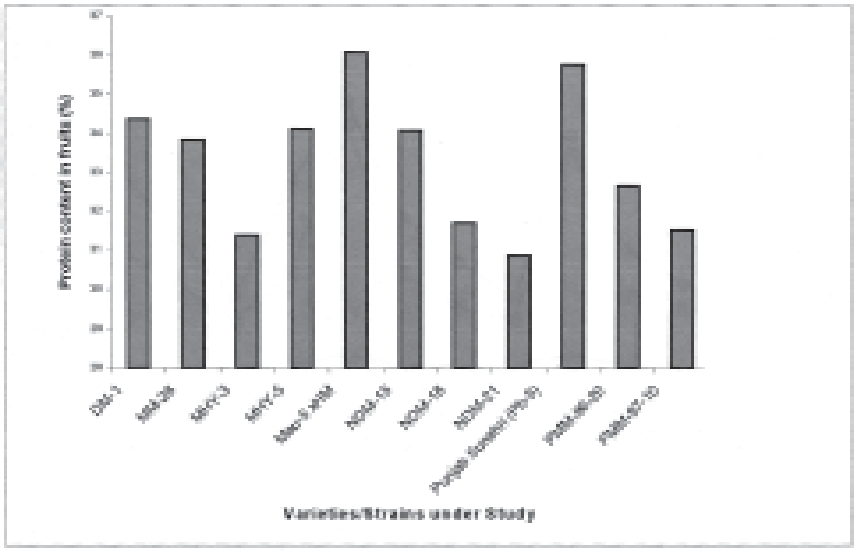
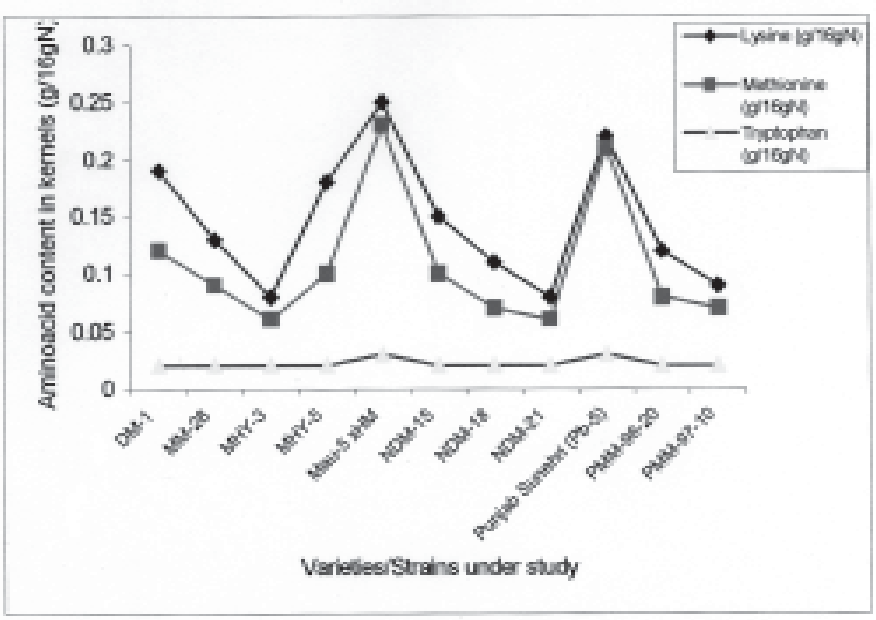


Table-2 depicts the amino acids (Lysine, Methionine and Tryptophan) variation in the kernels of muskmelon fruits of different strains/varieties. Lysine content in the defatted kernels was found in the range of 0.0849-0.2597 g/16gN while methionine content ranges from 0.0660-0.2348 g/16gN. Thus all the three amino acids were observed to be present in negligible amount of seed kernels. These observations find conformity with the results of **Sharma *et al.* (1986)** and **Melo *et al*. (2001)**.

Table 2: Variation in amino acid content in kernels of ripen fruit of different varieties/strains of muskmelon.

Varieties/Strains	**Lysine (g/16gN)**	**Methionine (g/16gN)**	**Tryptophan (g/16gN)**
DM-1	0.19	0.12	0.02
MM-28	0.13	0.09	0.02
MHY-3	0.08	0.06	0.02
MHY-5	0.18	0.10	0.02
Mau-5 xHM	0.25	0.23	0.03
NDM-15	0.15	0.10	0.02
NDM-18	0.11	0.07	0.02
NDM-21	0.08	0.06	0.02
Punjab Sunehri (Pb-5)	0.22	0.21	0.03
PMM-96-20	0.12	0.08	0.02
PMM-97-10	0.09	0.07	0.02

Fig. 2: Aminoacid variation in kernels of ripen fruits (g/16gN)



The *Table-3* shows the data of oil content variation (36.97 to 45.94 percent) of muskmelon seeds which primarily due to genotype differences. The present findings are inaccordance with those of other workers like **Sharma *et al*. (1995)**, **Hemavatahy (1992)** and **Undina *et al*. (1991)**. Highest oil content was exhibited by the genotype Mau-5xHM. The fatty acids found in muskmelon seed oil in present study are Myristic (9.50 - 13.97%), Palmitic (16.35 - 18.35%), stearic (4.71 - 6.00%), Arachidic (10.50 - 14.24%), Linoleic (18.47 - 21.03%) linolenic (16.03 - 17.56%) and Arachidonic (16.00 - 17.05%) as shown in *Table-4*. These results are inagreement with the findings of **Bora *et al.* (2000)** and **Undina *et al*. (1991)**. Out of these fatty acids melon seed oil contains very high amount of linoleic acid and hybrid Mau 5xHM showed maximum value (21.03%) of this fatty acid.

Table 3: Oil content in kernels of ripen fruit of different varieties/strains of muskmelon.

Varieties/Strains	Oil content %
DM-1	44.46
MM-28	41.83
MHY-3	37.80
MHY-5	44.83
Mau-5 xHM	45.93
NDM-15	42.69
NDM-18	41.25
NDM-21	36.97
Punjab Sunehri (Pb-5)	45.20
PMM-96-20	41.36
PMM-97-10	41.06

Fig.3: Fat content in kernels of ripen fruit of different varieties/strains of muskmelon.

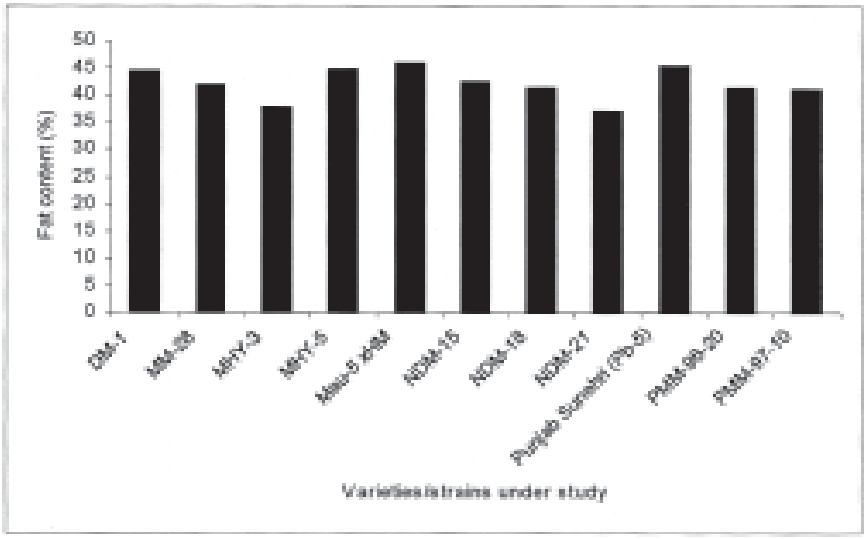
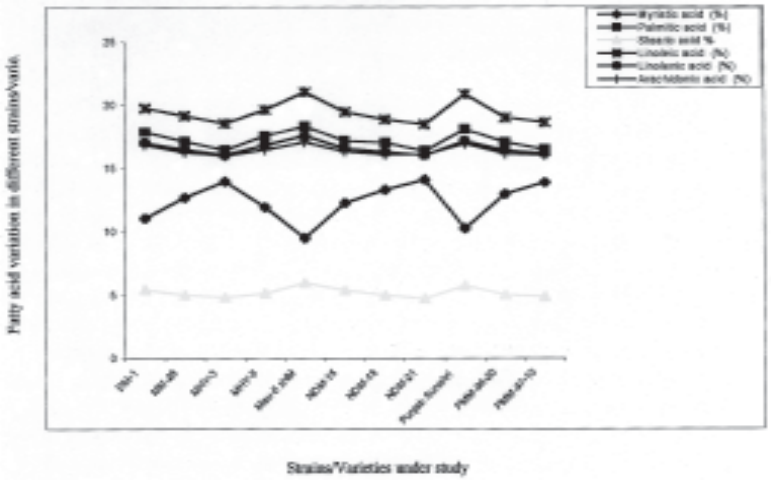


Table 4: Fatty acid profile of muskmelon seed oil.

Strain/ Varieties	Myristic acid (%)	Palmitic acid (%)	Stearic acid (%)	Arachidic acid (%)	Linoleic acid (%)	Linolenic acid (%)	Arachidonic acid (%)
DM-1	11.08	17.84	5.45	12.00	19.79	16.99	16.85
MM-28	12.69	17.12	5.02	13.25	19.19	16.47	16.25
MHY-3	13.97	16.41	4.85	14.14	18.58	16.05	16.00
MHY-5	11.95	17.55	5.14	12.46	19.64	16.81	16.44
Mau-5 xHM	9.50	18.35	6.00	10.50	21.03	17.56	17.05
NDM-15	12.26	17.16	5.39	12.81	19.49	16.55	16.33
NDM-18	13.29	16.98	4.98	13.52	18.89	16.25	16.08
NDM-21	14.11	16.35	4.71	14.24	18.47	16.03	16.09
Punjab Sunehri (Pb-5)	10.26	18.09	5.76	10.91	20.89	17.12	16.97
PMM-96-20	12.96	17.03	5.01	13.47	19.02	16.38	16.12
PMM-97-10	13.85	16.45	4.89	14.03	18.64	16.11	16.02

Fig.4: Fatty acid profile of muskmelon seed oil.

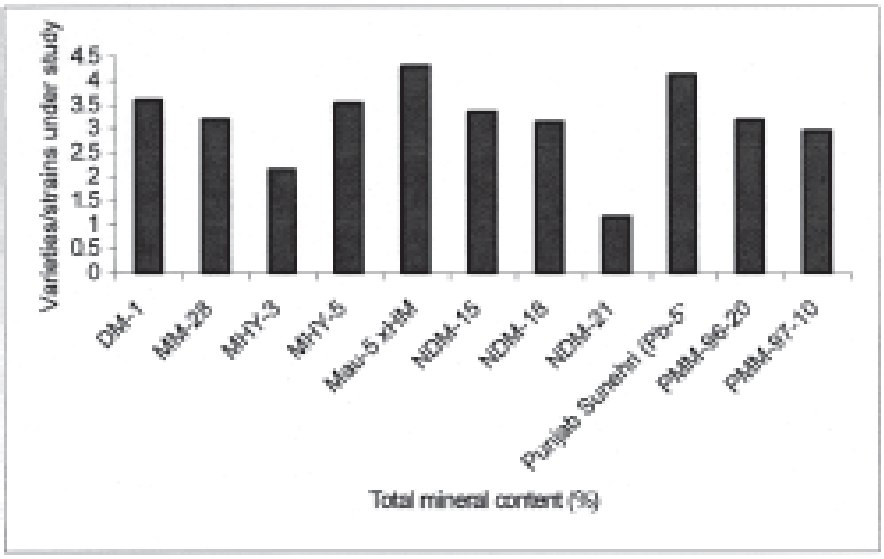


The nutritional analysis pertaining to total mineral content in seed kernels were presented in *Table-5* clearly visualizes the variation in total mineral content in seed kernels of different strains and varieties varied between 2.13 - 4.28 per cent. Highest total mineral content was noticed in strain Mau 5xHM (4.28%) and lowest total mineral content was obtained in strain NDM-21 (1.14%). Similar results were obtained by **Sharma *et al*. (1995)**.

Table 5: Total mineral content in kernels of ripe fruit of different varieties/strain of muskmelon.

Varieties/Strains	**Total mineral content (%)**
DM-1	3.60
MM-28	3.18
MHY-3	2.13
MHY-5	3.53
Mau-5 xHM	4.28
NDM-15	3.35
NDM-18	3.12
NDM-21	1.14
Punjab Sunehri (Pb-5)	4.11
PMM-96-20	3.15
PMM-97-10	2.92

Fig. 5: Total mineral content in kernels of ripen fruit of different varieties/strains of muskmelon.



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Influence of Sulpher and Phosphorus on Biochemical Constituents of Pearlmillet (*Pennisetum typhoides* L.)

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A field experiment was conducted during kharif season 2001-2002 to asses the effect of different sulphur levels 0, 20, 30 and 40 kg ha^{-1} and phosphorus levels 0, 30, 40 and 50kg ha^{-1} on *pearlmillet (Pennisetum typhoides* L.). The results revealed that protein quality and quantity both improve with increasing levels of fertilizer. Amino acid composition and mineral content were also significantly improved.

INTRODUCTION

Pearlmillet is an indispensible cereal crop of dry arid and semiarid region. Being a staple food, it is also value for its dry fodder in livestock based forming system. The nutritious cereals as a group are represented by sorghum, pearlmillet, fingermillet and maize. These nutritious cereals are cultivated in harsh environment with poor soil and water condition. Owing to their severe drought tolerance, their cultivation in drought prone area is effectively providing food and fodder security through risk oversion on sustainable basis. In providing nutrition, this group of cereal is not less than fine cereals like rice and even superior than these in certain constituents.

Pearlmillet contain 63-71% starch and its protein content is comparable with that of wheat **(Abadalla *et al*, 1998)**. Pearlmillet is also rich in fat. Lysine is an important amino acid present in sorghum and pearlmillet in 159-380 mg/100g of protein **(Abadalla *et al*. 1998)**. Pearlmillet is also rich in threonine, methionine and cysteine. Thus this nutritious cereal is comparable even superior than the fine cereals and therefore the inclusion of these cereals would definitely ensure the fulfilment of dietry requirement. Considering the above mentioned fact, the present study was conducted to determine the effect of sulphur and phosphorus levels on nutritional parameters of pearlmillet.

MATERIALS AND METHODS

A field experiment was conducted at the students instructional farm of N.D. University of Agriculture & Technology, Kumarganj during kharif season 2001-2002 to study the effect of sulphur and phosphorus levels on nutritional parameters of pearlmillet Variety NHB 2123 and ICMV-221. The experiment was laid out in randomized block design with three replications. Healthy seeds of hybrid variety NHB2123 and ICMV-221 were used to asses their performance as influenced by four doses of sulphur (0, 20, 30 and 40 kg ha^{-1}) and four levels of phosphorus (0, 30, 40 and 50 kg ha^{-1}). The available sulphur content in the soil sample was estimated by extraction in 0.15 per cent $CaCl_2$ solution and determined turbidity colorimetrically. After harvesting and threshing, healthy seeds were obtained and utilized for biochemical analysis.

The protein content in defatted meal was determined by **Lowry's method (1951)** using crystaline bovine serum albumin as standard protein. The amino acids were analysed by the methods namely Lysine **(Cancon, 1975)**, Tryptophan **(Spies and Chamber, 1949)**, **Methionine Horn *et al*. (1946)**. Total mineral content was determined by method given by **Hart and Fisher (1971)**. The data recorded on above characters were subjected to statistical analysis as described by **Fisher and Yates (1949)**.

RESULTS AND DISCUSSION

The biochemical examination of the sample revealed that sulphur and phosphorus both affects the quality of produce in varieties ICMV-221 and NBH 2133 as given in *table 1 & 2*. Protein content was affected due to various doses of phosphorus. Maximum (12.64%) protein was recorded in treatment P_3 followed by other treatments P_2 and P_1. Minimum protein was observed (10.56%) in control plot. In absence of phosphorus, most of the applied nitrogen remained unutilized in the soil **(Sinha, 1973)**. Sullphur @ 40 kg ha^{-1} gave maximum value of protein (12.64%). Sulphur has direct role in protein synthesis and is also a structural component in protein structure. Our findings are inaccordance with **Rao and Bharti (1996)** who emphasized that the degree of gluten strength and bread volume varied upon the rate of fertilizers applied. Higher fertilizer levels lead to high protein content, low gluten strength and higher bread volume. Interaction data reveals that suphur and phosphorus both positively affects the protein content of pearlmillet *(Table-1 & 2)* in both the varieties. Maximum (12.59%) protein was observed in the treatment S_3P_3 followed by treatments S_3 P_2 and S_2 P_2 *(Tablel-2)*. Protein content in ICMV-221 variety was observed between 10.56 -12.64 per cent in various treatments.

Minimum protein content was observed in control plot. Our findings are inaccordance with **Yakadri and Gautam (2001)**. Phosphorus level does not affect the lysine content but sulphur level positively affects the lysine content. Maximum lysine 2.76 g/16g N in variety ICMV-221 was observed in the treatment S_3 where sulphur was applied @ 40 Kgha^{-1}. Interaction of sulphur and phosphorus did not vary significantly. Sulphur @ 40 kg ha^{-1} gave highest lysine content in both varieties namely NBH-2123 and ICMV-221 *(Table- 1 & 2)*.

Phosphorus levels affect on tryptophan content. Data reveals that maximum tryptophan (0.98g/16gN) was recorded when phosphorus was applied @ 50kg ha^{-1}. Maximum tryptophan content was noticed when suphur was applied @ 40 kg ha^{-1} while interaction due to sulphur and phosphorus did not vary significantly. Phosphorus level did not show any effect on methionine content. Sulphur levels affect the quality of sulphur containing aminoacids. Maximum (2.38g/16g N and 2.52 g/16gN) methionine were recorded where sulphur was applied @ 40 kg ha^{-1} in variety NBH-2127 and ICMV-221. All the values were found significant over control while interaction of sulphur and phosphorus did not vary significantly. Maximum total mineral content i.e. 2.40% was noticed in variety MBH 2123 in the treatment P_3 where phosphorus was applied @ 50 kg ha^{-1}. Maximum (2.45%) total mineral content was noticed in treatment S_3P_3 in variety ICMV-221 *(Table-2)*. All minerals came from the soil and translocated into stem and finally reaches to the seed of plant as amount of total mineral of the seed. The results are well supported by the findings of **Sarkar and Warid (1977)**.

Table 1: Influence of sulphur and phosphorus on biochemical constituents of pearlmillet variety ICMV-221.

Treatments	Protein (%)	Tryptophan (g/16g/N)	Lysine (g/16gN)	Methionine (g/16gN)	Total mineral (%)
S_0P_0	10.56	0.88	2.33	1.84	2.11
S_0P_1	10.91	0.89	2.35	1.94	2.17
S_0P_2	11.48	0.96	2.50	2.05	2.31
S_0P_3	11.66	0.98	2.56	2.11	2.40
S_1P_0	10.64	0.96	2.16	1.72	2.01
S_1P_1	10.78	0.91	2.35	1.97	2.21
S_1P_2	11.14	0.93	2.46	2.03	2.37
S_1P_3	11.50	1.02	2.52	2.21	2.40
S_2P_0	11.35	0.87	2.42	1.96	2.03
S_2P_1	11.66	0.91	2.46	1.98	2.30
S_2P_2	11.75	0.94	2.48	2.08	2.33
S_2P_3	11.80	0.96	2.52	2.19	2.34
S_3P_0	11.88	0.86	2.47	2.10	2.24
S_3P_1	12.25	0.89	2.52	2.24	2.30
S_3P_2	12.46	0.90	2.68	2.36	2.40
S_3P_3	12.64	0.989	2.76	2.52	2.45
CD at 5%	0.27	0.09	0.24	0.20	0.07

S_0 - 0 kg ha^{-1} P_0 - 0 kg ha^{-1}

S_1 - 20 kg ha^{-1} P_1 - 30 kg ha^{-1}

S_2 - 30 kg ha^{-1} P_2 - 40 kg ha^{-1}

S_3 - 40 kg ha^{-1} P_3 - 50 kg ha^{-1}

Table 2: Influence of sulphur and phosphorus on biochemical constituents of pearlmillet variety NBH-2123.

Treatments	Protein (%)	Tryptophan (g/16gN)	Lysine (g/16gN)	Methionine (g/16g/N)	Total mineral (%)
S_0P_0	10. 33	0.82	2.01	1.62	1.87
S_0P_1	10.41	0.84	2.13	1.68	1.93
S_0P_2	10.53	0.88	2.18	1.78	2.06
S_0P_3	11.29	0.90	2.22	1.82	2.18
S_1P_0	10.30	0.86	2.33	1.80	2.13
S_1P_1	10.58	0.88	2.35	1.94	2.20
S_1P_2	11.69	0.93	2.36	2.06	2.23
S_1P_3	11.85	0.96	2.41	2.06	2.29
S_2P_0	10.62	0.90	2.42	1.90	2.26
S_2P_1	10.78	0.94	2.46	1.96	2.27
S_2P_2	11.37	0.96	2.48	2.12	2.39
S_2P_3	12.58	0.98	2.52	2.15	2.40
S_3P_0	11.87	0.95	2.47	2.04	2.17
S_3P_1	12.40	0.98	2.52	2.18	2.19
S_3P_2	12.57	1.08	2.68	2.26	2.24
S_3P_3	12.59	1.10	2.78	2.38	2.30
CD at 5%	0.53	0.19	0.49	0.41	0.13

S_0 - 0 kg ha^{-1} P_0 - 0 kg ha^{-1}

S_1 - 20 kg ha^{-1} P_1 - 30 kg ha^{-1}

S_2 - 30 kg ha^{-1} P_2 - 40 kg ha^{-1}

S_3 - 40 kg ha^{-1} P_3 - 50 kg ha

Considering the role of minerals in human diet, the status of total mineral will helpful in improving better nutritional quality. Total mineral content increases with increasing dose of sulphur. This may be due to this reason that it required information of chlorophyll and many other components that are involved in nitrogen fixation and photosynthesis **(Aulakh and Chibba, 1992)**. Interaction of sulphur and phosphorus did not vary significantly.

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