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Effect of $AgN0_3$, NAA + sucrose and sucrose on the post harvest life of cut gerbera *(Gerbera jamesonil)* cv. Yanara

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Abstract

An experiment was conducted, from a set of four treatment to $AgN0_3$ 20 ppm (mineral salt), NAA 150 ppm + sucrose 2% and sucrose 6% and control (Distilled water). Among all of them the $AgN0_3$ 20 ppm treatment recorded maximum vase life (9.18 days), fresh weight (85.58%) and highest water uptake (5.92g/f), *it is the positive water relations made better utilization of cut Gerbera. The $AgN0_3$ 20ppm also maintained the higher Anthocyanins content (9.41 mg Congo RedIg f wt) than other treatment combinations while minimum Anthocyanin content was recorded in control(4.49 mg Congo Red/g fwt.). Among treatment sucrose 6% recorded highest TLW (5.49* glt) *followed by $AgN0_3$ 20 ppm (5.05* g/t). *The vase life was higher in $AgN0_3$ 20 ppm (9.18 days) followed by NAA 150 ppm + sucrose 2% (8.09 days), Sucrose 6% (7.09 days) and control (4.80 days). On the bases of results, $AgN0_3$ 20 ppm performed better results in respect of vase life, water uptake, fresh weight, Anthocyanins control and medium value of TLW.*

Key words: Gerbera, vase life, water uptake, fresh weight, TLW

Introduction

Gerbera belongs to the sunflower family, Asteraceae *Gerbera jamesonii* adlam (Huxley *et a.,* 1992). It is herbaceous, popularly known as Barberton daisy, veldt daisy, African daisy and Hilton daisy. It is a native South Africa is well known as a cut flower with its plethora of colour combination. According to CMIE reports (2003-04), the total area under Floriculture is India is 1,50,000 ha with a production of 7.0 lakh MT of loose flowers and 680.6 million number of cut flower stalk. The area under protected cultivation is about 500 ha and Indian share of global flower trade is 0.06 per cent. Largest flower growing states in India are Karnataka, Tamil Nadu and AP. Tropical floritech Pvt. Ltd. in Bangalore is the leading player in commercial cultivation in India. The critical aspect of cut flower post-harvest quality is longevity. The problem with Gerbera cut flowers is the short post-harvest life (Wernett *et al.,* 1996). The vase life of cut gerbera flowers is often limited by bending of the flower stalk, called as scape bending (Penningsfeld and Foschthammer, 1966; Wilberg, 1974), a premature senescence, apart from normal senescence. Science works best when basic principles can be translated into practical technological solutions, and post-harvest longevity of cut flowers can often be improved by use of suitable vase solutions (Halevy and Mayak, 1979; 1981). Hence keeping in view, the importance of parameters in extending the vase life of cut flowers, the present investigation has been designed to study "Effect of $AgN0_3$, NAA + sucrose and sucrose on the post harvest life of cut gerbera *(Gerbera jamesonil)* cv. Yanara".

Materials and Methods

The present investigation "Effect of $AgN0_3$, NAA + sucrose, sucrose and control on the post harvest life of cut Gerbera *(Gerbera jamesonil)* cv. Yanara" was carried out in the Department of Horticulture, Shri F.H. (P.G.) Collage, Nidhauli kalan, Etah, (U.P.). The experiment was conducted, from a set of four treatment viz., $AgN0_3$ 20 ppm (mineral salt), NAA 150 ppm + sucrose 2% and sucrose 6% and control (Distilled water) with three replications.

The cut gerberas, used in studies were grown in commercial playhouse with all recommended fertigation and pest management practices. The flowers were harvested from one year old mother plants at the commercial stage (ray florets 3/4th opened) in the morning hours between 6.30 to 7.30 am by pulling the scapes of 50 to 60 cm from the crowns. Immediately after harvest 5 -10 cm of basal woody portion was cut under deionised water, packed, then placed in water (deionised) and transported. The flowers were precooled at 4±2°C for about 4 hr and then immediately unpacked, sorted to uniform length and quality of capitulum, in order to maintain uniformity within the replications. Flower scapes were trimmed under water to 40 cm. Water uptake (WU), transpiration loss of water (TLW) and fresh weight change (FWC) were recorded as per procedure given

by Venkatarayappa *et al.,* (1980).

The post harvest life of each gerbera inflorescence was considered terminated when either scape bending (>30°) from vertical axis / break or when developed injured or necrotic ray florets or ray florets wilted or disc florets abscised. The point of termination of vase life varies from the first sign of wilting or fading (Mayak and Dilley, 1976; Halevy and Kofranek, 1977) to the total death of all flowers (Salinger, 1975) with all intermediate values between these points (Salinger, 1975; Molnar and Parups, 1977).

One gram sample of fresh ligulae from all portions of the flower were taken and the anthocyanins extracted by grinding in 0.5% HCI- methanol. After filtration through Whatman No.1 filter paper, the clear anthocyanins extract was diluted to a standard volume (1/1 00" dilution). The absorbance of the solution was read at 525 nm in a spectrophotometer (Hitachi, U-2000 UV-vis spectrophotometer) on every three days interval. Reference to a standard curve developed from a serial dilution of Congo Red (Rutland, 1968) made possible the expression of results as milligrams of Congo Red for every two days interval, according to the following equation

Mg Congo Red / gram fresh weight of ligules = 2.3 x Optical density x Dilution factor

Results and Discussion

The data on effect of post harvest application of mineral salt on the post harvest life of cut gerbera cv yanara presented in Table 1 reveals that the vase life of Gerbera got significantly extended by application of different minerals salts compared to the control. Application of $AgNO_3$ at 20 ppm recorded maximum vase life compared to all other treatments. It also increased the vase life by 91.25% over the control. Application of NAA150PPM+SUCROSE 2% has also increased vase life by 68.54% over the control., 1976 Halvey and Mayak 1979, reported that application of sucrose 2% as increased the vase life. They also reported that the main effect of applied sugars in extending cut flower vase life was to maintain mitochondrial structure and function. It has been shown that sucrose has enhanced the effect of cytokine in delaying senescence of flowers and reduced the effect of ethylene (Mayak and Dilley1976).

Table 1: The effect of post harvest application of preservation solutions combination on vase life (days) in cut gerbera cv. Yanara

Treatment	Vase life
Ag NO_3 20 ppm	4.98 ± 0.13
NAA 150 ppm + Sucrose 2%	4.78 ± 0.09
Sucrose 6%	4.11 ± 0.11
Control	4.03 ± 0.07
SEm±	0.173
CD at 5%	0.211
CD at 1%	0.284

Application of different mineral salts significantly increased the uptake of water by the Gerbera compared to the control (Table 2). Application of $AgNO_3$ at 20 ppm concentration recorded maximum mean uptake of water compared to all other treatments. It also recorded maximum uptake of water even on tenth day compared to the other treatments. But the application of other mineral salts has not shown significant increase in the uptake of water after sixth day and remained on par with the control during the later period.

Transpiration loss of water reduced with the advancement of post harvest life in all treatments. However application of NAA 150 ppm + SUCROSE 2% and 6% sucrose recorded maximum transpiration losses even on tenth day. But reverse was observed with control treatment. No transpiration loss was recorded by the control on tenth day. The interaction effect between number of days and application of

Table 2: The effect of post harvest application of preservation solutions combination on water uptake (g/l) and transpiration loss (g/f) of cut Gerbera cv. yanara

Treatment	2 day	4 day	6 day	8 day	10 day	Mean	2 day	4 day	6 day	8 day	10 day	Mean
	Water uptake (g/l)						Transpiration loss (g/f)					
Ag No_3 20 ppm	6.94	9.18	5.29	2.98	2.19	5.92	6.51	8.98	5.80	3.50	0.45	5.05
NAA 150 ppm+Sucrose 2%	8.70	7.89	4.02	1.01	0.28	4.38	6.48	9.01	4.79	3.10	1.10	4.90
Sucrose 6%	11.08	9.89	5.28	1.05	0.00	5.46	9.02	8.78	6.42	2.01	1.21	5.49
Control	9.28	4.28	2.90	1.20	0.00	3.53	7.98	5.02	3.15	2.11	0.00	3.65
Mean	9.75	7.81	4.37	1.56	0.62	-	7.50	7.95	5.04	2.68	0.69	-
	SEm±	CD at 5%	CD at 1%				SEm±	CD at 5%	CD at 1%			
Days (D)	0.056	0.162	0.166				0.052	0.149	0.153			
Treatment (T)	0.051	0.145	0.149				0.047	0.133	0.137			
D x T	0.113	0.324	0.332				0.104	0.230	0.307			

Table 3: The effect of post harvest application of preservation solutions combination on fresh weight change (%) (initial wasted) and anthocynins content(mg Congo Red/ gfwt.) of cut gerbera cv. yanara

Treatment	2 day	4 day	6 day	8 day	10 day	Mean	2 day	4 day	6 day	Mean
	Fresh weight change (%)						Anthocynins content (mg Congo Red/ gfwt.)			
Ag No_3 20 ppm	106.67	99.05	86.89	71.89	63.40	85.58	6.48	6.98	8.90	7.45
NAA150 ppm+Sucrose 2%	105.89	98.50	87.50	70.08	61.58	84.71	6.50	7.02	9.29	7.60
Sucrose 6%	106.50	98.67	89.05	71.02	62.06	85.46	5.72	6.89	7.67	6.76
Control	106.80	73.05	65.08	0.00	0.00	48.99	6.29	7.24	8.87	7.47
Mean	106.46	92.32	82.13	83.24	46.76	-	6.25	7.03	8.68	-

	SEm±	CD at 5%	CD at 1%		SEm±	CD at 5%	CD at 1%
Days (D)	0.052	0.149	0.153	Days (D)	0.602	1.720	1.766
Treatment (T)	0.047	0.134	0.137	Treatment (T)	0.538	1.539	1.579
D x T	0.104	0.299	0.307	D x T	1.204	3.441	3.532

different minerals was found significant. It was observed that application of $AgNO_3$ resulted in maximum transpiration loss upto eighth day but same has resulted in drastic reduction in transpiration loss on tenth day. The data on mean transpiration loss during the vase life period of Gerbera showed that application of sucrose 6% has significantly increased the transpiration losses compared to other treatments. The control has recorded least value of transpiration loss.

The data on fresh weight per cent from the Table 3 revealed that the fresh weight percent in all treatments was drastically reduced with extended post harvest life. This was more pronounced in control. Application of $AgNO_3$ at 20ppm has recorded maximum fresh weight percent on all dates of sample weighing compared to other treatments. The same was observed with mean data also. Application of AgNO3 at 20ppm concentration maintained maximum anthocyanin content. It also recorded maximum mean anthocyanin content compared to the other treatments. Anthocyanin contents of Sucrose 6% solution and NAA 150ppm + Sucrose 2% were found at par. Control treatment has recorded least values. Halevy and Mayak (1979) suggested that improvement of flower quality and vase life period with $AgNO_3$ sucrose pulsing might be due to its influence by delaying degradation of proteins, stabilizing the Anthocyanin content.

From the above studies, it is concluded that post harvest application of $AgNO_3$ enhances the post harvest life of Gerbera cut flower and therefore it can be recommended at 20 ppm concentration.

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Vermi-composting of crop, weed residues and cattle dung with *Eisenia Foetida*

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Abstract

An experiment on vermin-composting with Eisenia foetida *of maize and thatch grass residues mixed with cattle dung in a 70-day composting experiment was conducted at research farm of ICAR, Nagaland Centre during 2007-08. An increase in mineral N and reduction in C:N ratio were resulted after 70 days of composting under vermi composting, over treatments uninoculated with earthworms. Dehydrogenase assay was done for study of microbial activity, and it increased up to 52 days and reduced on additional incubation. More total N was observed in the compost prepared by earthworm inoculation. But, the differences were not significant. The nutrient composition of total P, K and Cu concentration did not vary in compost prepared with earthworm inoculation from the uninoculated treatments.*

Keywords: Earthworms; Crop residues; Cattle dung; Decomposition; *Eisenia foetida*, Vermi composting

Introduction

The soil fertility management in north eastern India has different dimension as the use of chemical fertilizer is least compare to other part of the country.Maintenance of soil fertility for sustained soil productivity requires organic manures, crop residues, green manures and other organic wastes in agriculture. The farm wastes like the crop residues and cattle dung are the organic wastes, available easily on farm and their proper disposal by recycling can supply plant nutrients and improve soil health and environmental quality (Westermana and Bicudob 2005). The process of vermin-composting is one technique of utilization of farm wastes to produce manure, rich in plant nutrients. The earthworms are well known for their contribution in improving soil fertility. Earthworms feed on organic matter, cattle dung and other farm wastes. The vermicompost is now promoted at farm level by use of earthworms to sustain soil fertility. Many workershave reported the beneficial effect of the vermicomposting of animal excreta, sewage sludge and agro-industrial wastes (Butt, 1993; Edwards, 1998). However, there is gap in information on the use of maize crop residues and thatch grass for the production of vermicompost. Generally the crop residues are poor in N and need to be mixed with other, N-rich, organic wastes in order to provide nutrients and an inoculum of microorganisms (Elvira et al., 1996). Keeping this in view the experiment was conducted to evaluate the role of earthworms in composting of crop residues mixed with cattle dung to find out the chemical changes and to determine the suitability of Eisenia foetida for vermicomposting.

Materials and Methods

Maize (*Zea mays*) and thatch grass (*Imperata cylindrical* L.) residues after dully chopped into small pieces and cattle dung were mixed. The crop residues were air dried before use. The crop and weed residues and cattle dung contained 55.0, 57% and 48.2 organic C and 0.35%, 0.30% and 0.70% total N on dry weight basis with C:N ratios of 80, 110 and 65.0, respectively. The culture of earthworms (Eisenia foetida) was obtained from the University of Agricultural Sciences, Bangalore, and was maintained on cattle dung. The raw material for vermin-composting consisted mixture of cattle dung and crop residues in a ratio is 1:1 on dry weight basis. In one treatment cattle dung alone was also taken for comparison. Ten kilograms of material (dry weight) was put in cemented pits (120´x120´x90 cm^3). Moisture was maintained to about 65% of water holding capacity. In the treatment with earthworms, 100 mature earthworms were introduced after 10 days of decomposition. Samples were drawn at 0, 15, 30, 60 and 90 days. The 0 day refers to time of initial mixing of the wastes before preliminary decomposition. The earthworms were removed manually and vermin-compost was analyzed for organic C, total N, mineral N and dehydrogenase activity (Casida *et al*., 1964). At 70 days total N, total P, total K, Zn and Cu were determined. For estimation of P, K, Zn and Cu 500 mg of dry compost was digested with 10 ml of diacid mixture (HNO_3:$HClO_4$ in ratio 4:1 v/v), volume of the digest was made to 50 ml after filtration through Whatman No.1 filter paper and analysed. All the

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determinations were carried out in triplicate. Data were analysed statistically and difference between treatment means were compared at the 5%.

Results and discussion

The mineralization of organic nitrogenous compounds over the period enhanced the mineral N of the compost (Table 1). Maximum mineral N was maximum at 70 days of composting and earthworm inoculated organic wastes had a somewhat higher mineral N than did the treatments without earthworms. The variation in the value of C:N ratio during composting are presented in Table 2. A decline in C:N ratio was observed over the time in all the

Table 1: Changes in mineral N (mg kg^{-1}) during composting of organic wastes

Treatments	Days			
	0	20	40	70
Cattle dung	87	102	145	184
CD+ earthworms	93	111	158	190
CD +maize stover	74	104	121	178
CD+MS+earth worms	79	113	139	192
CD+ thatch grass	70	100	119	168
CD+thatch grass+earthworms	81	108	130	172
CD at 5%	8.1	12.2	13.4	9.3

Table 2: Changes in C: N ratio of cro residues and cattle dung during vermicomposting

Treatments	Days			
	0	20	40	70
Cattle dung	72	58	43	24
CD+ earthworms	65	56	39	21
CD +maize stover	84	64	44	25
CD+MS+ earth worms	82	63	40	24
CD+ thatch grass	90	76	47	30
CD+thatch grass+earthworms	84	68	42	25
CD at 5%	2.3	2.4	2.0	2.1

treatments due to use of carbon by microbial population in the process of decomposition. The lower C:N ratios were recorded in all the treatments in the presence of earthworms. The C:N ratio of the treatment with thatch grass was greatest during initial phase of decomposition. The variation in C:N ratio of maize stover treatment at 70 days sampling in the absence as well as presence of earthworms were statistically non-significant. However, in the case of treatment with thatch grass residues or cattle dung alone, the C:N ratio at 70 days was significantly lower in the presence of earthworms than in their absence. The decomposition of the organic wastes by microbial action resulted in loss of organic C as CO_2 and total N increases as a result of carbon loss. N content of compost is dependent on the initial N present in the waste and the extent of decomposition (Gaur and Singh, 1995). Microbial populations in the intestine of worms and gut enzymes, as well as microflora present in the waste, are involved in decomposition (Kavian and Ghatnekar, 1991). Enhanced organic matter decomposition in the presence of earthworms has been reported, which results in lowering of C:N ratio (Edwards, 1998).

Table 3: Microbial activity in the form of dehydrogenase activity (µTPF /g/h) during vermin-composting of the raw material

Treatments	Days			
	0	20	40	70
Cattle dung	710	1150	1550	1570
CD+ earthworms	716	1180	1700	1770
CD +maize stover	702	670	1020	1050
CD+MS+earth worms	707	687	1110	1210
CD+ thatch grass	698	550	890	1000
CD+thatch grass+earthworms	702	610	1100	1200
CD at 5%	32	45	80	78

During the initial stages of composting, the dehydrogenase activity increased rapidly (Table 3) up to 40 days and the rate of increase was slow at 70 days sampling. The higher dehydrogenase activity was noticed in earthworm-inoculated treatments than in treatments without worms. An increase in microbial activity was observed at 20 days sampling which is directly related with the high dehydrogenase activity The dehydrogenase activity is dependent on the substrate availability (Jose et al., 1998), so the lower activity at 7-day sampling was probably due to exhaustion of easily metabolizable components of the wastes.

The composition of total N, P, K and zinc after 70 days composting has been sown in Table 4. There was more N in earth worm-inoculated vermin-compost than in compost without earthworms. However, the difference of nutrient composition of compost were not statistically Significant (P=0.05). Earth worms did not enfluenced the nutrient content in finally prepared compost, but , statistically significant difference was observed in Zn in compost prepared from cattle dung with earthworms than in compost without earthworms.The nutrient contents of vermicomposts varied greatly depending on the raw material. There are ambiguous reports regarding plant nutrient content of vermicompost compared to composts prepared without earthworms. Some workers have reported higher content of N, P, K and micronutrients in vermicompost (Jambhekar, 1992; Delgado et al., 1995).

Table 4: Nutrient composition of compost and vermicopost after 70 days of decomposition of oraganic wastes

Treatments	Total N (%)	Total P (%)	Total K (%)	Total Zn (mg/kg)
Cattle dung	1.20	0.72	1.25	270
CD+ earthworms	1.36	0.70	1.27	298
CD +maize stover	1.1	0.51	1.25	210
CD+MS+earth worms	1.16	0.47	1.28	230
CD+ thatch grass	0.9	0.40	1.6	201
CD+thatch grass+earthworms	1.1	0.38	1.67	210
CD at 5%	0.19	0.04	0.20	27

On the other hand the nutrient contents of the vermicompost and ordinary compost have been found to be similar (Talashilkar et al., 1999). Norgrovea and Hauserb 2000 reported that earthworm communities even adjust to lower soil nutrient concentrations by increasing their selectivity and thus produce relatively higher quality casts on poorer soil.

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Effect of irrigation and integrated nutrient management on productivity, monetary return, sustainability value index and water use efficiency of cluster bean (*Cyamopsis teragonoloba*)- Wheat (*Triticum aestivum*) cropping system under North-Western canal command area of Rajasthan

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Abstract

*A field experiment was carried out during 2002-03, 2003-04 and 2004-05 to study the effect of irrigation and integrated nutrient management on wheat in cluster bean (*Cyamopsis tetragonloba *L. Taubert)- wheat (*Triticum aestivum *L. emend. Flori & Paol.) cropping systems. Clusterbean grain yield was not affected by residual effect of nutrients and irrigation applied to wheat. Higher irrigation frequency of IW/CPE ratio 1.0 recorded significantly higher seed yield (45.09 q/ha), net return (Rs. 27,100/ha), sustainable value index (80.2%), and benefit: cost ratio (1.80) of wheat. However, highest water use efficiency (39.6 kg/ha mm) was recorded at IW/CPE ratio 0.8. Significantly higher wheat yield of 42.51 q/ha was recorded in cluster bean (green manure)- wheat cropping system as compared to cluster bean (grain)- wheat cropping system. The same cropping system also gave higher sustainable value index (49.7%). However, cluster bean (grain)- wheat recorded higher monetary return (Rs. 31,677/ha), benefit:cost ratio (2.11) and water use efficiency (47.5 kg/ha mm). Residual effect of nutrients to wheat did not influence the yield of cluster bean. Highest wheat yield (43.00) was obtained with 120 kg nitrogen/ha (30 kg N from FYM and 90 kg from fertilizer). However, 90 and 120 kg N/ha in different ratios of FYM and fertilizer gave at par yield. Monetary returns of Rs. 26,406 to 26,701/ ha were obtained at 120 kg N/ha in different combinations of FYM and fertilizer. Higher sustainable value index (73.2 to 79.8), benefit:cost ratio (1.73 to 1.77) and water use efficiency were also recorded with 120 kg N/ha from different sources of FYM and fertilizer (0:120, 60:60 and 30:90). Cluster bean (green manure)- wheat cropping system gave higher organic matter content of soil (0.32%) against cluster bean-wheat (0.28%) cropping system. Irrigation and nutrient management did not influence organic carbon content of soil much.*

Key words: Cropping system, Integrated nutrient management, Monetary return, Sustainable value index, Water use efficiency

Introduction

Canal closure in summer season i.e., in sowing time of cotton has come out to be a common feature in Indira Gandhi Canal Command areas of north-western Rajasthan in recent past. Thus scarcity of water in May and June is replacing cotton with drought hardy leguminous crop cluster bean used for feed, fodder, vegetable, green manuring and gum production from cotton-wheat cropping system. As a result cluster bean-wheat (*Cyamopsis tetragonoloba* L.- *Triticum aestivum* L.) cropping system is being practiced extensively in canal command areas of north-western Rajasthan. General consciousness about soil health in terms of deteriorating organic matter content of soil has come out to be a major cause for yield plateau and lower fertilizer use efficiency. Present situation of low organic matter content of soil and fertilizer use efficiency need to be addressed by utilizing process and practices like green manuring and use of farmyard manure (Tiwari *et al.* 2004). Increasing demand for water in industry and domestic purposes has reduced the availability of water for agriculture sector particularly in water scarce state like Rajasthan. Thus, in the changed cropping system and lower organic matter content of the soil with limited irrigation water, present investigation was conducted to study the irrigation and integrated nutrient management in cluster bean-wheat cropping system for higher productivity,

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economic return and optimum use of irrigation water as well as maintenance of soil health.

Materials and Methods

The experiment was conducted for consecutive 3 years of 2002-03, 2003-04 and 2004-05 at Agricultural Research Station, Sriganganagar, Rajasthan. The soil was sandy loam in texture having pH (1:2) 8.25, electrical conductivity (1:2) 0.21, field capacity 19.8%, permanent wilting point 7.2%, bulk density 1.48 g/cc, organic carbon 0.28% available P_2O_5 32 and K_2O 330 kg/ha. The treatments comprising of 3 irrigation levels viz., IW/CPE ratio of 1.0, 0.8 and 0.6 to wheat and 2 cropping systems viz. cluster bean (green manuring)- wheat and cluster bean (for grain)-wheat were assigned to main-plots. Integrated nutrient management viz. treatment to wheat:recommended dose of N and P_2O_5 through fertilizer (120:40:0), 60 kg N/ha through farmyard manure + 60 kg N/ha through fertilizer, 30 kg N/ha through FYM + 60 kg N/ha through fertilizer and 30 kg N/ha through FYM + 30 kg N/ha through fertilizer were assigned to sub-plots. The experiment was analysed in factorial split-plot design and replicated thrice. Cluster bean (RGC 936) was sown on 22, 13 and 12th July in 2002, 2003 and 2004 respectively using seed rate of 16 kg/ha in 30 cm x 15 cm spacing. The corresponding harvesting dates for cluster bean for grain were 24, 6 and 9th October. Cluster bean for green manuring was incorporated in the soil at 50-55 days after sowing. One pre-sowing irrigation of 100 mm and 2 common irrigations, and nitrogen (20 kg/ha) and phosphorus (40 kg/ha) were applied to cluster bean for both grain and green manuring purpose. Wheat (Raj 1482) was sown on 27, 7th November and 4th December in 2002-03, 2003-04 and 2004-05 respectively using 100 kg/ha seed at 22.5 cm x 5 cm spacing. The corresponding harvest dates were 21, 7 and 9th April. One pre-sowing irrigation of 100 mm was applied for proper land preparation and germination of crop. A common irrigation of 60 mm was applied at crown root initiation stage. Thereafter, post sowing irrigation of 60 mm each was applied as per treatment. Farmyard manure (0.40:0.15:0.35) was applied during land preparation as per treatment. Full dose of phosphorus and half dose of nitrogen was drilled at the time of sowing and rest nitrogen was top dressed at first irrigation. Treatments consisting of FYM were supplemented with fertilizer phosphorus to get 40 kg P_2O_5/ha i.e., recommended levels. Cluster bean received rainfall of 36.4, 208.9 and 42.8 mm in 2002, 2003 and 2004 respectively. The corresponding pan evaporation values are 506.9, 369.3 and 549.1 mm. Similarly, wheat received rainfall of 69.4, 19.9 and 297.4 mm in 2002-03, 2003-04 and 2004-05 respectively and corresponding pan evaporation values were 417.9, 416.4 and 297.4 mm. Sustainability index was calculated as per Singh *et al.* 1990.

Results and Discussion

Irrigation to wheat

Irrigation had marked effect on wheat yield and yield attributes (Table 1). Increased irrigation frequency from IW/CPE ratio 0.6 to 1.0 increased grain yield of wheat significantly and the highest grain yield of 45.09 q/ha was recorded at IW/CPE ratio 1.0 followed by

Table 1: Effect of irrigation and integrated nutrient management on yields, net return, sustainable value index and water use efficiency (WUE) of cluster bean-wheat cropping system (pooled of 3 years)

Treatment	Cluster bean grain yield (q/ha)	Wheat grain yield (q/ha)	Net return (Rs./ha)	Sustainable value index (%)	B:C ratio	[1]Water use (mm)	Water use efficiency (Kg/ha mm)
Irrigation levels (IW/CPE ratio) to wheat							
1.0 (3.3)[2]	3.67	45.09	27100	80.2	1.80	707.5	37.8
0.8 (2.7)	3.56	41.99	26326	68.3	1.78	664.5	39.6
0.6 (2.3)	3.28	39.33	16673	69.7	1.61	644.5	36.8
CD (P=0.05)	NS	1.76	1765				
Cropping systems							
Clusterbean (GM)[3]-wheat	-	42.51	19725	49.7	1.30	671.2	29.1
Clusterbean (grain)-wheat	6.12	40.65	31677	42.5	2.11	671.2	47.5
CD (P=0.05)	0.69	1.37	NS				
Integrated nutrient management (Nitrogen in Kg/ha through FYM and fertilizer)							
120 (0:120)[4]	3.50	42.30	26437	79.8	1.77	671.2	39.4
120 (60:60)	3.61	42.86	26701	78.6	1.73	671.2	39.8
120 (30:90)	3.44	43.00	26406	73.2	1.75	671.2	39.4
90 (30:60)	3.45	40.68	24809	70.0	1.67	671.2	36.9
60 (30:30)	3.49	39.40	24174	62.0	1.65	671.2	35.9
CD (P= 0.05)	NS	2.40	NS				

[1]Includes rainfall and pre-sowing irrigation; [2]Data in parenthesis indicates number of irrigation applied to wheat; [3]GM, green manuring; [4]Data in parenthesis shown the ratio of FYM and fertilizer

Table 2: Effect of irrigation and nutrient management on yield components of wheat and organic matter added to the cropping system through green manuring + crop stubble and organic carbon content at the end of cropping sequence (pooled of 3 years)

Treatment	Plant height (cm)	Effective tillers/ m length	Ear length (cm)	Test weight (g)	Organic matter added (q/ha)	Organic carbon(%)
Irrigation level (IW/CPE ratio) to wheat						
1.0	97.3	91.3	9.6	36.21	61.9	0.31
0.8	96.6	88.7	9.3	35.46	60.5	0.31
0.6	96.8	89.3	9.8	34.89	59.8	0.30
CD (P=0.05)	NS	1.5	NS	1.2		
Cropping system						
Clusterbean (GM)[1]-wheat	99.5	89.4	9.9	35.22	96.3	0.32
Clusterbean (grain)-wheat	96.3	88.9	9.8	35.84	25.2	0.28
CD (P=0.05)	NS	NS	NS			
Integrated nutrient management (Nitrogen in Kg/ha through FYM and fertilizer)						
120 (0:120)	97.0	90.7	9.9	35.72	61.6	0.30
120 (60:60)	97.9	90.3	10.0	35.18	64.3	0.32
120 (60:90)	97.4	90.8	9.9	35.29	62.9	0.32
90 (30:60)	97.5	88.1	9.8	37.01	56.9	0.30
60 (30:30)	96.4	89.7	9.8	35.70	55.9	0.29
CD (P=0.05)	NS	1.6	NS	1.10		

[1]GM, Green manuring

IW/CPE ratio 0.8 (41.99 q/ha). Higher yield in IW/CPE ratio 1.0 is attributed to higher yield components viz. effective tillers/m length (91.3), ear length (9.6 cm) and test weight (36.21 g) (Table 2). It is in conformity with Singh *et al.* 2003. The yield benefit with higher irrigation frequency might be due to more mineralization of nutrients, transpiration, root growth due to reduction in mechanical resistance of soil and ultimately higher metabolic activities in plant which enhanced photosynthesis rate and transportation of photosynthet from source to sink (Bhunia *et al.* 2006). Irrigation levels to wheat could not influenced yield of cluster bean. Net return from cluster bean-wheat cropping system was influenced by irrigation frequency. At irrigation frequency of IW/CPE ratio 1.0 higher net return of Rs. 27,100/ha was recorded and that was at par with IW/CPE ratio 0.8 (Rs. 26,326/ha) but significantly superior to IW/CPE ratio 0.6 (Rs. 16,673/ha). Sustainability value index (SVI) showed increasing trend with increase in irrigation frequency and the highest SVI of 80.2% was recorded at IW/CPE ratio 1.0 followed by IW/CPE ratios of 0.6 (69.7%) and 0.8 (68.3%). This is attributed to higher consistent net returns over years with higher irrigation frequency. Similarly, higher benefit:cost ratio (1.80) was obtained at IW/CPE ratio 1.0 followed by 0.8 (1.78) and 0.6 (1.61). However, highest water use efficiency of 39.6 kg/ha mm was recorded at IW/CPE ratio 0.8 and further increase or decrease in irrigation frequency recorded lower water use efficiency.

Cropping systems

Wheat grown after green manuring with cluster bean gave significantly higher grain yield (42.51 q/ha) compared to wheat grown after cluster bean for grain. Shah *et al.* 2000 and Tiwari *et al.* 2004 also reported that green-manuring with dhaincha increased yield of wheat. This might be due to increase in organic matter in soils having poor organic carbon content. Addition of organic matter improve water holding capacity of soils as well as soil health through improving biological activities of the soil which in turn increase the availability of nutrients. However, higher net return of Rs. 31,677/ha and benefit:cost ratio of 2.11 were obtained with clusterbean (grain)-wheat cropping system. It is due to additional cluster bean grain yield of 6.12 q/ha added to the total production of the cropping system. Cluster bean (green manuring)-wheat cropping system gave the higher sustainability value index (49.7%) due to consistent higher yield of wheat ensured by addition of nitrogen rich organic matter through green manuring. Similarly, water use efficiency (47.5 kg/ha mm) was also higher in cluster bean (grain) wheat cropping system.

Integrated nutrient management

Integrated nutrient management markly influenced yield of wheat and significantly highest yield (43.0 q/ha) was obtained with 120 kg N/ha of which 30 N through FYM and 90 kg N through fertilizer. However, N levels of 30 (FYM) + 60 fertilizer kg/ha

(40.68 q/ha), 60 (FYM) + 60 (fertilizer) kg/ha (42.86 q/ha) and 120 (fertilizer) kg/ha (42.30 q/ha) gave at par grain yield. It indicates that higher yield of wheat can be achieved with recommended dose of nitrogen in combination of fertilizer and FYM. These results are in agreement with Deshveer *et al.* (2000) that partial substitution of inorganic N to the extent of 40% by FYM could be effective for enhancing yield of wheat. Higher nutrient level (120 kg N/ha) through fertilizer or fertilizer + FYM also increased yield components viz., effectively tillers and test weight (Table 2). It might be due to increased protolasmic constituents that accelerated the process of cell division and elongation which in term increased values of yield component with increased nitrogen levels. Similar findings were also reported by Auti *et al.* (1999) and Charijan and Gaikwad (2005).

The highest net return of Rs. 26,701/ha was obtained with 120 kg N/ha from fertilizer and FYM at 60:60 ratio. Similarly, 120 kg N through fertilizer only and, through FYM and fertilizer at 30:90 ratio gave monetary return of Rs. 26,437 and 26,406/ha respectively. However, 90 kg N (30:60) and 60 kg N (30:30) gave lower net return. The highest sustainability value index of 79.8% was recorded by 120 kg N through fertilizer followed by combination of FYM and fertilizer in 60:60 (78.6%), 30:90 (73.2%) ratio. Higher benefit:cost ratio (1.73 to 1.77) and water use efficiency (39.4 to 39.8 kg/ha mm) were also obtained with 120 kg nitrogen/ha through fertilizer or different combination of FYM and fertilizer (Table 1).

Addition of organic matter and organic carbon content of soil at the end of cropping system

Addition of organic matter through crop stubble and green manuring is presented (Table 2). Higher organic matter (61.9 q/ha) was added at IW/CPE ratio 1.0 closely followed by IW/CPE ratios 0.8 (60.5 q/ha) and 0.6 (59.8 q/ha) and thus organic carbon content increased to 0.30% to 0.31% in different irrigation treatments. Marked difference in organic matter addition and organic carbon content were observed in cropping system treatments. Clusterbean (green manuring)- wheat and cluster bean (grain)-wheat added 96.31 and 25.2 q/ha organic matter to the soil which resulted in organic carbon content of 0.28 and 0.31% respectively. Among the nitrogen levels 120 kg N/ha in different combinations added more organic matter (61.57 to 64.28 q/ha) to the soil than lower level of 90 and 60 kg N. As a result 120 kg N/ha in different combinations recorded higher organic carbon content of 0.30 to 0.32% in soils compared to lower nitrogen level (0.29 and 0.30%).

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Relative efficacy of different insecticide against mustard aphid under gird agro-climatic region of Madhya Pradesh

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Abstract

Eleven insecticides viz Quinalphos , Phosalone, Malathion, Monocrotophos , Oxydemeton methyl, Dimethoate, Phosphomidon , Verticillum lacanii, Deltamethrin , permethrin, Cypermethrin were applied on mustard crop (variety Varuna) grown in the field for the control of mustard aphid Lipaphis erysimi *kalt. Based on aphid mortality and increased yield of mustard oxydemetonmethyl was found most effective in suppressing aphid population and malathion was found least effective in all the tested insecticide. whereas, the phosphomidon was found quite effective in cost benefit ratio.*

Key words: Quinalphos, Phosalone, Malathion, Monocrotophos, Oxydemeton methyl, Dimethoate, Phosphomidon , Verticillum lacanii, Deltamethrin , Permethrin, Cypermethrin

Introduction

Rapeseed- mustard accounts for nearly 6 m ha acreage with a population of about 5.8 m tones of oilseeds in India (Katiyar *et. al*. 2005). Its national average productivity is quite low i.e. 903 kg/ha as against the potential yield of 2600-3000 kg/ha (Sharma, 2005). The production of rapeseed-mustard is low in India as compared to other countries because it is mainly grown in marginal lands under rain fed conditions, low and imbalanced use of fertilizer and of damage due to insect pests and disease (Bhaketia and Sekhon 1989). More than 43 species of insect pests infest rapeseed-mustard crops in India, which include about a dozen species as major pests (Purwar et. al. 2004). The mustard aphid, *Lipaphis erysimi* (Kalt.) is the key pest of rapeseed-mustard and damage the crop ranging from 9 to 96 % in different agro-climatic conditions of India (Singh and Sharma 2002). The pests cause severe damage to the crop in the absence of control measures. The losses in seed yield can be minimized by adopting chemical control measure. The unbridled use of insecticide often result in the development of resistance to insect to insecticide, residue problem, resurgence of secondary pest, effect of non target species including parasitoids, predators and insect pollinators (Smith 1970). To minimize these adverse effects it is imperative to use only need based insecticide. The judicious use of insecticide must be based on the population assessment of the insect pest. Therefore, the present study was undertaken to workout the relative efficacy of different insecticide for the control of *L. erysimi* on mustard.

Materials and Methods

Field experiment with mustard variety "Varuna" carried out at village of matabasaiya of Morena district. Elevan insecticide viz. Quinalphos (25 EC), Phosalone (35 EC), Malathion (50 EC), Monocrotophos (36 EC), Oxydemeton methyl (25 EC), Dimethoate (30 EC), Phosphomidon (85 EC), Verticillum lacanii (10 gram/liter) Deltamethrin (28 EC), permethrin (20 EC), Cypermethrin (25 EC), were applied with the help of manually operated knapsack sprayer. Untreated control (water spray) was also included. The population on mustard aphid was conducted on 10 plants apical twig each of 10 cm. length selected randomly from each plot. Pre and post treatment observation were recorded a day before and 1,3,7 and 15 day after the each spray. The grain yield was recorded separately for each treatment by excluding border rows at harvest. The data on aphid population count and grain yield were statistically analyzed. The economics of different insecticide was calculated to find out the cost: benefit ratio.

Results and Discussion

Pre treatment aphid population recorded a day before spraying did not differ significantly. It indicates uniform distribution in all the plots ranging from 28.5 to 36.8 aphid/10 cm twig length. Based on the population of mustard aphid 1, 3, 7 and 15 days after spraying of insecticide all the treatment were found significant superior to untreated control (Table 1)

First spray

The effectiveness of insecticide after 1 and 3 days spraying, cypermethrin (3.6 and 6.6 aphids) was

Table1: Effectiveness of insecticides against *Lipaphis erysimi*

Treatments	One day before	Average aphid population/10 cm twig length on different days after First spray				Second spray				Mean
		1	3	7	15	1	3	7	15	
Quinalphos	31.0(1.49)	8.0(0.95)	22.3(1.35)	40.3(1.60)	55.4(1.74)	7.7(0.92)	28.3(1.44)	29.0(1.45)	52.6(1.72)	30.6(1.40)
Phosalone	35.6(1.55)	9.7(1.02)	18.6(1.27)	32.7(1.40)	48.6(1.68)	11.0(1.07)	24.0(1.38)	32.1(1.50)	49.0(1.68)	29.0(1.40)
Malathion	34.7(1.54)	10.7(1.07)	32.3(1.51)	55.6(1.74)	72.3(1.86)	7.3(0.91)	29.3(1.45)	52.6(1.71)	64.6(1.81)	39.9(1.51)
Monocrotophos	32.3(1.51)	4.0(0.69)	9.4(0.93)	13.3(1.11)	35.7(1.55)	3.0(0.50)	11.6(1.01)	28.4(1.45)	25.4(1.40)	18.1(1.13)
Oxydemetonmethyl	39.1(1.59)	4.9(0.76)	7.3(0.85)	12.7(1.10)	32.7(1.51)	3.3(0.62)	6.3(0.79)	16.7(1.20)	24.0(1.38)	16.3(1.08)
Dimethoate	38.0(1.58)	5.0 (0.74)	8.6(0.90)	14.3(1.14)	32.6(1.51)	2.7(0.53)	10.7(0.96)	22.0(1.34)	26.7(1.42)	17.8(1.19)
Phosphomidon	37.5(1.57)	5.7(0.77)	7.3(0.80)	14.6(1.15)	24.3(1.38)	3.6(0.65)	10.6(1.00)	22.7(1.35)	26.6(1.42)	16.9(1.12)
V. Lacanii	32.9(1.52)	10.0 (1.03)	15.0(1.16)	28.4(1.44)	48.4(1.68)	8.4(0.96)	17.6(1.22)	27.3(1.42)	42.7(1.63)	25.6(1.34)
Deltamethrin	30.3(1.47)	4.3(0.71)	6.6(0.79)	10.7(1.00)	38.3(1.56)	6.0(0.83)	10.3(1.01)	33.0(1.52)	40.0(1.59)	19.9(1.16)
Permethrin	28.7(1.44)	6.4(0.86)	9.7(0.92)	11.3(1.05)	39.7(1.59)	5.3(0.78)	13.6(1.12)	29.0(1.45)	42.0(1.62)	20.6(1.20)
Cypermethrin	36.6(1.56)	3.6(0.61)	6.6(0.74)	13.3(1.11)	32.6(1.51)	7.0(0.86)	15.7(1.17)	27.3(1.42)	41.7(1.62)	20.4(1.17)
Control	38.0(1.57)	42.6(1.64)	64.1(1.80)	82.4(1.91)	123.0(2.09)	142.6(2.16)	182(2.26)	212.7(2.33)	160.6(2.20)	116.4(1.99)
SE (m) ±	0.043	0.082		0.059	0.038	0.096	0.106	0.059	0.036	0.040
CD at 5%	NS	0.242		0.174	0.112	0.282	0.311	0.174	0.106	0.110

Table2: Grain yield and economics of different treatments.

Treatments	Yield kg/ha	Additional yield over control	Additional profit (Rs/ha)	Net profit (Rs/ha)	Cost benefit ratio
Quinalphos	1540	565	5650	4250	1: 3.03
Phosalone	1462	487	4870	3420	1:2.35
Malathion	1290	315	3150	2350	1:2.93
Monocrotophos	1736	761	7610	6385	1:5.21
Oxydemetonmethyl	1852	877	8770	7590	1:6.43
Dimethoate	1740	765	7650	6520	1:5.76
Phosphomidon	1804	829	8290	7415	1:8.47
V. Lacanii	1710	735	7350	6050	1:4.65
Deltamethrin	1724	749	7490	6616	1:7.51
Permethrin	1714	739	7390	6565	1:7.95
Cypermethrin	1695	720	7200	6430	1:8.35
Control	975	-	-	-	-
SE (m) ±	12.32	-	-	-	-
CD at 5%	36.76	-	-	-	-

found highly effective and significant superior over malathion, v. lacnii phosalone, quinalphos and monocrotophos, but was at par with quinalphos. While 7 days after spraying decamethrin 10.7 aphids/10 cm twig length aphids proved significantly superior to malathion , quinalphos, phosalone and v. lacnii but was at par with rest of the treatment. After 15 days of spraying phosphomidon 24.3 aphids/10 cm twig length was found significant superior to rest of the treatments. Malathion was found least effective to control the aphid population followed by quinalphos.

Second spray

Similar observations were recorded after second spray. The effectiveness of insecticide after one day spraying. Dimethoate (2.7 aphids/10 cm twig length) was found most effective and significant superior to phosalone, V. lacanii, quinalphos malathion, cypermethrin and permethrin, but was at par with the rest of the treatments. After 3, 7 & 15 days after second spray the oxydemetonmethyl was found most effective and significant superior to malathion, phosalone, quinalphos and v. lacanii. Malathion was again found significantly less effective than all the tested insecticide.

The overall aphid population showed significantly superiority of insecticides treatment against control. Oxydemeton methyl, phosphomidon, dimethoate and monocrotophos were average 16.3 to 18.1 aphids/10cm

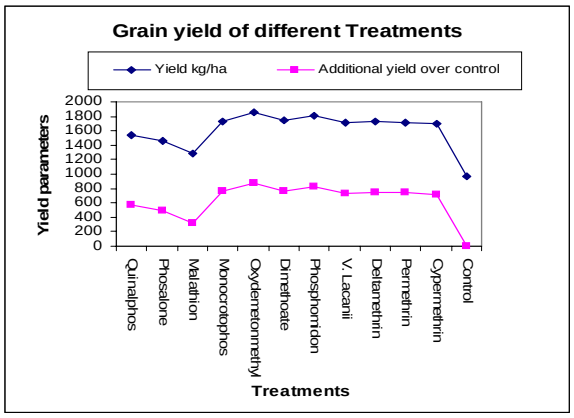

Fig.1. Grain yield of different treatments

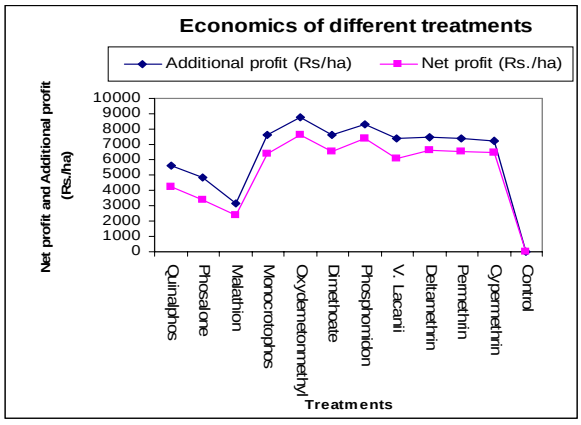

Fig. 2. Economics of different treatments

twig length proved to be significantly superior to malathion, quinalphos and phosalone. The effect of the aforesaid insecticide for mustard aphid control is in conformity with that reported by several workers (Thomas and Phadke 1995 , Dash et. al. 1996 and Sinha et. al. 1997).

Seed yield

On the basis of seed yield all the insecticide treatments were significantly superior to control (975.0 kg/ha). Maximum and significant higher seed yield (1852.0 kg/ha) was obtained with oxydemetonmethyl followed by phosphomidon, dimethoate and monocrotophos. Malathion proved least effective (1290.0 kg/ha) followed by phosalone and quinalphos (Table 2).

Economics

The economics of chemical control of mustard aphid revealed the highest net income in phosphomidon (Rs. 7615/ha) followed by oxydemetonmethyl (Rs 7590/ha). Malathion had minimum net return (Rs 2350/ ha) followed by phosalone and quinalphos. On the basis of cost benefit ratio phosphomidon was found more effective followed by cypermethrin.

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Combining Ability Analysis For Yield And Its Component Characters In Indian Mustard [*Brassica juncea* (L.) Czern and Coss]

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Abstract

A 10 x 10 diallel combining ability analysis showed that gca and sca variances were significant for all the characters except primary branches /plant and 1000 seed weight. The estimates of gca effect showed that parents differed regarding their general combing ability. The parent Kranti was best general combiner for seed yield and other component characters except days to maturity and no. of seeds/siliqua. Varuana was good general combiner for 1000 seed weight, no . of seeds/siliqua, days to flowering and days to maturity. In the expression of high sca effects, all the combination of parents viz. those with high x high, high x low and low x low gca effects were involved, showing predominance of non fixable genetic variance (Dominance).

Key words: Maturity, genetic variance, siliqua, seeds/siliqua, seeds/siliqua

Introduction

Oil seed crops play on important role in the Indian economy. There are various oleferous Brassica grown in India. Among them, Indian mustard [*B.Juncea* (L.) Czern and Coss] which is also known as rai laha or raya has gained importance due to its higher yield potential , more resistance to shattering and more tolerant to biotic and abiotic stresses.

The success in breeding depends mainly on the choice of superior parents for hybridization and the information on nature and magnitude of gene action combining ability of the parents and magnitude of exploitable heterosis. In the present investigation 45 F_1's of a 10x 10 diallel set were studied to obtain more information on combining ability.

Material and Methods

The present study is based on a diallel set of 10 genetically diverse parents viz. Pusa Bahar, Pusa Jaikishan, Pusa Bold, RH-30, Varuna, Kranti, BEC-144, BIO-YSR, BEC-286 and RC-781. The experiment was conducted during the year 2007-08 at Agricultural Research farm, R.B.S. College, Bichpuri, Agra. The 10 genetically diverse parents were grown during rabi 2007 and all possible crosses were made excluding reciprocals. All the 45 F_1s with their parents were grown during rabi 2008 in randomized block design (RBD) with three replication. Each replication consisted of 4 rows of 3 mt. length accommodating 20 plants per row and row to row distance was 50 cm. To maintain proper spacing thining was done at three week old stage. The recommended cultural practices were followed to raise a good crop. The data were recorded on yield and yield contributing characters on 10 randomly selected competitive plants. The statistical analysis was carried out according to Panse and Sukhatme (1961) and combining ability analysis were carried out by using model 1, method 2 of Griffing (1956).

Results and Discussion

The analysis of variance for combining ability (Table 1) revealed that gca and sca variances were significant for most of the characters. However, variances due to gca for primary branches/plant and 1000 seed weight and variance due to sca for 1000 seed weight was not significant.

The estimates of gca variances were higher than those of sca variances for days to 50% flowering , days to maturity, no. of secondary branches/plant, no. of seeds/ siliqua, 1000 seed weight and seed yield/ plant indicating the preponderance of additive gene action for these traits. However, the sca variances found higher than gca variances for plant height and no. of primary branches/plant indicating the presence of non additive gene action. Similar findings were also reported by Singh (2007) and Lohia (2008) in Indian mustard.

The estimates of gca effects (Table 2) indicated that the parents differed regarding their combining ability. Two parents viz. Varuna and Kranti were good general combiner for majority of traits. The per se performance of superior combining parents was generally high. The parents were also compared on the basis of per se performance and gca effects. It was observed that, for all the traits under study parents were same under both comparisons, however positions occupied by them were different.

The estimates of sca effects are presented in Table 3. The sca effect of crosses for different characters have been grouped in three categories i.e. those involving parents with high x high, high x low

Table 1: ANOVA for combining ability analysis for 8 characters in mustard

Sources of variation	d.f.	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of primary branches /plant	No. of secondary branches /plant	No. of seeds/ siliqua	1000 seed wt (g)	Seed yield/ plant (g)
GCA	9	4.709**	67.099**	33.910	1.124	10.411**	3.589**	1.128	4.812**
SCA	44	4.449**	40.288**	78.253**	1.992**	5.836**	2.124*	0.595	4.059**
Error	108	1.697	6.262	7.976	0.144	0.236	0.135	0.037	0.501

Table 2: Best parent selected on the basis of per se performance and gca effect

Characters	Per se performance	Gea effect
1. Days to 50% flowering	Varuna**	Varuna**
	Pusa bahar	Pusa jaikisan
	RH-30	Kranti
2. Days to maturity	Pusa bold**	Pusa bold**
	RH30	Pusa bahar
	Varuna**	Varuna**
3. Plant height	Pusa bold	RH-30*
	Pusa bahar	BEC-286
	RH-30*	Bio-YSR
4. No. of primary branchs	RH-30**	RH-30**
	BEC-144	Pusa jaikikisan
	Kranti**	Kranti**
5. No. of secondary branches	Kranti	Pusa bahar*
	Pusa bahar*	RH-130
	Pusa jaikisan**	Pusa jaikisan**
6. No. of seeds/siliqua	BEC-286*	Varuna*
	RH-30**	BEC-286*
	Varuna*	RH-30*
7. 1000 seed weight (g)	Pusa bold	Kranti*
	Kranti*	Varuna
	RH-30	RC-781
8. Seed yield/plant (g)	RC-781**	RC-781**
	Pusa bold**	Pusa bold**
	Kranti**	Kranti**

** Parents occupying the same position * Parent occupying the different position

and low x low. Generally, high sca effects could not be exploited fully in the improvement of autogamous crop except in cases where commercial production of hybrid varieties is feasible. However, if the cross showing high sca effects involve both parents which are good general combiners, those could be exploited for recovering superior transgressive segregants either by selection in large segregating population or by intermitting the desirable segregants within the population.

The cross combinations showing high sca effects for different character were different. It was also noted that crosses with high sca effects also had high per se performance. in order to confirm whether the crosses selected on the basis of sca effects were really the best performing crosses, the best crosses were selected firstly on the basis of per se performance and secondly on the basis of sca effects.

It is evident from Table 3 that most of the crosses were common in both the comparison. Some of the occupied the same position on the basis of both comparisons whereas it was different for others. This suggested that crosses with high sca effects also had high per se performance.

It was also evident from this comparison that best crosses involved low (L) and high (H) general combiners. Best general crosses were involved only in few crosses but not in all superior crosses. Only seven crosses viz. Pusa Jaikishan X Kranti and Varuan X Kranti for days to 50% flowering, Pusa Jaikishan X RH -30 for number of primary branches and secondary branches/Plant, Pusa Bahar X Pusa Bold for number of seeds /siliqua, Pusa Jaikishan X Varuna for 1000 seed weight and RH -30 X BEC-286 for seed yield / plant involved high x high general combiners while other have involved low x low or high x low general combiners. This indicted that gca in general had no bearing on the sca effects of the crosses. Similar findings were also reported by Yadav et al. (1974)

Table 3: Best five crosses selected on the basis of se performance and gea effect

Characters	Per se performance	Gea effect
1. Days to 50% flowering	Varuna x BEC-144	Pusa bahar x RH-30 (LxH)
	VarunaxRC-781*	Pusa jaikisan x Kranti (HxH)
	Pusa jaikisan x BEC-286	Varuna x Kranti (HxH)
	BEC-144 x BEC-286	Varuna x BEC-144 (LxH)
	Pusa jaikisan x BIO-YSR	Varuna x RC-781* (HxL)
2. Days to maturity	Pusa bahar x Pusa bold	Pusa jaikisan x BEC-286* (LxL)
	Pusa bahar x Varuna	Pusa jaikisan x RC-781 (LxL)
	Pusa bahar x RH-30	Pusa jaikisan x Kranti (LxH)
	Pusa jaikisan x Pusa bold	BIO-YSR x BEC-286 (LxL)
	Pusa jaikisan x BEC-286*	BEC-144 x RC-781 (LxL)
3. Plant height	Pusa bold x BEC-286**	Pusa bold x BEC-286** (HxL)
	RH-30 x BIO-YSR	Pusa bahar x BIO-YSR (LxH)
	Pusa jaikisan x Varuna**	Pusa jaikisan x Varuna** (LxL)
	Pusa jaikisan x BEC-286**	Varuna x BEC-144* (LxH)
	Varuna x BEC-144	Pusa jaikisan x BEC-286* (LxH)
4. No. of primary branchs	Pusa jaikisan x RH-30*	Pusa bold x BIO-YSR (LxL)
	Kranti x RC-781	Pusa bold x BEC-286 (LxL)
	Pusa bold x RH-30	Pusa jaikisan x BEC-286* (HxL)
	Pusa jaikisan x BEC-286	Pusa bahar x Kranti (LxH)
	BEC-144 xBIO-YSR	Pusa jaikisan x RH-30* (HxH)
5. No. of secondary branches	Pusa bahar x Varuna*	Varuna x BEC-144(LxL)
	Kranti x RC-781	Pusa jaikisan x BIO-YSR (HxL)
	Pusa bahar x Pusa bold	RH-30 x BEC-286 (HxL)
	Varuna x BEC-144	Pusa bahar x Varuna* (HxL)
	Pusa bold x RH 30	Pusa jaikisan x RH-30* (HxH)
6. No. of seeds/siliqua	Pusa bahar x Pusa bold**	Pusa bahar x Pusa bold** (HxH)
	Pusa jaikisan x RH-30	RH-30 x BEC-144 (HxL)
	Pusa jaikisan x Varuna	BEC-144 x RC 781 (LxL)
	Varuna x Kranti	Pusa bahar x RC-781 (HxL)
	Pusa jaikisan x RC-781	BIO-YSR x RC-781 (LxL)
7. 1000 seed weight (g)	Pusa jaikisan x Kranti	BIO-YSR x BEC-286 (LxL)
	Pusa jaikisan x Varuna*	Pusa bahar x Pusa bold* (HxL)
	Pusa bahar x Pusa bold*	Pusa jaikisan x Varuna* (HxH)
	Varuna x Kranti	BEC-144 x RC-781(LxH)
	Pusa jaikisan x RH-30	BEC-144 x BEC-286 (LxL)
8. Seed yield/plant (g)	Kranti x BEC-144*	RH-30 x Varuna* (HxL)
	RH-30 x Varuna*	Kranti x BEC-144* (HxL)
	Pusa bold x BEC-286	Pusa bold x BEC-144* (HxL)
	Pusa bold x BEC-144*	Pusa bahar x Pusa jaikisan (LxL)
	RH-30 x BEC-286**	RH-30 x BEC-286** (HxH)

** Parents occupying the same position * Parent occupying the different position

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Impact of Integrated Fish Farming for Improving Socio-Economic Status of Rural Fish Farmers of Eastern Uttar Pradesh

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Abstract

The fish farmers of the district Mau are socio-economically weak, in spite of having large number of water bodies and practicing composite fish culture involving high input cost. In integrating the fish culture with livestock where excreta of the livestock are efficiently utilized in manuring the pond and production of natural fish feed-plankton's, thereby reducing the production cost of the fish. Keeping these facts, a front line demonstration programme was launched by Krishi Vigyan Kendra, Mau at the fish farmer's ponds involving 5-10 fish farmers per year since 1995 integrating the fish culture with dairy/poultry/ducks/pigs systems. The study revealed that in fish-cum-duck demonstration the cost of fish production is much lower than the conventional system. The expenditure on feed for the ducks can also be reduced since they utilize natural food available in the pond. Though, the production cost of integrating fish culture with pig farming is lower than the other integrating systems, Fish-Pig integration is not found suitable due to social customs and popular in restricted communities. Thus, the integration of fish culture with livestock has been found to improve the socio-economic condition of the rural fish farmers.

Key words: Integrating, production, socio-economic, farming

Introduction

District Mau, a heartland of the Eastern Uttar Pradesh has got a sizeable area of Water resources in the form of village ponds-1827 nos. covering an area of 883.5 ha., five number of lakes with 405 ha. Area, canals-391 Km., river Ghaghra and Tauns. As regards fish farming communities there exist a total of 5700 families with a population of 45,720 people (Department of Fisheries personal communication). These farming communities belong to socio-economically weak sections of the society, in addition some progressive farmers have also come up to practice fish culture operations along with crop production and animal husbandry. In spite of having a large number of water bodies the level of fish production of the district is very low. This low yield may be due to less use of high cost input in the ponds and poor level of technical know-how.

The spiraling costs of protein fish feed and fertilizers have necessitated the use of animal manure's as partial or complete substitutes in integrating fish culture with animal husbandry, agriculture and allied farming systems. The demand for land, water, feeds and fertilizers is affecting further expansion of aquaculture (Devaraj, 1987), Integration of fish culture with agriculture and/or animal husbandry is economically and environmentally sound since most of the waste products can be efficiently reused within the system discarding little or no product on earth's biosphere. The waste products from agriculture and/ or animal husbandry supply cheap feed materials and organic manures for fish farming. As a result the overall cost of fish production can be reduced and profit increased (Manissery & Basavraja, 1987)

In the present paper an attempt has been made to enumerate the result of demonstrations laid down at the fish farmer's pond on fish culture integrating with dairy/poultry/ ducks/pig farming systems under front line demonstration programme of ICAR and to suggest the viability of the model.

Materials and Methods

Front line demonstration

The front line demonstrations laid down at the fish farmer's pond integrating with dairy/poultry/duck/ pig during the period 1995-96 to 2003-04. While selecting the fish farmer for demonstrations their socio-economic condition was also taken into consideration. For the local check, farmers practice was taken as control. The details of fish culture operations with various integrations described in details are given below:

A) Fish Pond

For laying down demonstrations at the farmer's field the average pond area of 0.4 ha was selected. Each pond was cleared off unwanted small and

predatory fishes, parasites and disease causing microbes using bleaching powder @ 525 kg/ha (35ppm).

B) Selection of Fishes and Fish culture

A combination of Indian and exotic major carps i.e. *Catla, Rohu, Nain, Silver carp, Grass carp* and *common carp* were selected. The fish fingerlings were stocked at the rate of 10,000 per ha. in number used for culture purposes in the different integrating systems. Partial fish harvesting was done 3-4 lines in a years as & when fish attains weight above 700g.

Table 1: Details of Demonstration under taken during 1995-96 to 2003-04

Year	No. of demonstrations			
	Fish-cum dairy	Fish-cum Poultry	Fish-cum Duckery	Fish-cum Piggery
1995-96	5	-	-	-
1996-97	4	-	-	1
1998-99	4	-	1	-
2000-01	3	1	-	1
2001-02	3	1	1	-
2002-03	8	1	1	-
2003-04	10	-	-	-
Total	37	3	3	2

C) Fish culture-cum-Dairy

A number of three Murrah breed of buffaloes were selected for milk production and getting cattle dung, as they were well suited near the pond and less susceptible to climatic conditions and diseases. A low cost cattle shed was constructed to accommodate three number of buffaloes. Green fodder was cultivated near the pond embankment. Buffaloes were fed with a ration containing concentrate, wheat straw and green fodder as per recommendation of balance ration. Buffaloes were allowed to take bath in the ponds. The raw cattle dung and washing of the shed was used in the pond for fertilization. The milk produced was sold daily. Fish culture operations were done as usual without using chemical fertilizer and supplementary feeding.

D) Fish cum poultry

Broiler strains of poultry birds for meat purposes which attain marketable size in 6-weeks were selected for rearing. A flock of 250 birds were reared. A simple low cost chicken shade of capacity 250 birds providing 0.25 sq.mt. living space for each bird was constructed at/or near the pond embankment. These birds were fed with specially formulated feed at the rate of 80-100g/day and also provided drinking water in troughs. Each bird was vaccinated against the diseases. The litter at the rate of approximately 60kg/ ha/day was put in the fish pond for production of natural planktons as feed. Six crop of broiler was undertaken in a year. The fish culture operations were done as usual but fertilization and supplementary feeding was not done except putting poultry litter having droppings. Chickens were sold after six weeks rearing regularly when they attained marketable size 1.25-1.50 kg. Fish culture operations were done as usual without using chemical fertilizer and supplementary feeding.

E) Fish cum Duck Farming

A local variety duck "Indian runner" was selected for farming which is a hardy and found to be most suitable with the egg-laying capacity 180-200 eggs in a year and attaining 2-2.5 kg. body weight in two years. A flock of 100 birds of two month old ducklings was reared. Necessary prophylactic medicines were provided to each duckling against the common diseases. A small low cost shelter-Thatched-house to accommodate 100 ducks was constructed on the pond embankment facing towards pond by using splits of bamboo or any other cheap wood. Each bird was provided 0.5sq.mt. living space for night shelter to avoid crowding. As regards the feed management during day time when they are in pond feed upon larvae of aquatic insects, tadpoles, mollusks, aquatic weeds which do not form the food of stocked fish. Apart from this for proper growth the supplementary feed, a mixture of poultry feed and good quality rice bran in the ratio of 1:2 @ 100g/bird/day was given in the morning and evening in the duck house in shallow plates. Duck house was washed regularly, kept dry maintained in proper hygienic condition using disinfectant. The ducklings were allowed to go into the pond when the fish fingerlings attain 10-15 cm size to avoid preying by the ducks. The ducks start laying after attaining the age of 24 weeks and continued to lay for two years. The ducks lay eggs only at the night. Some straw & hay was put in the corners of duck house for egg laying. Eggs were collected every morning after the ducks are let out of duck house. Eggs produced were sold regularly. Fish culture operations were done as usual without using chemical fertilizer and supplementary feeding.

F) Fish cum Pig farming

The exotic *land race* variety of pig was selected for farming as they have faster growth and least occurrence of diseases. A herd of two month old (wt. 15kg.) piglet in 12 numbers containing 11 female & one male was reared for providing pig castings to be used in pond as manure. A low cost Pig house (Pigsties) called pig pens was constructed in a single row of pens facing the pond near embankment with bomboo woods of 1.5m of height & the height of the walls separating the pigpens and surroundings the run was 1.0m. for healthy growth of pigs a living space of 1.5sqm/pig was provided. The feeding & water troughs

and the cemented drainage system towards the pond were also built.

Pigs are fed with balanced diet (Pig-mash) @1kg/Pig/day which contains 30% rice bran, 15% rice polish, 30% wheat bran, 10% maize bran, 10% groundnut cake, 1% common salt & 4% fishmeal. In addition to this feed green cattle fodder-berseem, napier, Kitchen refuge etc. with drinking water was also provided. The proper hygienic condition was also maintained. The pigs were regularly bathed. Pigsties were washed daily in morning hours to drain out whole excreta into the pond. Disinfectants were also used once in a week. The piglets were vaccinated against swine fever before keeping them for rearing. After attainment of marketable slaughter size (60-70kg.) within six months period pigs were sold. Two crops of pig was undertaken./ Fish culture operations were done as usual without using chemical fertilizer and supplementary feeding.

Results and Discussion

The results obtained in the front line demonstrations on Fish Culture integration with dairy/ poultry/duck/pig farming are encouraging. The results obtained are given below :

1. Fish cum dairy - Fish - 1400 kg. Milk -6600 kg
2. Fish cum poultry - Fish - 1800 kg. Chicken meat - 2250 kg
3. Fish cum duckery - Fish -1500 kg, Duck egg-10,400 nos. duck meat - 250 kg
4. Fish cum piggery - Fish -2400 kg, Pork meat- 1680 kg
5. Fish culture (control)- Fish -650 kg (Farmers practice)

In India, this system of fresh water fish culture has assumed greater significance presently in view of its potential role in recycling of organic wastes and integrated rural development (Sinha, 1981). Income, expenditure and net profit for 0.4 ha area of pond in certain integrating system has been shown in Table 2.

Out of 45 demonstrations 37 were on fish culture integration with dairy which is very popular, most acceptable in the farming Community (Table 1) Apart from providing raw dung for fertilizing fish pond for natural plankton production their presence in pond during taking bath have beneficial effect on fish health and growth. Adopting this system, farmers could get a production of 6600 kg milk and 1400 kg fish with a total income of Rs 1,28,559/-with a net profit of Rs 20,641/-. on expenditure of Rs 1,49,200.

Economic analysis of the fish culture integration with poultry farming revealed a good economic return with six crops of poultry in a year. In this system farmers could get 2250 kg. of poultry meat; 1800 kg fish with an average income of Rs. 1,91,250/- and net profit of Rs. 61,683 on the expenditure of Rs. 1,29,567. Fish and poultry rearing is a compatible business and also provide ready-made fertilizer for fish pond. As fish & poultry are mutually familiar form of agriculture to the rural population, of which the production of fish now becomes only a sub component can contribute substantially towards the actual reduction in costs and the eventual success of the fish culture component (Das, 1981; Prinsloo et al, 1999; New, 1991 and Lightfoot et al 1993).

The fish cum duck farming system not only results in more economic benefit to the farmer but also the fish and ducks are benefited by their coexistence. During day time when ducks are in pond the water surface is disturbed while swimming causing dissolution of more oxygen in the water beneficial for good fish growth. The droppings of ducks and duck house washings act as substitute fish feed and pond fertilizer which account for 60 percent of the total input cost in fish culture (Jhingran and Sharma, 1980). The economic analysis of this farming system demonstrations conducted on 3 farmers pond envisaged that at low expenditure cost of Rs. 60,711. for 0.4 ha of fish pond and rearing of 100 ducks an income of Rs. 1,12,050/- with net profit of Rs. 51,339. could be obtained.

Fish cum pig farming system demonstrated at two fish farmer's pond revealed the high net return as pig castings and pig pens washings in the pond act as good fertilizer and feed for the most of the cultured fishes. In this system rearing of 12 piglets in two batches for six months in a year yielded 1,680 kg of

Table 2: Income, expenditure and net profit under fish culture integration with dairy, poultry, duckery, pig farming and fish farmers practice (for 0.4 ha pond area).

S.No.	Farming System	Income (Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
1.	Fish + dairy	1,49,200	1,28,559	20,641
2.	Fish + poultry	1,91,250	1,29,567	61,683
3.	Fish + duckery	1,12,050	60,711	51,339
4.	Fish + piggery	1,87,200	90,703	96,497
5.	Fish farmers practice	32,500	29,212	3,288

pork meat and 2,400 kg of fish with an expenditure of Rs. 90,143/- income of Rs 1, 83,200/- with net profit of Rs 97,057/- could be obtained which is one of the highest profit gained in comparison with other integrating system (Jhingran and Sharma, 1980).

In the farmer's practice which was taken as control it was found that there was low fish production with less economic return. It may be due to not eradicating weed and predatory fishes from the pond, avoiding proper use of manure except occasionally putting as smell quantity of rice bran in the pond as manure and fish feed. Economic analysis revealed that an income of Rs 32,500/- on expenditure of Rs 29,212/- with net profit of Rs 3,288/- was obtained. In comparison of expenses, it is evident clearly from the table -2 that income and net profit gained in fish culture integration with dairy, poultry, duckery and piggery over farmer's practice.

The demonstration on fish culture integration with dairy showed good impact among the rural people as cattle rearing for milk production for small family subsistence and for dairy purposes has long been practiced in the district. It is easier for the fish farmers to have a small pond and use the cattle excreta for fish production. On the other hand demonstrations on fish culture integration with poultry bird and duck farming could not have good impact in comparison to dairy. The reason behind it may be that rural fish farmers are more akin to backyard poultry and rearing 4-5 ducks for their family subsistence only and not on higher scale and to integrate with fish culture in spite of having rich nutrient in poultry and duck droppings there by reducing the production costs. Although some fish farmers have come up to adopt this system but it needs further awakening among the farmers.

The results of demonstrations laid down on the farmers pond integrating with pig farming had revealed high return but could not have much impact among the fish farmers. It may be attributed that pig farming is popular in restricted weaker rural community who traditionally rear pigs and are unable to have fish pond to integrate the system. It may be popularized among these people if they were given pond on lease and provided financial assistance and water resources. Another point may also be considered that the people consuming fish do not like to eat the fish produced by using pig castings as manure in the pond. It needs more awakening among the higher community to adopt this system.

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Response of durum wheat (*Triticum durum* Desf) to balanced nutrient application, herbicidal weed control and sowing methods

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Abstract

In a study conducted during 2003-04 and 2004-05, balanced nutrition with 50 kg S, 5 kg Zn and their combined application in addition to 120 kg N + 40 kg P_2O_5 +30 kg K_2O/ha significantly increased the number of effective tillers/m^2, grains/ear, grain weight/ear 1000 rain weight, grain, straw and biology yields over NPK alone in durum wheat. The highest yield was recorded under NPK+S+Zn fertilization which was significantly. Higher over rest of the nutrient combinations. Overall increase in grain yield was 14.06, 11.71 and 19.53% owing to NPK+S, NPK+Zn and NPK+S+Zn fertilization, respectively, over NPK alone. Application of S and Zn in conjugation with NPK significantly increased the N,P,K,S and Zn uptake by durum wheat crop. Herbicidal weed control through 2,4 – D 500g/ha. and metsulfuron methyl 4.0g/ha. POE reduced weed drymatter by 78.4 to 80.6 per cent. Weed control significantly increased the effective tillers/m^2, grains/ear and grain weight/ear. Both these herbicides gave significantly greater yields than the weed check and were at par with each other. Significant decrease in nutrient uptake by weeds and significantly increase by crop plants were also observed by herbicide application. Cross sowing resulted in significantly higher yield attributes, grain ,straw and biological yields than normal line sowing. The cross sowing recorded significantly lower nutrient depletion of weed and corresponding increase by crop by cross sowing.

Keywords : Durum wheat, Balanced nutrition, 2,4 –D, Metsulfuron methyl, Sowing method, Yield

Introduction

Durum wheat has good export potential because not many countries are producing good quality durum. In view of its importance in food industry for the preparation of pastes, sweet and savory dishes, vermicelli, suji and bati, etc. there is need to develop appropriate agro-technologies for improving productivity and quality of durums. With intensification of agriculture and improvement in productivity levels, the removal of secondary and micronutrients has gone up many times leading to multiple nutrient deficiencies beyond NPK scenario (Hegde and Sudhakara Babu, 2001). At least five essential nutrients (N, P, K, S and Zn) are already having wide spread practical importance (Fertilizer Association of India, 2000). Looking to all aspects of productivity, the concept of balanced nutrition need to be exploited, using all these five nutrients. Weeds cause enormous losses in production and productivity of all major crops. Uncontrolled presence of broad leaf weeds in wheat crop led to the reduction of grain yield to the tune of 7 – 50 per cent depending on their density (Kurchania *et al*,. 2000). Planting of wheat is considered to be of prime importance for proper distribution of plants over cultivated area, thereby better utilization of available soil and atmospheric resources. Manipulating plant geometry by cross sowing has conclusively proved for yield advantage of aestivum wheat. It needs to be exploited in durum also. Keeping the above consideration in view, the present experiment was conduct.

Materials and methods

A field experiment was conducted at Krishi Vigyan Kendra, Kota (Rajasthan) during *rabi* seasons of 2003 –04 and 2004 –05. The soil was clay loam in texture and slightly alkaline in reaction, medium in organic carbon (0.7%), available nitrogen (257.0kg/ha), phosphorus (15.8 kg/ha), high in potassium (470.0kg/ha), low in sulphur (8.1mg/kg soil) and zinc (0.17 mg/kg soil) with pH 7.9. The experiment was laid out in split plot design, comprising two sowing methods (normal line sowing at 23 cm and cross sowing at 23 x 23 cm), three weed control treatments (weedy check, 2,4 –D 500 g/ha and metsulfuron methyl 4.0g/ha 30 DAS) in main plots and four nutrient combinations NPK 120+40+30 kg/ha, NPK +S 50 kg/ha, NPK+Zn 5 kg/ha and NPK+S+Zn) in subplots and was replicated thrice. Durum wheat cv. HI-8498 was sown on 25th November and 2nd December 2003 and 2004, respectively. As per treatment total quantity of phosphorus, potassium, sulphur, zinc and half dose of nitrogen were drilled in furrows before sowing. The remaining half of nitrogen was top dressed at first irrigation applied at CRI stage. Urea, DAP, MOP, gypsum

and zinc oxide were used as sources of N,P,K,S and Zn, respectively. Herbicides were applied 30 days after sowing of wheat, as per treatments, with the help of a knapsack sprayer fitted with flat fan nozzle with a spray volume of 600 litre/ha. The crop was grown with all recommended package of practices except the treatments under investigation. The dominant weeds of the experimental site during both the years were *Anagallis arvensis, Chenopodium album, Chenopodium murale, Convolvulus arvensis, Cornopus didymus, Melilotus indica and Vicia hirsuta.*

Results and discussion

Effect of nutrient combinations

The data show that nutrient application to durum wheat, treatment failed to bring about significant variation in dry matter of weeds 50 and 75 DAS. The application of S, Zn, and S+ Zn in addition to NPK improved the yield attributing characters, grain, straw and biological yields compared to NPK alone. Increase of 7.2, 5.4 and 9.0% in number of effective tillers/m2, 5.8, 4.6 and 6.8% in grains/ear, 11.5, 8.8 and 12.38% in grain weight/ear and 5.1, 3.8 and 6.1% in 1000-grain weight was observed on pooled basis with NPK+S, NPK+Zn and NPK+S+Zn over NPK alone, respectively. However, maximum values of yield attributing characters were recorded with the application of NPK+S+Zn. Maximum grain, straw and biological yields were recorded with NPK+S+Zn, which were significantly higher over rest of the nutrient combinations. Overall, increase in grain yield was 14.0, 11.7 and 19.5% with application of NPK+S, NPK+Zn, and NPK+S+Zn. The harvest index was also significantly influenced by these nutrient combinations over NPK alone. The uptake of plant nutrients by weeds was not significantly influenced by combined application of 50.0kg Zn/ha in addition to recommended dose of NPK. IT has been well emphasized that balanced nutrition with NPK+S+Zn markedly improved overall growth of the crop by virtue of its impact on morphological and photosynthetic components along with accumulation of nutrients. This provides opportunity for availability of nutrients and metabolites for growth and development of reproductive structure (sink), which ultimately resulted in realization of higher productivity of individual plants. The results of present investigation indicating positive response of various yield parameter and yield of wheat to balanced nutrition corroborates finding of Ravankar, *et al*. (2003).

Effect of weed control

The data reveals that application of 2,4 –D and metsulfuron methyl brought about 78.3 and 80.5% reduction in weed biomass at 50 DAS and 83.2 and 85.0% at 75 DAS in comparison to weed check. However, the two herbicides were at par to each other. Yield attributes *viz*., effective tillers, grains/ear and grain weight/ear were increased significantly by different weed control treatments over the weedy check (Table 1). However, 1000 grain weight remained unaffected. Increased in effective tillers/m^2 was 7.4 and 8.8% in grains/ear 5.8 and 6.8% and in grain weight, it was 9.1 and 10.4%, respectively under 2,4 – D and metsulfuron methyl, over the weedy check. The application of 2,4 –D and metsulfuron methyl were statistically at par in respect of yield attributes. Similar results were obtained by Singh and Singh (2005). The lowest values of yield attributing characters were obtained under weedy check which were due to the fact that wheat plants in weedy check were under

Table 1: Effect of balanced nutrition, weed control and sowing methods on weed biomass, yield, yield attributes and net returns of durum wheat (pooled data of 2003-04 and 2004-05)

Treatments	Weed biomass (Kg/ha) 50DAS	75DAS	Effective tillers/m^2	Grains /ear	Grain weight /ear(g)	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)	Net retunes (Rs/ha)
Fertilization										
NPK	103.47	177.49	302.30	43.20	2.26	49.88	39.26	50.71	43.61	25013
NPK+S	103.44	180.50	324.16	45.73	2.52	52.45	44.78	55.23	44.73	29750
NPK+Zn	103.80	173.95	318.77	45.18	2.46	51.79	43.86	53.49	45.02	27453
NPK+S+Zn	105.88	177.21	329.66	46.16	2.54	52.95	46.93	57.87	44.75	30246
C.D.(P=0.05)	N.S.	N.S.	4.72	0.75	0.06	1.18	1.19	1.53	0.83	1014
Weed control										
Weedy check	221.79	404.17	302.35	43.67	2.30	51.34	40.68	51.47	44.10	25581
2,4-D	47.77	67.53	324.70	45.66	2.51	51.65	44.65	55.12	44.71	28875
Me6tsulfuron methyl	42.89	60.16	329.12	45.87	2.54	52.30	45.79	56.28	44.76	29891
C.D.(P=0.05)	18.56	28.84	8.22	1.00	0.06	N.S.	1.69	1.72	N.S.	1397
Sowing methods										
Line sowing	115.48	196.46	306.47	43.59	2.29	51.41	41.10	52.24	44.00	26157
Cross sowing	92.81	158.12	330.98	46.55	2.60	52.12	46.32	56.41	44.05	30074
C.D.(P=0.05)	15.15	23.55	6.71	0.81	0.05	N.S.	1.38	1.40	0.87	1141

Table 2: Effect of balanced nutrition, weed control and sowing methods on nutrient uptake by weeds & crop (pooled data of 2003-04 and 2004-05)

Treatments	Uptake by weeds					Uptake by crop				
	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)	S (Kg/ha)	Zn (g/ha)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)	S (Kg/ha)	Zn (g/ha)
Fertilization										
NPK	3.30	0.50	3.72	0.90	5.35	104.87	28.21	92.02	17.20	2185.11
NPK+S	3.29	0.50	3.67	0.91	5.36	126.80	32.39	113.30	22.05	2464.13
NPK+Zn	3.37	0.51	3.78	0.94	5.44	122.22	30.18	107.97	20.24	2765.83
NPK+S+Zn	3.30	0.50	3.68	0.92	5.26	134.26	33.42	121.70	23.62	3017.13
C.D.(P=0.05)	0.21	N.S.	N.S.	0.06	N.S.	3.46	0.75	3.38	0.52	61.67
Weed control										
Weedy check	8.69	1.32	9.69	2.43	14.08	109.37	28.41	99.30	18.90	2420.02
2,4-D	0.67	0.10	0.78	0.18	1.05	126.70	31.79	111.29	21.45	2672.20
Me6tsulfuron methyl	0.59	0.09	0.67	0.15	0.94	130.05	32.95	115.65	21.98	2731.93
C.D.(P=0.05)	0.56	0.09	0.75	0.14	1.07	4.89	1.29	3.38	0.71	77.04
Sowing methods										
Line sowing	3.82	0.58	4.29	1.05	6.22	115.01	29.17	102.51	19.65	2477.04
Cross sowing	2.81	0.42	3.13	0.78	4.49	129.07	32.93	114.98	21.91	2739.06
C.D.(P=0.05)	0.45	0.08	0.62	0.12	0.87	3.99	1.05	2.76	0.58	62.90

competitive stress for all resources. As yield is the resultant of yield attributes, maximum values of these parameters due to less crop weed competition in metsulfuron methyl treated plots resulted in the highest grain yield (Table 1) which was at par with that of 2,4 –D. Similar trend were also observed in respect of straw and biological yield. The increase in yield with these herbicides was due to significant reduction in density and dry matter of weeds which consequently resulted in the better expression of yield components and thus gave higher yield of wheat. The improvement in yield with these herbicides were also reported by Sardana et al. (2001) and Singh and Singh (2005). Harvest index was not affected by weed control treatments. Significant decrease in NPKS and Zn depletion by weeds were recorded with both the weed control treatments compared to weedy check. The minimum NPKS and Zn depletion were recorded with the application of metsulfuron methyl which was significantly lower than 2,4 –D (Table 2).

Effect of sowing methods

The cross sowing proved significantly superior to line sowing in reducing weed dry matter. Cross sowing recorded maximum number of effective tillers/ m^2 (330.98), number of grains/ear (46.55) and grain weight g/ear (2.60), which were significantly higher than normal line sowing (Table 1). However, 1000-grain weight was not affected significantly by sowing methods. Cross sowing resulted maximum grain (46.32 q ha^{-1}), straw a (56.41 q ha^{-1}) and biological yield (102.73 1 ha^{-1}) which were significantly higher over normal line sowing. The harvest index was also significantly higher over normal line sowing. The harvest index was also significantly increased by sowing methods over normal line sowing. Pandey an Kumar (2005) also reported the similar results. Higher yield under cross sowing was due to better crop canopy development which resulted in more efficient utilization of solar radiation and nutrients by the crop.

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Dietary Intake Pattern and Nutritional Status of Rural Households: Socio-economic evidences from Chhattisgarh

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Abstract

Food security essentially means that all people at all time have access to safe nutritious food to maintain health and active life. The need for food security arises primarily due to the fluctuation in food production and non-availability of sufficient food from domestics' sources. An attempt is made in the present study to examine the influence of socio-economic factors on dietary intake pattern as well as nutritional status in order to target groups for prioritizing and focusing efforts for improvement of nutritional status of rural population. Conducted in Raipur district of Chhattisgarh state, the study revealed that the food basket was dominated by cereals with a negligible portion of protein and energy being supplied by food of animal origin. Cereals supplied more than 75 per cent of proteins, carbohydrates, calories, phosphorus, thiamine and niacin, though they all were deficient from the recommended dietary allowance. The per capita consumption of fruits in the state was found to be much lower than the all India for both the farm and non-farm households. Diet diversification increased with increase in the farm size, monthly per capita expenditure and literacy level. Policies aimed at improving the nutritional status of rural population include intensifying the rural development programmes and promoting agro-based industries to increase purchasing power of rural population. Dairy enterprises need to be promoted on priority in order to diversify food basket and raising nutritional status of rural population while simultaneously raising income levels.

Key words: non-availability, domestics, consumption, population, diversify

Introduction

Food security essentially means that all people at all times have access to safe and nutritious food to maintain health and active life. Its need arises primarily due to the fluctuation in food production and non-availability of sufficient food from domestic source (Ram, 1996). Food being the foremost basic need gets the priority in the pattern of expenditure of people, especially the poor class. Access to food demands affordability, which depends upon the twin factors, namely income of people and price of the commodity. Slower growth in income than price would undermine the purchasing power, resulting inadequate access to food and nutrients consumption.

The introduction of Green Revolution has enabled India to achieve self-sufficiency in food production and also enhance its capacity to cope with inter year fluctuations in production. Even after these achievements at the national level, the problem of household food security is yet to be solved. Soe (2002) argued that India's nutritional problem is not due to non-availability of food grains at the national level, but due to lack of adequate economic access to food. They stated that nearly one-third poor households' family income in the country is so low that nutritional needs are not met even 70 per cent of that income is spent on food only. The food-grain self-sufficiency that is visible in India is often argued to be due to lack of purchasing power among large masses of rural population (Nasurudeen et al, 2006). While Sukhatme (1987) reported that India's nutritional problem is not just that of the purchasing capacity of the poor, but a more complex problem which results from a complex interaction of income, price, individual preferences and belief, cultural traditions as well as geographical, social, political, economic and environment forces (WHO, 2003). These forces combine to prevent the poor and other disadvantaged segments of the population from acquiring and effectively utilizing enough food to meet their nutritional requirements. Because of these, the extent of malnutrition and poverty are still important reminders, which needs immediate attention.

The Indian diet is predominately cereal based and expenditure shares on foods of animal origin (meat, fish and eggs) and fruits, which are rich in different nutrients, are very low (Kaul, et.al, 1977). However, in recent years, the food consumption pattern is under going substantial change. There is a shift from consumption of traditional cereals towards higher value and higher protein foods (Rae, 1999). Such shifts in consumption pattern are evident more in urban areas than in rural

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areas (Selvarajan and Ravishankar, 1996). Under the changing scenario, it is imperative to determine the dietary intake pattern and nutritional status of rural population in the relatively backward region of the country. This study specifically attempts to study the expenditure and dietary intake pattern, determine the nutritional status of rural households and suggest measures to improve nutritional status of rural poor households in Chhattisgarh. Attempt is also made to identify the socio-economic factors determining the nutritional status of the rural people in the state of Chhattisgarh.

Methodology

A household is a group of persons normally living together and taking food from the same kitchen. It may also be conceived as a basic unit of food consumption, whose members typically pool their income, buy as a unit and share somewhat similar food preferences. In this study, a sample of 118 households was surveyed for assessment of dietary intake pattern and nutritional status of rural households. These households were also categorized according to socio-economic status, which may influence the nutritional status of rural folk. Per capita expenditure, educational status of head, social group and farm holding size play a role on the consumption of food items, which in turn, contribute to the nutritional well being of the individuals and households.

The enquiry was conducted by survey method and collection of information was based on primary data. The data related to quantity consumed for various commodities were grouped in food items like cereal, pulses, vegetables, milk and milk products, edible oils, meat, fish and eggs, fruits, and sugar and jaggery. Consumption data were collected with a reference period of the last 30 days just preceding the date of survey. The study was conducted in Dharsiwa block of Raipur district in Chhattisgarh state. In order to select ultimate units of the sample, the multistage sampling technique was adopted. Boria-Khurd village cluster of Dharsiwa block was purposively selected, as it was fairly well representative of the dietary intake pattern of rural folk in the state. The rural households were categorized into two major categories i.e. farm households and non-farm households. Farm household were further categorized in four size groups i.e. marginal, small, medium and large farmers. A representative sample of respondents (25 per cent of each category) was drawn proportionately, representing various household categories. Thus, 118 respondents comprising non-farm (50), marginal (16), small (22), medium (20) and large farmers (10) were randomly selected. The information collected through personal interview with rural households was analyzed according to the socio- economic groups.

Results and Discussion

Food Expenditure Pattern

Table 1 shows the proportionate expenditure share on different food items in rural area of Chhattisgarh state as well as all India (rural) level. The table shows that per capita total food expenditure was generally lower in non-farm households (Rs. 186) than farm households (Rs. 208). The farm and non-farm difference in per capita expenditure was fairly large (11.83% higher in farm households). It was also observed that per capita expenditure in rural Chhattisgarh (Rs. 198) was lower than the all-India rural average (Rs. 289) by 31.49%. An examination of the expenditure share of different food items to total food expenditure in both groups, i.e. farm and non farm households, revealed that expenditure on cereal dominated in total food expenditure, followed by pulses and edible oils.

The share of cereals in the food budget ranged from 41 to 58 per cent for rural population. The farm households incur higher level of expenditure on milk and its products and pulses as compared to non-farm households. Thus, farm households exhibited a more diversified food basket. The results also showed that the share of cereals, pulses, edible oils, sugar and

Table: 1 Share of Different Food-items in Total Food Expenditure (%) in Rural Chhattisgarh

Particulars	Farm Households					Non-Farm	Over all	All India
	Marginal	Small	Medium	Large	Total			Rural*
Cereals	55.49	50.94	48.44	40.73	48.78	57.18	51.82	37.31
Pulses	10.73	11.02	11.51	10.40	11.00	9.68	10.71	6.63
Vegetables	6.08	5.58	6.21	5.45	5.82	5.19	5.69	10.40
Milk and its Products	5.15	12.95	14.13	20.36	13.61	4.81	9.42	14.74
Edible Oils	8.95	8.62	8.83	9.73	8.96	9.64	9.82	6.29
Meat, Fishand Eggs	3.13	2.20	1.59	2.87	2.30	2.77	2.49	5.59
Fruits	0.53	0.48	0.65	0.93	0.64	0.66	0.65	2.39
Sugar and Jaggery	5.27	5.11	5.51	5.01	5.24	5.21	5.30	4.01
Others	4.66	3.12	3.13	4.52	3.66	4.86	4.11	12.68
Total Food Expenditure[#]	183	203	214	254	208	186	198	289

*National Sample Survery (55 th round, 1999-2000)

[#] Rs per person per month

jaggery in total food expenditure was higher in rural areas of Chhattisgarh than the national average.

The combined expenditure on protein rich food items like pulses and vegetables in rural areas of Chhattisgarh state follow the all-India average trend. The share of expenditure on cereals was found to be considerably higher while that on milk and its products was lower in rural areas of Chhattisgarh state as compared to the national average. This indicates the economic backwardness of rural population in Chhattisgarh relative to rural population of all India level.

Share of all food items other than cereals and milk and its products in total food expenditure shows more or less similar trend in farm and non-farm households as well as different categories of farm households. Cereals expenditure share showed inverse relationship with farm size while there was a positive relationship in case of expenditure on milk and its products. Thus, development of dairy enterprises may be given priority to diversify the food basket of non-farm, marginal and small farm households.

Dietary Intake Pattern

Food-items consumed by rural population were categorized as cereals, pulses, vegetables, milk and its products, fat and edible oils, fruits, meat, fish, eggs, sugar and jaggery. Dietary intake pattern of rural households was accessed by socio-economic groups. The consumption of various food-items was computed on per adult consumer unit per day basis. The per capita intake of food items (gm/person/day) for rural farm and non-farm households in Chhattisgarh are shown in Table 2. The results further confirmed our earlier observations that cereals dominated dietary intake pattern in the state which is also the cheapest sources of calories and nutrients in both farm and non-farm households. In the farm households, the per capita consumption of cereals was 451 gm/person/day and in non-farm households 490 gm/person/day as compared to all India consumption of in 424 gm/person/day. Rice contributed more than 90% to total cereals consumption in the Chhattisgarh state. It was observed that the Recommended Dietary allowance (RDA) in terms of quantity was far ahead than that observed in Chattisgarh region. The deficit from the RDA to the tune of 51 percent in pulses and 29 percent in vegetables, 83% in fruits 63% in milk and milk products and 37% in fats and edible oils was observed in the region.

Cereals also dominated the food basket across socio-economic groups. Consumption of pulses, which are generally considered to be low cost protein for vegetarians, was lower by 51 per cent in rural area of chhattisgarh as compared by recommended dietary allowance. In contrast to it, the consumption of pulses was found higher by 39% in rural area of Chhattisgarh than that of aii India rural pulses consumption average.

The result showed that pulses and vegetable consumption levels in Chhattisgarh were reasonably high. In the state, per capita consumption of pulses and vegetable were found to be 39 and 177 grams for rural population as compared to all India average consumption of 28 and 173 grams, respectively.

Among different socio economic groups of Chhattisgarh, pulses and vegetables are given equal importance in dietary pattern. However, per capita consumption of fruit in state was found to be much lower than all-India for both farm and non-farm households.

Consumption of sugar per person was found to be the same as all India average. Sugar consumption was higher on farm households and lower on non-farm households as compared to all India rural average.

Per capita consumption of milk and its products showed a wide range in rural area of Chhattisgarh. It ranged from less than 40 grams / person/ day among non-farm and marginal farm households to 200 grams/ person/ day to large farm households. Although its consumption was considerably lower in Chhattisgarh as compared to all India rural average. Fats and edible oils were consumed lower than that is recommended, but its consumption is somewhat higher than all India rural average. The consumption of foods like meat, fish and eggs was extremely low (4 grams / person/ day) in the study area.

Table 2 shows that cereals were consumed in large quantities across all the socio-economic groups. This was followed by vegetables and milk and its products while the least consumed items were meat, fish, eggs and fruits. The low consumption of these was basically due to combined effect of various social, economic and cultural effects. A high proportion of the rural population was vegetarian and even non-vegetarians did not consume meat and fish regularly. This might be explained by the fact that major proportion of rural population was vegetarian either of traditional persuasions or for economics reasons (Musebe and Kumar, 2000). It was observed that for various socio-economic groups revealed that consumption of cereals decreased and non-cereals items increased with increase in farm holding size, monthly per capita expenditure, educational level of head of the family and social status of households. As expected, the lowest consumption of non-cereals was observed for the small farmer, scheduled caste and scheduled tribe households and poor households with low educational status.

Dietary intake across socio-economic groups portrays lower consumption by the scheduled caste and scheduled tribe for most of food-items. An interesting feature was the high consumption of higher value food-items by households with large farm size with higher educational and social status.

Status of Nutrient Intake

The nutrients considered in the present study were protein, fat, carbohydrate, calories, calcium, phosphorus, iron and vitamins. The quantities of respective nutrients consumed from each food items were computed by multiplying the quantity of food-items consumed with the percent of nutrient available in each of food-items. The summarization of this product over all food items for each nutrient gives an approximation of the quantity of each nutrient available for consumption.

Nutrient consumption increased with increase in farm size and there were significant differences in consumption of almost all nutrients between farm and non-farm households as well as different categories of farm households.

Nutrient intake varied across farm and non-farm households as well as different categories of farm size groups. Average intake of calories ranged from 1933 to 2037 Kcals among the rural population. Protein intake ranged from 43 to 48 grams. The intake of all nutrients increased with increase in farm size. Although, the intake of nutrients was deficient than the recommended dietary allowance in most of nutrients, it was nearly 26% for protein, 35% for carbohydrates 18% for energy and 48 percent for calcium. The Iron and vitamins were too observed to be deficient in the level of 41 and 10% respectively.

Assessment of nutrient intake revealed that the extent of diet diversification increased with farm size, monthly per capita expenditure, social status and educational status of head. The poor and non-farm households had lower consumption of non-cereals compared to other households. The share of non-cereals in the total intake of nutrient was relatively low. Since cereals are main sources of nutrient. Thus cereals are considered very important food items, especially by weaker section of society. At the same time, diet diversification is essential for improvement in the nutritional status because different types and amount of nutrients were supplied by different food items.

Analysis of nutritional status revealed that there were deficiencies in intake of all nutrients except fat and phosphorus. The deficiencies in nutrient intake varied across socio-economics groups. Calorie deficiency was higher among all groups. There was a

Table: 2 Consumption of Selected Food-items by Socio-Economics Groups (Gms/ Person/ Day)

Socio-Economic Groups	Cereals	Pulses	Vegetable	Fruits	Milk and its Products	Fats/ Edible Oils	Meat and Fish	Sugar and Jaggery
Land Class[1]								
Farm Households	451	41	211	5	101	19	4	29
Marginal	459	37	147	4	31	17	5	25
Small	456	40	210	4	100	19	3	29
Medium	460	45	233	4	109	19	2	32
Large	413	45	273	8	200	25	5	33
Landless	490	35	130	4	36	18	5	26
Monthly Per Capita Expenditure Class[2]								
Low	496	35	161	3	19	16	4	21
Medium	463	40	189	4	76	19	4	27
High	455	43	226	8	163	23	5	41
Educational Status of Household Head								
Illiterate	474	39	142	3	50	17	3	30
Primary	478	36	173	3	42	17	4	23
Middle	475	41	189	5	83	18	6	25
High School	449	38	201	6	104	21	4	32
University	440	43	247	9	145	24	3	38
Social Groups								
Scheduled Caste	471	36	140	6	46	17	4	27
Scheduled Tribe	462	37	148	4	54	18	4	27
Others	471	40	188	5	78	19	4	29
General	451	38	236	8	172	21	3	26
Overall	468	39	177	5	74	19	4	28
All India[3]	424	28	173	21	134	17	14	28
RDA	420	80	250	30	200	30	-	30
Deficit (%)	0	51	29	83	63	37	-	7

Note: [1] Non-farm 0 ha., Marginal upto 1.0 ha, Small 1-2 ha, Medium 2-4 ha and Large Farmer above 4.0 ha.
[2] Low <Rs. 236, Medium Rs. 236-284 and High above Rs. 284.
[3] National Sample Survey (55 th round, 1999-2000)
RDA =Recommended Dietary Allowance, National Institute of Nutrition, Hyderabad

Table 3: Nutrients Intake Pattern by Socio-Economics Groups

Socio-Economic Group	Protein (gms)	Fat (gms)	Carbohydrates (gms)	Energy (Kcals)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Vitamins (mg)
Land Class[1]								
Farm Households	45.13	27.37	386.68	1974.02	236.14	1108.88	16.53	55.58
Marginal	42.87	23.04	388.42	1933.22	156.58	1043.06	16.40	51.36
Small	44.66	26.21	385.64	1957.55	224.67	1102.33	16.46	55.13
Medium	45.20	26.96	390.09	1984.19	239.78	1111.92	16.61	57.33
Large	48.41	34.96	382.01	2036.49	335.69	1188.29	16.72	60.20
Landless	43.22	23.38	398.29	1977.15	154.05	1053.13	16.60	47.51
MPCE Class[2]								
Low	41.14	20.83	369.74	1835.36	136.13	1005.18	15.89	48.18
Medium	44.36	26.00	387.07	1960.42	211.01	1085.76	16.47	54.14
High	50.42	33.58	430.65	2227.12	327.42	1241.77	17.93	62.80
Educational Status of head								
Illiterate	43.69	23.12	394.12	1960.02	172.53	1069.80	16.55	48.47
Primary	43.79	22.91	391.14	1831.40	167.97	1073.77	16.72	51.17
Middle	45.99	25.62	394.77	1994.31	226.89	1122.80	16.91	55.17
High School	44.04	28.80	382.82	1968.81	242.71	1082.00	16.10	55.35
University	45.46	33.13	387.18	2029.29	296.88	1177.14	16.18	62.55
Social Groups								
SC	43.37	22.97	388.57	1934.36	168.08	1057.63	16.40	47.83
ST	42.90	24.13	382.69	1920.22	177.82	1050.52	16.17	48.44
Others	45.02	26.16	394.91	1995.88	214.46	1102.86	16.73	54.57
General	46.37	31.48	383.66	2004.01	322.95	1149.34	16.42	61.57
Overall	44.46	25.96	390.86	1975.52	207.19	1089.40	16.56	52.99
RDA	60	20	600	2400	400	800	28	58.60
Deficit (%)	25.90	-	34.86	17.69	48.20	-	40.86	9.58

Note: [1] Non-farm 0 ha., Marginal upto 1.0 ha, Small 1-2 ha, Medium 2-4 ha and Large Farmer above 4.0 ha.
[2] Monthly Per Capita Expenditure, Low <Rs. 236, Medium Rs. 236-284 and High above Rs. 284.
RDA =Recommended Dietary Allowance, National Institute of Nutrition (ICMR), Hyderabad

decrease in deficiency of specified nutrients as the farm size, monthly per capita expenditure and educational status of head increased. This corroborated the Musebe and Kumar (2002) assertion that the deficiency of nutrients was among poor, landless households, scheduled caste and scheduled tribe with low education status. Therefore, they required special attention for improvement of their nutritional status. These results suggested that increase in the household's income, education status could greatly improve the nutritional status of rural households.

Sources of Nutrient Supply

Livestock products contributed 6.87% to total protein supply of which about 75% was accounted for by milk and its products. The relative share of milk and its products to total protein supply was more in farm households than non-farm households. On the contrary, the share of meat, fish and eggs was more in non-farm households. Of the average, daily fat intake of 26 grams per person rural households derived 67.23% from edible oils and 11.25% from milk and its products. The invisible fat percent in cereals, pulses, vegetables and fruit constituted 20.56 per cent of total fat consumed while negligible portion (0.96%) was supplied by non-vegetarian food-items like meat, fish and eggs.

The proportionate share of edible oils to fat supply declined with increase in farm size, while the share of animal fat improved substantially towards the larger farm size groups. Similarly the share of invisible fat too, declined with the farm size.

Carbohydrates and calories were mainly derived from consumption of cereals, which contributed 87.89 per cent to carbohydrate and 78.82% to calories supply in rural households. Their respective share was more in non-farm households as compared to farm households. Cereals share in supply of these nutrients decreased progressively towards larger end of farm size.

Cereals were also the dominant supplier of minerals particularly phosphorus and iron. Their contribution was estimated to be about 82.59% of total intake of phosphorus and 89.78 per cent of total intake of iron. As expected, importance of cereals was more for non-farm households rather than farm households.

Milk and its products constituted the second largest source of phosphorus and were followed by pulses and vegetables. Not much appreciable differences were observed in the proportional contribution of pulses and vegetables to total phosphorus intake between farm and non-farm as well as different categories of farm households, whereas

the proportional contribution of milk and its products in total phosphorus supply under farm households category was almost 2.5 times to non-farm households.

In case of iron, vegetables and pulses were next to cereals and their share was 23.21% higher under farm households as compared to non-farm households. Milk and its products supplied 41.27% calcium to sample households followed by cereals pulses and vegetables. The share of milk and its products was significantly higher among farm households as compared to non-farm households, while that of vegetables and pulses was higher for non-farm household.

Rural population derived carotene mainly from vegetables, edible oils and milk and its products. For farm households, the proportion of carotene supply by milk and its products and fruit was higher while that from other food items were lower.

Most of protein in the form of niacin comes from cereals followed by pulses and vegetables. Similarly, cereals contributed major portion of thiamin supply followed by pulses and vegetables. In case of calcium and thiamine, the contribution of cereals declined and that of pulses and vegetables increased in farm households. The composition mix of important vitamin constituent, riboflavin was more diversified with cereals and milk and its products. However, cereals, as a source of riboflavin were increasingly substituted by milk and its products among the farm groups. Most of vitamin-C was supplied by vegetables and pulses. The households consumed more or less same proportion of vitamin-C from vegetables and pulses in both farm and non-farm households categories.

Elasticities of food items

Income has been identified as one of important determinant of dietary intake; however its impact may vary among farm and non-farm households. The expenditure elasticity coefficient measured the percentage change in consumption for one per cent change in expenditure. The sign and magnitude of elasticity of coefficient indicates nature of the commodities. Expenditure elasticities of the demand for each of the food items for rural farm and non-farm households were computed separately and presented in Table 4. It may be seen from the table that expenditure coefficients for all the food items are lower for farm households as compared to non-farm households.

Table 4: Elasticities of Different Food-items under Farm and Non-farm Households

Food-items	Expenditure Elasticity	Farm	Non-farm	Overall
Cereal	0.208	0.878		0.494
Pulses	0.327	0.423		0.479
Vegetables	0.560	0.689		0.589
Milk & its Products	2.981	3.423		3.916
Edible oils	1.119	1.826		1.091
Meat, Fish & Eggs	0.871	2.148		1.428
Fruits	1.241	2.368		2.221
Sugar & Jaggery	0.773	1.032		1.267

Expenditure elasticities for cereals, pulses and vegetables are lower than unity, implying that with an increase in income level there will be small increase in demand for these items. The expenditure elasticities for milk and its products, fruits, meat, fish, eggs, sugar and jaggery and edible oils are more than unity and higher in non-farm households in rural area of Chhattisgarh state. This may be mainly due to average higher per capita income and food expenditure on farm households.

This demonstrates that an increase in income in non-farm households has comparatively higher bearing on consumption expenditure of these food items. Thus, the study suggests that poor households would diversify their dietary intake pattern as their income increase.

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On Farm Trial on the Efficiency of Different Types of Ploughs in Garhwa District of Jharkhand

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Abstract

An on farm trial was initiated in the Narayanpur village of Garhwa. The OFT was planned in the Rabi of 2008. Source of technology selected was Birsa Ridger developed by BAU, Ranchi. The implements used for the OFT desi plough, MB plough, Birsa Ridger. The parameters for spread depth of roots did not show any significant differences between the treatments. However, the largest amount of root spread was noticed in the treatment no. 3. Thus, over thirty three percent rise in depth and width of soil cut was recorded over farmer's practice. In terms of energy efficiencies, cost to benefit ratio noticed, and higher grain yield output of the treatment three was considered to be successful onfarm trials.

Keywords: Evaluation, ploughs, Tillage, Performance, Garhwa

Introduction

The plough is a tool used in farming for initial soil preparation for sowing seed or planting (Abubakar *et.al*. 2009). It has been a basic instrument for most of recorded history, and represents one of the major advances in agriculture (Ahaneku *et.al.* 2007). Ploughs were initially human powered, but the process became considerably more efficient once animals were pressed into service (Al-Suhaibani *et.al*. 2010). However, to grow crops regularly in less fertile areas, the soil must be turned to bring nutrients to the surface. The basic plough with coulter, ploughshare and mouldboard remained in use for a millennium. A major advance was the *mouldboard plough*. Major changes in design did not become common among farmers. The primary contribution of cattle to agricultural production in the Garhwa highlands remained as a source of draught power. The farmers generally prepare wheat field by four ploughing with deshi hal which does not exceed a depth of 10-12 cm resulting in poor tillage. Therefore a deep ploughing with MB plough / Birsa Ridger is necessary for good tillage in wheat field. Therefore an attempt has been made to carry out efficiencies studies in the farmer's field of Garhwa.

Materials and methods

The OFT was planned in the Rabi of 2008. For this a 500m^2 plot in a preselected village in Garhwa district of Jharkhand was screened out after carrying out Rapid roving survey of the area. Source of technology selected was Birsa Ridger developed by BAU, Ranchi. The implements used for the OFT were desi plough, MB plough, Birsa Ridger. Test crop was wheat and there were three treatments as per the technologies selected which is given below:

Details of technology selected:

Treatment

T1 - Farmers practices (Four ploughing by Desi plough)

T2 - One Ploughing by M.B Plough (Bullock drawn) followed by Desi Plough (Two Ploughing)

T3 - One Ploughing by Birsa ridger plough (bullock drawn) followed by Desi Plough (Two Ploughing)

The experiments were replicated ten times in different farmers fields of the same village keeping the plot six and sample size and the technologies selected same.

Results and discussions

Field tests were conducted to evaluate the performance of three different types of ploughing vis a vis indigenous method of ploughing or farmer's desi plough. The improved technology in the form of Birsa Ridger which was intended to be introduced among farmers was the main focus of the technology to be demonstrated among the farming community. Different parameters selected were depth of cut, width of cut, Energy used in plough/unit area day / ha, Spread depth of roots system (cm), Time taken to germination (day), Grain yield q/ha, C:B Ratio.

Soil volume disturbed depends on the effective capacity and the depth and width of cut. In this parameter, Birsa Ridger alongwith two desi ploughing shown significant results. As per results presented in table 1, treatment 3 achieved highest soil disturbance.

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[2]Central Soil Salinity Research Institute, Karnal, (Haryana)

Table 1: Performance of the technology with performance indicators

Treatment	Technology Assessed	Depth of Cut (cm)	Width of cut (cm)	Energy used in plough/ unit area day / ha.	Spread depth of roots system (cm)	Time taken to germination (day)	Grain yield (q/ha)	C:B ratio
T1	Farmers practices (Four ploughing by Desi plough)	9.8	8.0	6.33	10.1	8.0	22.3	1:2.4
T2	One Ploughing by M.B Plough (Bullock drawn) followed by desi plough (Two Ploughing)	14.7	12.8	5.89	10.2	7.8	25.7	1:2.9
T3	One Ploughing by Birsa ridger plough (bullock drawn) followed by Desi Plough (Two Ploughing)	14.8	14.6	5.78	11.0	7.4	30.6	1:3.7
CD at 5%		2.1	1.3	0.84		0.9	3.2	

Over 33% rise in depth and width of soil cut was recorded over farmer's practice. The results also indicated that higher efficiency of operation by Birsa ridger affected soil volume disturbed positively. Over 15% energy saving could be achieved by following treatments 2&3 over farmer's practice. Other parameters tested although were not statistically significant but higher efficiencies were observed in the treatment three. Grain yield harvested was significant in all the treatments. The maximum grain yield of 30.6 q/ha were recorded by one ploughing by Birsa ridger plough (bullock drawn) followed by one ploughing by M.B Plough (Bullock drawn) (25.7q/ha). The least grain yield of 22.3q/ha was recorded under farmer's practice. Cost benefit ratio calculated was significantly higher in the treatment three. Among different technology indicators the maximum C : B ratio of 1:3.7 was recorded by one ploughing by Birsa ridger plough (bullock drawn) followed by desi Plough followed by one ploughing by M.B Plough (Bullock drawn) of 1:2.9 and Farmers practices (Four ploughing by Desi plough) recorded C:B ratio which was lowest among all the technology tested (Table 1).

Conclusions

The parameters for spread depth of roots did not show any significant differences between the treatments. However, the largest amount of root spread was noticed in the treatment one ploughing by Birsa ridger plough (bullock drawn) followed by desi plough. In terms of energy efficiencies, cost to benefit ratio noticed, and higher grain yield output of the treatment three was considered to be successful on farm trial.

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Effect of Mechano-Chemical Weed Control Methods on productivity of Wheat (*Triticum aestivum)*, under Irrigated Conditions in North West Plain Zone

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Abstract

A field experiment was conducted at Nidhauli Kalan, Etah, during the Rabi season of 2009-10 to find out the suitable herbicides and their optimum dose for controlling the weeds in wheat under agro-climatic conditions of Etah region. The experiment was laid out in Randomized Block Design with three replications. Wheat variety Raj-3765 was sown on November 27th, 2009. Treatment consisted of nine combinations of herbicides as well as mechanical method of weed control. Significant lower total weed population was recorded with the application of Isoproturon + 2, 4-D (Ester 38 EC/Sodium salt 80 w p) @ 750+500 g ha^{-1}) while the use of Isoproturon +2,4-D (Ester 38 EC/Sodium salt 80 wp) @ 1000+500 g ha^{-1} (T_7) proved most effective resulting in the lowest accumulation of dry matter of weeds at 120 DAS. Weed free treatment (Two hand weeding 30 and 40 DAS) followed by application of Isoproturon (Arelon 75 wp @ 750 g ha^{-1} at 30-35 DAS produced statistically higher grain, straw yield and total biological yield than all the herbicidal formulations tested.

Key words: Herbicides, Isoproturon, population, biological yield

Introduction

India's share in world wheat area is about 12.54%, whereas it occupies 11.39 % share in the total world Wheat production. Wheat is grown in India over an area of about 28.04 Million ha. with a production of 78.57 Million tonnes. The normal National productivity is about 28.02qha^{-1}. There is hardly any scope for expansion of area under wheat. The main emphasis would be on increasing the productivity of wheat by adopting the improved cultivation practices.

Wheat field is generally infested from both dicot and monocot weeds. The major dicot weeds are: Chenopodium album (bathua), Fumaria parviflora (gajri), Cirsium arvense (kateli), Anagallis arvensis (Krishna neel), Melilotus alba and Melilotus indica (senji), Bicia sativa (ankri), Lathyrus spp. (chatri marri) etc. Monocot weeds include: Phalaris minor, Avena fatua (wild oat), Polypogon monspliensis, Cyperus rotundus (motha) and Cynodon dactylon (doob).

Weeds compete with crop for water, soil nutrients, light and space and thus reduce crop yields. They increase the expenditure on labour and equipment, render harvesting difficult and reduce the quality and marketability of produce.

Hence, an experiment was conducted on wheat and various herbicides to find out the suitable herbicides and their optimum dose for controlling the weeds in wheat under agro-climatic conditions of Etah region.

Materials and Methods

Field experiment was conducted at Agriculture Research Farm of Shri F.H. (P.G.) College of Science, Agriculture & Forestry, Nidhauli Kalan, Etah, (27^{0}10' N and 78^{0}50' E). The soil of experimental site is sandy loam soil in texture and contained 0.50% organic carbon, 181.0, 25.6 and 292.0 kg N-P-K/ha in 0.30 cm soil layer. Initial pH and electrical conductivity (dSm^{-1}) was 7.9 and 1.8, respectively. The total rainfall received during the crop span was 55.5 mm, out of this 26.1 mm, 6.8 mm, 8.3 mm and 14.1 mm rains were received in the month of November, December, January and February, respectively. In spite of five irrigations, these rains were advantageous for better growth and development. During the germination and early stages of crop growth, the maximum temperature ranged in between 23^0-26^{0}C, while that of minimum temperature ranged in between 6.2^0 to 16.2 ^{0}C. During further stages of crop growth (up to February 15), maximum temperature ranged in between 15.2^0 to 26.3 ^{0}C, while minimum temperature ranged in between 4.5^0 to 10.4^0 C. During development and maturity stages of crop growth, maximum temperature ranged in between 27.2^0 to 40.5 ^{0}C, while minimum temperature ranged in between 8.8^0 to 24.4 ^{0}C. This shows that maximum and minimum temperature at growing period of wheat was almost similar to that of normal values. The maximum relative humidity was between 58.4 to 93.1 per cent and the range of bright sunshine hours days^{-1} during crop growth and development stages was also normal.

The experiment was laid out in Randomized Block Design with three replications. Wheat variety Raj-3765 was sown on November 27th, 2009. Treatment

[1] Saline water project, R.B.S.College, Bichpuri, Agra

consisted of nine combinations of herbicides as well as mechanical method of weed control *viz.* Isoproturon (Arelon 75 wp @ 750 g ha^{-1} at 30-35 DAS (T_1), Isoproturon (Arelon 75 wp @ 1000 g ha^{-1} at 30-35 DAS (T_2), Isoproturon +Carfentrazone (AIM 40 w p) @ 1000+15 g ha^{-1}(T_3), Isoproturon +Metsufuron (Algrip 20 w p) @ 750+4 g ha^{-1} (T_4), Isoproturon +Metsufuron (Algrip 20 w p) @ 1000+4 g ha-1 (T_5), Isoproturon +2,4-D (Ester 38 EC/Sodium salt 80 w p) @ 750+500 g ha^{-1}(T_6), Isoproturon +2,4-D (Ester 38 EC/Sodium salt 80 w p) @ 1000+500 g ha^{-1}(T_7), Two hand weeding (at 30 and 45 DAS) (T_8) and Weedy check(T_9). The data were subjected to analysis of variance by following standard statistical procedure.

Results and Discussion

Weed growth

Variations in total weed population were significant at all the stages of the crop growth and development. Total weed population under treatment T_6 (Isoproturon +2, 4-D (Ester 38 EC/Sodium salt 80 w p) @ 750+500 g ha^{-1}) recorded significant lower over all the treatments under test except T_7, T_4 and T_1 (Table 1). Amongst the herbicidal treatments, the use of Isoproturon +2,4-D (Ester 38 EC/Sodium salt 80 wp) @ 1000+500 g ha^{-1} (T_7) proved most effective resulting in the lowest accumulation of dry matter of weeds at 120 DAS. The next best treatment in this respect was Isoproturon (Arelon 75 wp @ 1000 g ha^{-1} DAS formulation sprayed every at 30-35 (T_2), However, manual weeding (T_8) was effective in controlling weeds in early stages but again reappear in later stages. Therefore, weed killing efficiency was judged to be the first in case of continued application of Isoproturan and 2 4D (T_7). The next best treatment was adjudged to be hand weeding.

Growth and yield attributes of wheat

In the present investigation weed free plot was maintained with a view to assess the cooperative performance of each herbicidal formulation under test and also to know the exact of advantages or disadvantages likely to accrue over and above the weed free plot (T_8). Maximum number of shoots per running meter raw length was recorded in plots of T_5 (Isoproturon + Metsufuron (Algrip 20 wp) @ 1000+4 gha^{-1}) as compared to all at 120 days stage but the variations could not cross the level of significance. Different treatments under test could not bring any remarkable change in shoot height at any stage of plant growth. Effective shoots or ear bearing shoots per running metre were noted maximum in T_8 (Two hand weeding 30 and 40 DAS) being statistically superior over rest of the treatments while treatment T_9 produced minimum number of effective shoots $metre^{-1}$ row length. Various treatments had no significant effect on the number of grains $spike^{-1}$, however, treatment T_7 (Isoproturon +2, 4-D (Ester 38 EC/Sodium salt 80 wp) @ 1000+500 gha^{-1}) produced maximum number of grains $spike^{-1}$. Weight of grains per spike and 1000 grains weight were significantly maximum in T_7 (Isoproturon +2, 4-D (Ester 38 EC/Sodium salt 80 w p) @ 1000+500 g ha^{-1}), which may be responsible for higher yield (Table 2).

Weed free treatment (Two hand weeding 30 and 40 DAS, T_8) followed by Isoproturon (Arelon 75 wp @ 750 g ha^{-1} at 30-35 DAS (T_1) produced statistically higher grain yield than all the herbicidal formulations tested (Table 3) . Straw yield and total biological yield was also recorded statistically maximum at T_8 closely followed by T_2 treatment resulted in significantly higher yield than T_3 (Isoproturon +Carfentrazone (AIM 40 w p) @ 1000+15 g ha^{-1}) and T_9. Minimum grain, straw and total biological yields were observed at T_9 treatment. The superiority of these treatments has also been judged by yield contributing characters. The harvest index was non-significantly increased due to different cultural & chemical weed control treatments. However, maximum harvest index was noted under Isoproturon (Arelon 75 wp @ 750 g ha^{-1} at 30-35 DAS (T_1).

It may be concluded that Weed population was effectively controlled and the maximum grain yield was

Table 1: Effect of macheno-chemical weed control methods on weed density, dry matter of total weeds and weed killing efficiency in wheat at different stages of crop growth

Treatments	Weed population (No./m^2)			Dry Matter of total weeds (g)			Weed killing Efficiency	
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	60 DAS	90 DAS
T_1	120.18	75.19	183.60	233.61	119.95	117.48	15.40	7.53
T_2	154.51	96.68	236.06	211.16	101.07	101.47	28.70	20.11
T_3	137.34	85.94	209.83	242.45	129.52	110.51	8.66	13.02
T_4	107.30	67.14	163.93	116.54	77.76	81.21	45.15	36.07
T_5	124.47	77.88	190.16	212.41	125.17	113.96	11.74	10.32
T_6	94.42	59.08	144.26	100.99	70.71	62.23	14.85	3.78
T_7	111.59	69.82	170.48	97.37	51.58	36.14	63.60	71.54
T_8	137.34	85.94	209.83	108.34	65.76	54.48	39.30	49.71
T_9	296.15	185.30	452.44	233.61	141.78	117.48	0.00	0.00
SEm ±	9.759	6.106	14.909	3.391	1.913	1.720	0.419	0.423
CD at 5 %	29.258	18.306	44.699	10.167	5.736	5.154	1.255	1.269

Table 2: Effect of macheno-chemical weed control methods on growth and yield attributes of wheat

Treatments	Crop stand m^{-1} row length 120 DAS	Shoot height at 120 DAS (cm)	DMA at 120 DAS (g)	Effective shoots m^{-1} row length	No. of grains $spike^{-1}$	Weight of grain $spike^{-1}$ (g)	1000 Grain weight (g)
T_1	109.17	83.08	137.00	80.33	33.21	1.59	47.88
T_2	109.50	82.83	122.33	79.05	34.33	1.46	42.53
T_3	110.17	83.50	119.33	78.21	35.08	1.44	41.05
T_4	108.00	82.25	131.67	79.04	32.66	1.51	46.23
T_5	110.50	83.08	126.00	77.53	31.50	1.28	40.63
T_6	109.83	85.92	123.33	78.66	33.80	1.56	46.15
T_7	110.33	84.00	125.33	77.56	36.83	2.00	54.30
T_8	109.17	85.00	135.67	90.05	31.58	1.32	41.27
T_9	109.00	83.67	137.33	69.39	33.66	1.30	37.02
SEm ±	0.697	0.359	2.625	1.503	1.53	0.18	1.23
CD at 5 %	NS	NS	NS	4.63	NS	0.56	3.84

NS-Non Significant

Table 3: Effect of macheno-chemical weed control methods on Grain, straw, total biological yield (q ha^{-1}) and harvest index of wheat

Treatments	Grain yield(q ha^{-1})	Straw yield(q ha^{-1})	Biological yield(q ha^{1})	Harvest index(%)
T_1	37.85	42.87	80.72	46.89
T_2	36.58	45.48	82.06	44.58
T_3	33.94	39.71	73.65	45.86
T_4	36.88	44.93	81.81	45.08
T_5	34.85	42.68	77.53	43.49
T_6	34.64	43.74	78.38	44.19
T_7	36.58	44.84	81.42	44.93
T_8	41.34	50.43	91.77	45.05
T_9	33.89	39.42	73.31	45.70
SEm ±	0.86	1.37	1.79	0.79
CD at 5 %	2.69	4.28	5.59	NS

NS-Non Significant

obtained by two hand weeding (T_8). As the chemical control of weeds is concerned use of Isoproturon (Arelon 75 wp @ 750 g ha^{-1} at 30-35 DAS (T_1) followed by Isoproturon (Arelon 75 wp @ 1000 g ha^{-1} at 30-35 DAS (T_2) were noted to be best herbicidal treatments. As far as the relative performance of hand weeding v/s chemical control is concerned, the supremacy of chemical weed control is justified on the basis of labour problem and economics.

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Rural women empowerment through Self Help Groups (A case study in J&K)

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Abstract

Women empowerment aims to enabling them to realize their identities, potentiality and power in all walks of their lives, the real empowerment of a women is possible only when a women has increased access to economic resources. More strength, more self motivation and confidence and more say in the family matters. The study has shown that through the formation of self help groups, the rural women have started identifying their strength, opportunity for growth and their role in reshaping their own destiny. Above all, the process of empowerment becomes the beacon light to their children, families and society at large it has proved that women empowerment is the best strategy for poverty eradication.

Key words: Women empowerment, Self Help Groups

Introduction

Women in India lived in virtual isolation, unable to access even the most basic of services. They are generally not to have perceived to have any meaningful income generation capacity and hence, are neglected mainly to household duties and cheap labour.

In a society where men control the destiny of women, how it is possible to empower women? Women will gain power only when both men and women begin to respect and accept the contribution of women. Developing women capacity for income generation without threatening men is key; Empowerment of women has emerged as an important issue in recent times. It is a process by which women gain greater control over resources and participates in leadership and decision making process to become active participates for developing the skills to assert themselves, there is urgent need of empowering women especially in rural areas. The formation of self help groups has passed the way for economic independence and empowerment of rural women.

Objectives of the study

The overall objective of the present study is to analyse the empowerment of rural women through SHG in Jammu district (block-MARH) in J&k state. However the specific objectives of the study are as.

(a) To enumerate the growth of self help groups.
(b) To analyse the empowerment of the women through self help groups in the study area,

Research methodology

The study has been conducted in four villages of MARH block in Jammu district. The villages were selected purposively because SHG in these villages were functioning well. Therefore these villages were selected for the study. The information required for study has been collected from both the primary and secondary sources; the primary data were collected with the help of an prepared interview scheduled. The secondary data were collected from various reports, journals.

In the study proportionate random sampling technique were used only thirty SHG were selected from five villages from each SHG only two members were selected through lottery method in order to get accurate information about the group for analysing the collected data the statistical tools were used percentage, mean Z test, garrets and ranking technique.

Results and Discussion

Origin of Self Help Groups and progress of S.H.G. linkage In India.

SHG' S are of recent origin in rural India and have come along way since its inception in 1992 when a pilot projects was introduced by NABARD for linking banks with self helps groups. At present, SHGS is widely used as an instrument to empower rural women. It has been observed that majority of rural women who are associated with the self help groups succeeded to gain themselves empower, the growth of SHG in India is given in Table 1.

Table 1: Progress of SHG and bank linkage in India

year	No. of SHGs linked
1992-1993	255
1997-1998	14317
2000-2001	263825
2001-2002	461478
2002-2003	717360
2003-2004	1079091
2004-2005	1618456
2005-2006	2238565
2006-2007	2924973

Source: NABARD annual reports and SHG bank linkage data

Family income of respondents

For analysing the family income of the

respondents, before and after forming the groups the data have been collected and presented in Table 2.

Table 2: Family income of the respondents

Amount of income	Before joining SHG (No. of respondents)	After joiningSHG (No. of respondents)
0-2000	29	3
2000-3000	13	24
3000-4000	8	17
4000-5000	6	9
Above5000	4	7
Total	60	60

The Table 2 indicates that these an increase in income after joining the SHG by the families.

Mode of savings.

Savings is the key factor of each self help group. The SHGs have their savings bank accounts for analysing the saving details of the respondents before and after joining SHGs, the data have been shown in Table 3. The table revealed that the savings have also increased after joining the SHG..

Table 3: Saving of the families

Saving in Rupees	Before joining (No. of members)	After joining No. of members
0-5000	50	24
5000-10000	10	20
Above 10000	-	16
Total	60	60

Loan details

A self help group contributes on monthly basis and out of savings, internal loan are given to the groups members. Table 4 shows the internal loan received by the respondents before and after joining the group. The table revealed that the loan amount of families has increased after joining the SHG..

Table 4: Monthly basis and out of savings, internal loan

S.No	Loan amount in Rs	Before joining	After joining
1	0-5000	32	12
2	5000-10000	18	35
3	Above-10000	10	13
	Total	60	60

Bank loan received by the respondents

As per the SHG norms, the member of the group deposits the savings in a particular bank and that bank links the SHG i.e. provide loan to the group to the tone of 1 to 4 times of its savings after six months. Table 5 gives the details of the bank loan availed by the respondents for different purposes.

It is observed that respondents mainly get loan to meet family expenses house repair and next preferences is the other purposes are to meet the expenses for children education (Table 5). It is also clear that SHG is a viable alternative to achieve the objectives of rural women empowerment. The self help group through micro credit are providing a platform for a rural women to take off towards the main stream of economic growth and rural development, almost all the credit requirement of rural women are met through SHG, the group member save a regular amount per month of Rs 20 to Rs 100 and in some cases it is little more. The group rotates the money among themselves by way of their landings at a specified interest rate as the repayment is cent percent and the recycling is fast, the saving amount increases rapidly. The saving habits helps the members to escape from the cluster of relatives and money lenders etc.

Table 5: No. of beneficiaries availed loan for different purposes

Particulars	I	II	III	IV	V	VI	Total
Educate children	12	10	9	13	11	5	60
To meet medical expenses	8	13	12	10	9	8	60
For house repair	7	8	10	8	12	14	60
For business	12	10	9	13	10	6	60
To meet expenses of social &domestic consumption	10	10	9	8	9	14	60
To purchase seed & fertilizer	11	8	12	7	12	10	60

Finally it leads to the empowerment of rural women as they have become an integral part of their household operations and family decisions. After six months, the SHGs are linked with the bank credit .the banks provides credit for various farm as well as rural farm activities. The repayment of loan is almost cent percent (nearly(90%), beside focusing on empowering women, SHGs concentrate on all rural development of members and their village as a whole. The groups are also doing other social works like literacy, health and raise their voice against alcohol etc.

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Effect of plant geometry and irrigation levels on productivity, yield components, water use and water use efficiency of castor (*Ricinus communis*) in canal command areas of north-western Rajasthan

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Abstract

*A field experiment was conducted during rainy (kharif) and winter (rabi) seasons of 2005-06 and 2006-07 at Agricultural Research Station, Rajasthan Agricultural University, Sriganganagar, Rajasthan to study the row spacing and irrigation levels on seed yield, harvest index, yield components, water use and water use efficiency of 'MRCH 409' castor (*Ricinus communis *L.) in canal irrigated trans-gangetic plains of Rajasthan. Among the row spacing of 67.5, 101.2 and 135 cm, 135 cm was found optimum (23.1, 21.9 q/ha) in term of seed yield. Similarly, 135 cm row spacing also recorded significantly higher yield attributes, like branches/ plant (5.3, 3.7), spikes/ plant (6.0, 4.1), spike length (44.5, 34.2), capsules/ spike (37.9, 47.0) and seed index (23.3, 23.7 g). However, row spacing of 67.5 cm gave the highest harvest index (16.3, 16.4%) compared to 101.2 (16.2, 16.3%) and 135 cm (16.1, 16.0%) row spacing. Increase in irrigation levels increased yield and yield attributes and the highest seed yield (20.1, 18.6 q/ha), branches/ plant (5.9, 4.0), spikes/ plant (6.4, 4.1), spike length (48.8, 34.3 cm), capsules/ plant (39.7, 53.2) and seed index (23.7, 24.9 g) were recorded with IW/CPE ratio 0.7 (5.5 irrigations). However, highest water use efficiency (8.87 kg/ha mm) and harvest index (18.6, 18.52) were recorded with IW/CPE ratio 0.3 (2 irrigations).*

Key words: Optimum, capsules, attributes, efficiency

Introduction

Green revolution intensified the agriculture for more production of food and fibre crops. Less importance was given for soil health and soils were over-exploited with more and more use of chemicals to meet the growing need for food and fiber (Vani and Bheemaiah 2003). Thus soils become poor in organic matter content which decreased microbial activity and inhibit fixation of nitrogen as well as release of native nutrients, ultimately affecting the crop productivity. Frequent canal closure during summer and rainy seasons in Indira Gandhi Canal Command areas and less water supply in winter season further aggravated the situation and the popular cotton-wheat cropping sequence has become untenable. Drought hardy, long-duration, low nutrients and water requiring crops like castor (*Ricinus communis*) (Sree and Reddy 2004) has come out to be a potent crop to replace cotton-wheat to some extend. Therefore, farmers of north-western irrigated plains of Rajasthan are growing castor extensively and recently the area under this crop mainly hybrids is more than 1 lakh ha in irrigated condition. As hybrids are highly popular and grown with substantial irrigation, therefore, a strong need was felt to evaluate the row spacing and irrigation requirements of castor, the frequently encountered problems of the farmers of the north-western irrigated plains to enhance production efficiency as well as water use efficiency.

Materials and Methods

The field experiment was conducted during rainy (*kharif*) and winter (*rabi*) season of 2005-06 and 2006-07 at Agricultural Research Station, Rajasthan Agricultural University, Sriganganagar in Rajasthan. The soil was sandy loam in texture having pH (1:2) 8.1 electrical conductivity (1:2) 0.2, field capacity 16.2%, permanent wilting point 6.3%, bulk density 1.48 g/cc, organic carbon 0.28%, available P_2O_5 38 and K_2O 344 kg/ha. The treatments comprised of 3 row spacings of 67.5, 101.2 and 135.0 cm in main plots and 4 irrigation levels, viz., irrigation at 35+65+85 days after sowing; IW/CPE ratio 0.3, 0.5 and 0.7 in sub-plots. The experiment was laid out in split-plot design and replicated thrice. The castor crop ('MRCH 409')

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was sown in 1 and 21st July in 2005-06 and 2006-07 respectively through dibbling using 14.0, 9.3, 7.0 kg seed/ha in 67.5 cm x 30 cm, 102.2 cm x 30 cm and 135.0 cm x 30 cm spacing respectively. Four and 5 pickings were done starting from October to January in 2005-06 and October to February in 2006-07 respectively. The crop was finally harvested on 23rd January and 17th February in 2005-06 and 2006-07 respectively. A common pre-sowing irrigation of 100 mm was applied for proper land preparation and to ensure good germination. Thereafter, post sowing irrigations of 60 cm each were applied as per treatment. A fertilizer dose of 40 kg nitrogen/ha through urea and 32 kg phosphorus/ha through single super phosphate was applied for raising the crop. Half of nitrogen and full of phosphorus were drilled during sowing and rest half of nitrogen was applied as top dressing at first irrigation. The crop received rainfall of 100.8 and 157.2 mm in 2005-06 and 2006-07 respectively and corresponding pan evaporation values were 762.8 and 800.7 mm.

Results and Discussion

Row spacing

Row spacing significantly influenced the seed yield in 2006-07 and highest seed yield of 21.9 q/ha was recorded with 135 cm row spacing. Row spacing of 101.2 cm also gave significantly higher seed yield of 21.3 q/ha which was at par with 135 cm row spacing but superior to 67.5 cm row spacing. However, row spacing gave at par seed yield in 2005-06, but higher yield of 23.1 q/ha was recorded in both 101.2 and 135 cm row spacing. The higher yield with wider spacing (135 cm) is attributed to more branches/ plant (5.3, 3.7), spikes/ plant (6.0, 4.1), spike length (44.5, 34.2 cm), capsule/ spike (37.9, 47.0) and ultimately the seed index (23.3, 23.7). These results are in conformity with Porwal *et a*l. 2005. Though non-significant, wider spacing also recorded higher stover yield (120.4, 114.9 q/ha) as compared to narrow row spacing of 67.5 cm (117.6, 103.1 q/ha). Significant increase in yield and most of the yield attributes of castor under wider row spacing might be due to least competition offered for solar energy, water and nutrients (Chauhan and Singh, 1994). However, decrease in row spacing increased harvest index and the highest harvest index (16.3, 16.4%) was recorded at 67.5 cm row spacing.

Irrigation levels

Irrigation had a marked effect on seed yield (Table 1). As irrigation frequency was increased from 35+65+85 DAS and IW/CPE ratio 0.3 to 0.7, yield increased significantly, and the highest seed (26.2, 24.8 q/ha) and stover (151.4, 146.2 q/ha) yield were recorded at IW/CPE ratio 0.7. Higher yield with IW/CPE ratio 0.7 attributed to significantly higher branches/ plant (5.9, 4.0), spikes/ plant (6.4, 4.1), spike length (48.8, 34.3 cm), capsules/ spike (39.7, 53.2) and seed index (23.7, 24.9 g). Higher yields and yield components with higher levels of irrigation might be due to its key role in root development by reducing mechanical resistance of soil, higher transpiration, greater nutrient uptake and more photosynthesis due to better metabolic activities in the plant (Bhunia et al. 2006). Increase in irrigation frequency also decreased harvest index. Irrigation at 35+65+85 days after sowing recorded the highest harvest index (18.6, 18.5%) closely followed by IW/CPE 0.3 (2 irrigations) (17.9, 17.9%). This might be due to restricted vegetative growth with lower frequency of water, which reduced the stover yield and thus increased harvest indices. Higher frequency of water increased the water use as well as water use efficiency (Table 2). At irrigation level of IW/CPE ratio 0.7 higher water use (559 mm)

Table 1: Response of castor to row spacing and irrigation levels in relation to yield, harvest index and yield attributes

Treatment	Seed yield (q/ha)		Stover yield (q/ha)		Harvest Index (%)		Height (cm)		Branches/ plant		Spikes/ plant		Spike Length(cm)		Capsules/ spike		Seed Index(g)	
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Row Spacing (cm)																		
67.5	23.0	20.2	117.6	103.1	16.3	16.4	190	168	3.8	3.1	4.7	3.0	43.8	31.0	35.8	43.8	23.0	22.5
101.2	23.1	21.3	119.1	109.4	16.2	16.3	187	170	5.0	3.6	5.6	4.1	43.9	32.3	36.2	44.8	23.3	23.7
135	23.1	21.9	120.4	114.9	16.1	16.0	184	174	5.3	3.7	6.0	4.1	44.5	34.2	37.9	47.0	23.3	23.7
CD (P = 0.05)	NS	1.0	NS	NS			NS	NS	0.3	0.2	0.2	0.6	NS	NS	0.7	NS	0.1	0.1
Irrigation leves																		
IW/CPE 0.3	20.1	18.6	92.4	85.5	17.9	17.9	135	151	3.9	3.2	4.8	3.4	41.6	30.8	34.9	40.9	22.7	22.5
IW/CPE 0.5	24.6	22.6	137.5	123.3	15.2	15.5	231	182	5.0	3.6	5.8	3.8	45.6	32.6	37.5	47.6	23.4	24.6
IW/CPE 0.7	26.2	24.8	151.4	146.2	14.7	14.5	245	196	5.9	4.0	6.4	4.1	48.8	34.3	39.7	53.2	23.7	24.9
35+65+85 DAS	21.3	18.5	93.7	81.5	18.6	18.5	137	154	3.9	3.1	4.7	3.7	40.4	32.3	34.5	39.0	22.9	22.6
CD (P = 0.05)	1.2	1.7	4.1	4.5			6	2.1	0.2	0.6	0.2	0.4	3.2	3.5	3.2	6.9	0.2	0.2

Y_1, 2005-06; Y_2, 2006-07

Table 2: Water use and water use efficiency of castor as affected by irrigation levels (mean of 2 years)

Irrigation levels	Average No. of irrigation	Water use (mm)*	Water use efficiency (kg/ha mm)
IW/CPE 0.3	2.0	349	8.87
IW/CPE 0.5	4.0	469	5.03
IW/CPE 0.7	5.5	559	4.56
35+65+95 DAS	2.5	379	5.25

*Including rainfall and pre-sowing irrigation

and water use efficiency (8.87 kg/ha mm) were recorded compared to lower irrigation frequency treatments. This might be due to maintenance of proper plant water potential which helps in higher photosynthesis rate and also enhanced transport of photosynthet from source to sink.

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Appropriateness of rice technologies perceived by the farmers in R.S. Pura and Samba block of J. & K.

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Abstract

Rice is the most important stable food grains of human race; it is the chief source of food of the half of the world. In India, it occupies a premier place in term of both area and production. The survey was conducted in Samba and R.S. Pura block of Jammu district. Majority of 50.83 percent respondents were old age (above 50 years) groups and educated middle class. 62.49 percent respondent's occupation was agriculture + biomasses and agriculture + service and they living in single family system. In samba and R.S. Pura block majority (74.16 percent) respondents were hear radio some times and 25.83 percent hear regularly. 50.00% respondents watch television sometimes. Majority 83.33-85.00 percent respondents were not treated seed for fungal and bacterial infection before sewing. 45.00 percent respondents were not saw nursery on time and 70 to 75 percent respondents not use recommended area and seed rate, they reduce yield and production. In case of fertilizer respondents used excess dose of nitrogenous fertilizer and less dose of phosphorus fertilizer. Majority 63.33 and 70.83 percent respondents were not use proper weed control measures and lack of knowledge of seedling per hill and spacing at the time of transplanting. Area, Yield and production trends of 31 years were significantly increased, some area production decreased because number of farmers adopting Basmati rice, the yield of Basmati rice is less in comparison to other varieties and secondly due to disturbance on the bodies the peoples have migrated towards other places.

Key words: Infection, nitrogenous, production, varieties, migrated, respondents

Introduction

Agriculture has become a pride of nation economy providing livelihood to about 70 percent of rural people. In India, rice is grown over an area of 43 m. ha. With total production of 87, m. tons. Contributing about 41.8 percent of total food grain. Rice production has increased from 39 million tones in 1964-65 to 87 million tons in 2003-04. The increase in production has been mainly due to improved varieties and better agronomic practices. The irrigated areas have contributed to the grain pool and productivity in the rainfed areas continues to be low.

To meet the targeted rice demand of 134-145 million tons by 2020 the productivity needs to be increased which is possible through refined technology.

In Jammu and Kashmir paddy cultivation is mainly concentrated in Jammu, Anantnag, Kathua, Baramulla and Badgam. Among all the rice producing districts of Jammu and Kashmir major area is concentrated in Jammu district.

In J & K state of India with average of 244.05 th. hectare in production 4153.0 quintals during the year 2000-01.

In J & K paddy is mainly concentrated in Jammu (50.16 th hec), Anantnag (37.58 th. Hac.), Kathua (34.30 th. hac.), Baramulla (27.10 th hac.) and Budgam (24.19 th hac.). In J & K state largest area under paddy is in Jammu district. (Statistical Digest 2000-2001).

Methodology

The survey has been conducted in Samba and R.S. Pura block of Jammu district. 3 villages were selected randomly from each blocks thus six villages were selected. 20 respondents were selected from each village randomly basis, thus the total 120 respondents were selected for thus study. The data were collected with the help of present structured schedule by personally interviewing the respondents. The date was analyzed using appropriate statistical methods.

Results and Discussion

It is evident from Table 1 that majority (50.83%) of respondents from selected blocks were of old age (above 50 years) group and 34.16% respondents were educated occupation were agriculture & business, agriculture & Service and they living in single family system 35.83% respondents annual income is Rs. 50000.

It is also evident from the table that 74.16 percent respondents of both blocks hear radio sometimes and 25.83 percent hear regularly 50 percent respondents

Table 1: Trends in Area production and yield of rice in Jammu district of Jammu & Kashmir (J&K) State

Period-I 1970-71 to 1979-80			
	Area	Production	Yield
C.G.R	8.9192***	4.0323***	-4.492***
S.E	1.8626	1.1617	1.0189
C.V %	24.63	13.74	16.82
Period-II1980-81 to 1989-90			
	Area	Production	Yield
C.G.R	-0.0319 n.s.	-2.8592*	-2.8563*
S.E	0.2369	1.5907	1.6247
C.V %	11.93	13.87	13.97
Period-II1990-91 to 2000-2001			
	Area	Production	Yield
C.G.R	-0.8930**	-2.4064*	-1.4630 n.s.
S.E	0.2964	1.1615	1.050
C.V %	13.88	13.06	10.90
Overall(1970-71 to 2000-2001)			
	Area	Production	Yield
C.G.R	1.3093***	0.3417 n.s.	-0.929**
S.E	0.3417	0.3268	0.2697
C.V %	15.63	15.05	15.65

Note: *** ** and * denote significant at 1, 5 and 10 per cent level of significance respectively.

S.E.: Indicates standard error of the estimated coefficients.

NS: denotes Non significant.

watch television sometimes and 45.83 percent never watch television.

It is evident from table 2 that 13.33 percent respondents not sue selection of seed of seed method for sowing 83.33-85 percent respondents were not treated seed for fungal and bacterial infection before sowing. 45.00 percent were not sow nursery on time, which reduce yield and production. 70 to 75 percent respondents did not use recommended area and seed rate.

In case of fertilizer requirement all the respondents given excess dose of nitrogen and less dose of phosphorus fertilizers but they not apply potassium fertilizers. 63.33 percent respondents not use proper weed control necessaries. 70.83 percent respondents were lack of knowledge of seedling per hill and spacing at the time of transplanting 18.23 percent respondents from both blocks suffer from damage caused by insect pest and 15 percent respondents those which felt that disease are damaging their crop but they are not able to control it. The respondents were threshed on same day, because due to risk of weather and shattering of grain.

It is evident from Table 3 that area, yield and production trends of 31 year from 1970-71 to 2000-01 that area under rice has increased from 223.00th hac.

Table 2: Profile of the respondents with respect to independent variables in the selected villages of Samba and R.S. Pura Block of Jammu district of J & K State.

S.No. Independent Variable	Samba block						Total		R.S. Pura block						Total		Grand Total	
	Tanda		Sordi		Raipe				Badyal		Kotli		Kadyal					
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
1. Age																		
(a) Young 18-40 years	0	0	4	20	4	20	8	13.33	10	50	3	15	9	45	22	36.6	30	25
(b) Middle 40-50 years	1	5	3	15	5	25	9	15	5	25	7	35	8	40	20	33.3	29	24.16
(c)More than 50 years	19	95	13	65	11	55	43	71.66	5	25	10	50	3	15	18	30	61	50.83
2. Education																		
(a)I iterate	10	50	6	30	3	15	19	31.6	1	5	3	15	5	25	9	15	28	23.33
(b)Primary	1	5	2	10	2	10	5	8.33	3	15	1	5	1	5	4	8.33	9	7.5
(c)Middle	5	25	9	45	7	35	21	35	5	25	9	45	6	30	20	33.33	41	34.16
(d)Matric	3	15	3	15	5	25	11	8.33	7	35	5	25	7	35	19	31.66	30	25
(e)Gradyate	1	5	0	0	3	15	4	6.66	3	15	2	10	1	5	6	10	10	8.33
(f) Above	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0.65	1	0.83
3. Occupation																		
(a) Agricuylture only	11	55	6	30	9	45	26	43.33	5	25	7	35	7	35	19	31.66	45	37.5
(b) Agriculture & Business	4	20	5	25	3	15	12	20	5	25	9	45	5	25	19	31.66	31	25.83
(c) Agriculture & Service	5	25	9	45	8	40	22	36.66	10	50	4	20	8	40	22	36.66	44	36.66
4. Family Type																		
(a) Single	8	40	10	50	13	65	31	51.66	16	80	12	60	18	90	46	76.66	77	64.16
(b) Joint	12	60	10	50	7	35	29	46.33	4	20	8	40	2	10	14	23.33	43	35.83
5. Annual Income in (Rs. 000)																		
(a) Less than 50	4	20	12	60	7	35	23	36.33	5	25	9	45	6	30	20	33.33	43	35.83
(b) 50-100	13	65	6	30	112	60	31	51.66	8	40	8	40	13	65	29	48.33	60	50
(c) Above 100	3	15	2	10	1	5	10	16.6	7	35	3	15	1	5	11	18.33	21	17.5
6. Experience in rice cultivation																		
(a) Up to 15 years	2	10	16	80	13	65	31	51.66	14	70	8	40	8	40	30	50	61	50.83
(b) 15-25 years	2	10	2	10	5	25	9	15	3	15	5	25	12	60	20	33.33	29	24.16
(c) Above 25 years	16	80	2	10	2	10	20	33.33	3	15	7	35	0	0	10	16.66	30	25

Table 3 Profile of the respondents with respect to Paddy cultivation in Samba and R.S.Pura block of J&K.

S.No. Particulars	Samba block						Total		R.S. Pura block						Total		Grand Total	
	Tanda		Sordi		Raipe				Badyal		Kotli		Kadyal					
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
1. Seed selection & treatment																		
(a) Selection	3	15	2	10	2	10	7	11.66	4	20	3	15	2	10	9	15	16	13.33
(b) Fungicide	16	80	15	75	17	85	48	80	17	85	17	85	18	90	52	86.66	100	83.33
(c) Bacterial	18	90	17	85	17	85	52	86.66	16	80	18	90	16	80	50	83.33	102	85
2. Nursery																		
(a) Time of sowing	8	40	10	50	10	50	28	46.66	9	45	8	40	9	45	26	43.33	54	45
(b) Pudding	7	35	5	25	7	35	19	31.66	6	30	7	45	6	30	19	31.66	38	31.66
(c) Narsery area	16	80	14	70	12	60	42	70	14	70	13	65	16	80	43	71.66	85	70.83
(d) Seed rate	14	70	13	65	15	75	42	70	17	85	16	80	15	75	48	80	90	75
(e) Nitrogen applied	20	100	20	100	20	100	60	100	20	100	20	100	20	100	60	100	120	100
(f) Phosphorus applied	20	100	20	100	20	100	60	100	20	100	20	100	20	100	60	100	120	100
(g) Un applied	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(h) Weed control	10	15	13	65	15	75	38	63.33	14	70	13	65	11	55	38	63.33	76	63.33
3. Transplanting																		
(a) Time	10	15	12	60	9	45	31	51.66	11	55	9	45	10	50	30	50	61	50.83
(b) Seedling per hill	14	70	13	65	16	80	43	71.66	15	75	14	70	13	65	42	70	85	70.83
(c) Spacing	18	90	15	75	16	80	49	81.66	17	85	15	75	16	80	48	80	97	70.83
4. Chemical weed control																		
(a) Time	9	45	7	35	6	30	22	36.66	8	40	7	35	9	45	24	40	46	38.33
(b) Dose	7	35	7	35	9	45	23	38.33	6	30	8	40	8	40	22	36.66	45	37.5
(c) Method	8	40	9	45	10	50	27	45	9	45	11	55	7	35	27	45	54	45

To 224.05th hac in 2000-01 registered a significant growth rate of 1.31 percent per annum. The production of rice has also showed positive signs with the compound growth rate of 0.3417 percent per annum during the same period, while yield has been decreased at the rate of 0.929 percent per annum. The reason for decreased rate is that now along number of farmers are adopting Basmati rice for production. The yield of Basmati rice is less in comparison to other varieties of rice and secondly due to disturbance on the border the peoples have migrated towards other places due to all variables i.e. area, production and yield have been affected.

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Response of berseem to potassium and manganese under saline irrigation water

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Abstract

Field experiment was conducted with four levels of saline irrigation water (canal water, 3.0, 6.0 and 9.0 dSm^{-1}), three levels of phosphorus (control, 30 and 60 Kg ha^{-1}) and three levels of manganese (control, 7.5 and 15.0 Kg ha^{-1}) and revealed that higher salinity levels decreased significantly the plant height, green foliage yield and nutrient contents (N, P, K, Ca, Mg and Mn) over control. The Na content enhanced by increasing levels of saline irrigation water. Soil application of 60 Kg P_2O_5 ha^{-1} and 15.0 Kg ha^{-1} manganese proved better regarding fodder production of berseem and it can be grown successfully using saline waters up to EC 4.2 dSm^{-1}.

Key words: irrigation, phosphorus, salinity, production, nutrient content

Introduction

The Indian agriculture being primarily cereal production oriented, the main problem, be setting the livestock industry, is the extremely low nutritional status of our cattle feeding of livestock population (343.1 million) has created an acute imbalance between fodder resources and the number of animals as is evidence by the livestock Census 1977 and availability of feeds and fodder (Arora, 1980).

In other words, there exists a big gap between the requirement and available supplies of feeds and fodders. Based on these figures, it is also felt that feeds and fodders available at present can maintain only about half of the existing livestock population.

Berseem is one of the most important fodder's for cultivation in saline water of low sodicity of this region. It acts as cover crop on the soil and protect it from erosion. Besides, berseem being a legume help in building up soil fertility is well known and has been recognized. The benefit has been attributed to the fixation of atmospheric nitrogen through the agencies of bacteria contained in the nodules on the root of plants. Farmers grow berseem generally using nitrogen through chemical fertilizers and they are unable to get economic return under saline environment. The present study is an attempt to find out the 'Response of berseem to potassium and manganese under saline irrigation water'.

Materials and Methods

Field experiments were conducted at R.B.S. College, Research Farm, Bichpuri, Agra during Rabi seasons of 2004-2005 and 2005-2006. The soil of the experimental filed was sandy loam in texture with pH 8.4, EC 3.0 (dSm^{-1}) organic carbon 4.3 g Kg^{-1}, available N 185.5 Kg ha^{-1}, available P 12.5 Kg ha^{-1}, available K 249.0 Kg ha^{-1} and available Mn 3.9 mg Kg^{-1}. The experiment was laid out with three replication in split plot design with four EC levels as canal water (S_1), 3.0 (S_2), 6.0 (S_3) and 9.0 (S_4) dSm^{-1}, three phosphorus levels as control (P_0), 30.0 (P_1) and 60.0 (P_2) Kg ha^{-1}, three levels of manganese as control (Mn_0), 7.5 (Mn_1) and 15.0 (Mn_2) Kg ha^{-1}. Recommended dose of nitrogen (20 Kg ha^{-1}) and potassium (40 Kg ha^{-1}) were supplied to every plot through urea and muriate of potash, respectively. The irrigation water of different salinity levels (3.0, 6.0 and 9.0 dSm^{-1}) were prepared by adding the calculated amount of $CaCl_2$, $MgSO_4$, $MgCl_2$ and NaCl salt in canal water. The Pusa Giant variety of berseem was grown up to three cuttings (25 days interval). The plants were irrigated with specified treatments. The observation data were recorded as when required at different growth stages. After harvesting the plants samples were first dried in the sun and finally in oven at 70^0 C. After grinding in a Wiley mill, the samples were stored in wide mouth glass stopped bottle with proper labeling for chemical analysis.

Results and Discussion

Effect on plant height

It is evident from Table 1 that the plant height of berseem declined significantly with increasing levels of irrigation water as compared to control during both the years of experimentation. The maximum significant reduction in plant height was noted at highest level of salinity (S_4) over control during Rabi 2004-2005 and 2005-2006. On the basis of mean data of two years, the plant height decreased by 10.34, 21.35 and 41.92

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Table 1: Effect of water salinity, phosphorus and manganese on plant height (pooled data of cuttings) and green foliage yield of berseem.

Treatment	Plant height (cm)			Green foliage yield (q ha^{-1})		
	2004-2005	2005-2006	Mean	2004-2005	2005-2006	Mean
Salinity levels						
S_1	27.50	28.80	28.15	68.66	70.42	69.54
S_2	24.67	25.80	25.24	47.02	48.52	47.77
S_3	21.57	22.70	22.14	40.91	42.07	41.49
S_4	15.67	17.03	16.35	26.98	28.09	27.54
S.Em±	1.469	1.445		1.887	1.725	
C.D. at 5%	4.15	4.08		5.33	4.87	
Phosphoruslevels						
P_0	22.07	23.10	22.59	44.58	45.62	45.10
P_1	25.53	26.40	25.97	58.92	60.37	59.65
P_2	28.50	29.30	28.90	70.71	72.53	71.62
S.Em±	0.374	0.327		1.345	1.292	
C.D. at 5%	1.05	0.925		3.80	3.65	
Manganeselevels						
Mn_0	23.43	24.10	23.77	45.74	46.80	46.27
Mn_1	26.53	27.50	27.02	60.81	62.23	61.52
Mn_2	29.33	30.00	29.67	68.65	70.48	69.56
S.Em±	0.374	0.327		1.345	1.292	
C.D. at 5%	1.05	0.925		3.80	3.65	

Table 2: Effect of water salinity, phosphorus and manganese on nutrient composition (N, P, K, ca, Mg and Mn) of berseem (Pooled data of two years)

Treatments	Nutrient contents						
	Nitrogen(%)	Phosphorus(%)	Potassium(%)	Ca(%)	Mg(%)	Na(%)	Mn(ppm)
Salinity levels							
S_1	2.49	0.89	1.55	0.44	0.26	0.18	183.82
S_2	1.99	0.53	1.39	0.40	0.24	0.21	170.21
S_3	1.63	0.45	1.28	0.30	0.20	0.24	146.68
S_4	0.81	0.30	0.86	0.23	0.13	0.27	141.41
S.Em±	0.0094	0.0179	0.0088	0.0065	0.0076	0.00164	0.00154
C.D. at 5%	0.026	0.0505	0.0248	0.0186	0.0215	0.0465	0.0437
Phosphoruslevels							
P_0	1.56	0.59	1.49	0.36	0.22	0.22	183.60
P_1	1.66	0.66	1.55	0.39	0.25	0.19	197.49
P_2	1.74	0.82	1.63	0.45	0.28	0.18	206.39
S.Em±	0.00486	0.0066	0.0042	0.00484	0.00178	0.0067	0.0072
C.D. at 5%	0.0137	0.0187	0.0119	0.0136	0.0504	0.0189	0.0204
Manganeselevels							
Mn_0	1.50	0.61	1.46	0.35	0.20	0.23	140.30
Mn_1	1.63	0.69	1.57	0.37	0.23	0.20	158.88
Mn_2	1.99	0.74	1.62	0.43	0.27	0.17	182.74
S.Em±	0.00486	0.0066	0.0042	0.00484	0.00178	0.0067	0.0072
C.D. at 5%	0.0137	0.0187	0.0119	0.0136	0.0504	0.0189	0.0204

Percent with S_2, S_3 and S_4 levels of salinity over control, respectively. Similar results were observed by Singh et al., (2002).

Further evaluation of data (Table 1) indicate that the plant height of berseem increased significantly with increasing doses of phosphorus or manganese application as compared to control during both the years of experimentation. The maximum plant height of berseem was recorded under highest level P_2 (60 Kg ha^{-1}) of phosphorus/ or Mn_2 (15.0 Kg ha^{-1}) level of manganese. On the basis of mean data of two years, the plant height increased by 14.96 and 27.93 percent

with P_1 and P_2 levels of phosphorus over control, respectively. Similarly, the plant height increased by 13.67 and 24.82 percent with Mn_1 and Mn_2 levels of manganese over control, respectively. Similar results were also reported by Chandel (2010), Pathan et al., (2010) and Singh et al., (2010**).**

Effect on green foliage yield:

An evaluation of data given in Table 1 show that the green foliage yield of berseem decreased significantly with rising salinity levels of irrigation water in comparison to control during both the years. The maximum significant reduction in fresh weight was recorded at highest salinity level (S_4) of irrigation water over control. On the basis of mean data of two years, the salinity levels S_2, S_3 and S_4 resulted 31.30, 40.34 and 60.40 percent reduction in green foliage yield of saline irrigation water was also noted by Singh et al., (2002), Prasad et al., (2010) and Sisodia et al., (2010).

In general, green foliage yield of berseem improved by the application of phosphorus or/ manganese during both the years of experimentation. On the basis of mean data of two years, the phosphorus levels P_1 (30 Kg ha^{-1}) and P_2 (60 Kg ha^{-1}) resulted 32.26 and 58.80 Percent enhancement in green foliage yield over control, respectively. Similarly, green foliage yield increased by 32.96 and 50.35 percent with Mn_1 (7.5 Kg ha^{-1}) and Mn_2 (15.0 Kg ha^{-1}) over control, respectively. These results are in agreement with the opinion of Chandel (2010) and Singh et al., (2010).

Effect on nutrient composition:

It could be inferred from Table 2 that the N, P, K, Ca, Mg and Mn contents of berseem reduced significantly with each higher level of salinity as compared to control, whereas the Na content of berseem enhanced with increasing levels of salinity of irrigation water. It is also noted except the Na content of berseem, the N, P, K, Ca, Mg and Mn contents improved significantly with the application of phosphorus or /manganese over control. The highest levels of phosphorus and manganese proved better in case of nutrient composition of berseem fodder crop. Similar to these findings by Chandel (2010), Pathan (2010), Singh et al., (2010) and Sisodia et al., (2010).

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Problems/constraints faced by the farmers in borrowing and by the financial institutions in lending the agricultural loans in Jaipur district Rajasthan

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Abstract

An attempt was made to identify the major constraints faced by the farmers in borrowing as well as by the financial institutions in lending the agricultural loans in Jaipur district of Rajasthan. The results of opinion survey revealed that 84.61 percent farmers faced the problem of inadequate supply of loan for their requirements and 76.47 percent farmers did not have proper knowledge about bank credit formalities. About 75 percent of the farmers reported that the borrowing procedure was very time consuming. The problem of lengthy and difficult lending procedure was expressed by 74.66 percent farmers. In addition to above, other problems reported by the farmers were insufficient time period for repayment and existence of insufficient financial institutions in the study area. On the other hand, inadequacy of staff and influence of economically powerful farmers in getting the loan sanctioned were the major problems faced by the financial institutions. All the staff members of commercial banks, two-thirds of managers and one-third of assistant managers of RRBs and only one-fourth of general managers of co-operative societies pointed out that the farmers had large overdues. Besides, the other main problems faced by the financial institutions were improper utilization of sanctioned loan, mass exemption of loan by the Government and low education level of the farmers.

Keywords: Borrowing, constraints, farmers lending, financial institutions, agricultural loans.

Introduction

Agriculture is the backbone of Indian economy which plays an important role in the economic development of India. Agriculture is the source of livelihood of more than 52% of the population in the country and it contributes about 16% to GDP. This way, agriculture is not a business but the way of life of majority of the population. Most of the farmers followed traditional method of cultivation and can no longer support the demand for increasing population in the country. To meet the requirement of the growing population and rapid developing economy, agriculture has to grow fast and get modernized. This requires the use of high pay off inputs, adoption of high yielding varieties, fertilizers, plant protection chemicals, modernized equipments and machineries which need huge investment.

The agricultural sector of the Indian economy is labour intensive, land poor and capital scarce. So it would be very difficult to get the benefits of modernization of agriculture without adequate credit to the farmers at reasonable interest.

The institutional credit system in India started with the passing of the credit Co-operative Act in 1904. At present, agricultural credit is disbursed through a multiagency network consisting of Commercial Banks, Regional Rural Banks (RRBs) and Co-operative Banks. The institutional credit network has expanded through the breadth and length of the country but their expansion and working are not free from various controls. Similarly, the majority of the farmer borrowers being illiterate is unaware of the loaning procedure and, therefore, hesitates to approach the financing institutions. In this study an attempt has been made to investigate the major problems being faced by the banking institutions in lending and by the farmers in borrowing the loans.

Methodology

The present study was conducted in Jaipur district of Rajasthan. Out of thirteen panchayat samitis of the district, only two panchayat samitis namely; Govindgarh and Sambhar Lake were randomly selected for the study purpose. From each panchayat samiti, two gram panchayats were selected at random and all the villages falling within each selected gram panchayat were selected for further investigation. Thereafter, a sample of 221 farmers consisting of 55 marginal, 51 small, 45 semi-medium, 52 medium and 18 large farmers was selected by using the random sampling technique. All the financial institutions falling within the study area

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and all of their staff were selected for constraints analysis. The opinions of the farmers regarding the constraints faced by them during the borrowing process and that of the staff members of financial institutions in the lending process were properly recorded by personally interviewing them for the agricultural year 2005-06. For identifying the problems faced by the farmers as well as the financial institutions, parameters of the constraints were enquired into and simple percentages and averages were computed to arrive at the conclusions.

Results and Discussion

1. Constraints faced by the farmer borrowers

The empirical results regarding the problems faced by the farmer borrowers in borrowing the loan from the credit agencies in the study area are presented in table 1. The table shows that 84.61 percent of the farmer borrowers expressed that the supply of loan was short of their requirements. Category-wise, 87.27 percent of marginal, 82.35 percent of small, 84.44 per cent of semi medium, 78.85 percent of medium and all of the large farmer borrowers reported to have faced this problem. Further, 72.73 per cent of marginal, 78.43 per cent of small, 84.44 percent of semi- medium, 86.54 per cent of medium and 72.22 per cent of large farmer borrowers disclosed that the scale of finance was very low. The study results also revealed that 76.47 per cent of farmer borrowers did not have proper knowledge about bank's formalities.

As regards the problem of time consuming procedure of borrowing, 75.11 percent of the farmer borrowers reported that the borrowing procedure was very time consuming. This problem was more acute on medium sized farms (94.23 per cent) as compared to that on the semi-medium sized farms (93.33 per cent). About three-fourths (74.66 per cent) of the farmer borrowers expressed the problem of lengthy and difficult lending procedure and 96.15 percent of medium and all of the large farmer borrowers reported to have faced this problem. Moreover, 81.82 percent of marginal, 84.31 percent of small, 75.55 percent of semi-medium, 57.69 percent of medium and only 44.44 percent of large farmer borrowers disclosed that the time period for repayment of the loan was insufficient.

Existence of insufficient credit agencies in the study area was another problem faced by 72.85 percent of farmer borrowers. Category-wise, 43.64 percent of marginal, 70.59 percent of small, 86.67 percent of semi-medium, 86.54 percent of medium and 94.44 percent of large farmer borrowers reported to have faced this problem. About 70 percent of farmer borrowers pointed out that red-

Table 1: Problems/constraints faced by farmers in borrowing the agricultural loans from the financial institutions

S.No. Constraints	Marginal(55)	Small(51)	Semi-medium(45)	Medium(52)	Large(18)	Total(N=221)	Rank
1. Inadequate amount of loan	48(87.27)	42(82.35)	38(84.44)	41(78.85)	18(100.00)	187(84.61)	I
2. Lengthy and difficult lending procedure	25(45.45)	30(58.82)	42(93.33)	50(96.15)	18(100.00)	165(74.66)	V
3. Lack of proper technical guidance	17(30.91)	15(29.41)	20(44.44)	22(42.31)	8(44.44)	82(37.10)	XIV
4. Higher interest rate	7(12.73)	10(19.61)	25(55.55)	33(63.46)	14(77.78)	89(40.27)	XIII
5. Insufficient time for repayment	45(81.82)	43(84.31)	34(75.55)	30(57.69)	8(44.44)	160(72.40)	VII
6. Inflexibility in the structure of credit instalments for repayment	5(9.09)	10(19.61)	18(40.00)	20(38.46)	4(22.22)	57(25.79)	X
7. Lack of knowledge about bank's formalities	47(85.45)	42(82.35)	30(66.67)	35(67.31)	15(83.33)	169(76.47)	III
8. Credit not available in time	40(72.73)	37(72.55)	35(77.78)	31(59.61)	8(44.44)	151(68.32)	IX
9. Borrowing procedure was time consuming	25(45.45)	35(68.63)	42(93.33)	49(94.23)	15(83.33)	166(75.11)	IV
10. Non-cooperation from bank's personnel	30(54.54)	28(54.90)	20(44.44)	31(59.61)	10(55.55)	119(53.85)	VI
11. Low scale of finance	40(72.73)	40(78.43)	38(84.44)	45(86.54)	13(72.22)	176(79.64)	II
12.High cost of credit	20(36.36)	22(43.14)	35(77.78)	42(88.77)	16(88.89)	135(61.08)	X
13. Production inputs not available on time	15(27.27)	17(33.33)	32(71.11)	35(67.31)	17(94.44)	116(52.49)	XII
14. Red-tapism was rampant	40(72.73)	38(74.51)	35(77.78)	30(57.69)	12(66.67)	155(70.13)	VIII
15. Prevalence of corrupt practices	5(9.09)	7(13.72)	11(24.44)	13(25.00)	7(38.89)	43(19.46)	XV
16. Insufficient credit agencies in the study area	24(43.64)	36(70.59)	39(86.67)	45(86.54)	17(94.44)	161(72.85)	VI

Figures in parentheses are the percentages by the total

tapsim was rampant in the loaning system. Category-wise, 72.73 percent of marginal, 74.51 percent of small, 77.78 percent of semi-medium, 57.69 percent of medium and 66.67 percent of large farmer borrowers reported to have faced this problem. Moreover, 72.73 percent of semi-medium, 59.61 percent of medium and 44.44 percent of large farmer borrowers disclosed that the amount of credit was not available on time.

The problem related to high cost of credit was more acute on large sized farms (88.89 per cent) followed by medium (88.77%), semi-medium (77.78 per cent), small (43.14%) and marginal (36.36%) farms. About 54 percent of farmer borrowers pointed out that the bank's staff was non-cooperative in nature. Category-wise, 54.54% of marginal, 54.90% of small, 44.44 percent of semi-medium, 59.61% of medium and 55.55 percent of large farmer borrowers reported to have faced this problem. 52.49 percent of the farmer borrowers reported that they could not got avail of the production inputs at the time of sowing. This problem was more acute on large farms (94.44%) as compared to semi-medium farms (71.11%). The problem of charging higher interest rate was more acute on large farms (77.78 per cent) followed by medium (63.46 per cent), semi-medium (55.55%), small (19.61%) and marginal (12.73%) farms.

About 37 percent of farmer borrowers expressed that there was lack of proper technical guidance and 25.79% of farmer borrowers reported that there was rigidity in the repayments of loan instalments. Only 19.46% of farmer borrowers reported that there was prevalence of corrupt practices in sanctioning of loans.

2. Constraints faced by the staff members of financial institutions

The problems faced by the financial institutions in lending the loan in the study area are presented in Table 2. The results reveal that cent percent of staff members engaged in lending process expressed the problem of inadequate staff and influence of economically powerful farmers in getting the loan sanctioned.

As regards the problem of overdues, all the staff members of the commercial banks, 66.67 percent managers and 33.33 percent assistant managers of RRBs and 25.00 percent general managers of co-operative societies pointed out that the farmers had large overdues. In the opinion of 60.00 percent managers, 40.00 percent assistant managers and cent percent agricultural and marketing officers of commercial banks, the lending policy was defective. About 33 percent

Table 2: Problems / constraints faced by the staff members of financial institutions in lending the agricultural loans

S. No. Constraints	Commercial banks				Regional rural banks		Co-operatives	Total (N=24)	Rank
	Manager (5)	Assit. Manager(5)	A.O.(2)	M.O./ M.R.O.(2)	Manager (3)	Assit. Manager(3)	General Manager (4)		
1. Inadequate staff	5(100.00)	5(100.00)	2(100.00)	2(100.00)	3(100.00)	3(100.00)	4(100.00)	24(100.00)	I
2. Improper utilization of loan	3(60.00)	4(80.00)	2(100.00)	1(50.00)	2(66.67)	2(66.67)	1(25.00)	15(62.50)	VI
3. Having large overdues	5(100.00)	5(100.00)	2(100.00)	2(100.00)	2(66.67)	1(33.33)	1(25.00)	18(75.00	IV
4. Lack of co-ordination with other banks	2(40.00)	2(40.00)	1(50.00)	2(100.00)	1(33.33)	1(33.33)	-	9(37.50)	XII
5. Conversion of loans	2(40.00)	2(40.00)	1(50.00)	1(50.00)	2(66.67)	1(33.33)	-	9(37.50)	XII
6. Mass exemption of loan	3(60.00)	2(40.00)	1(50.00)	1(50.00)	2(66.67)	2(66.67)	2(50.00)	13(54.17)	VIII
7. Influence of economically powerful farmers	4(80.00)	5(100.00)	2(100.00)	2(100.00)	3(100.00)	3(100.00)	4(100.00)	23(95.83)	II
8. Low education level of farmers	4(80.00)	5(100.00)	2(100.00)	1(50.00)	2(66.67)	2(66.67)	3(75.00)	19(79.17)	III
9. Insufficient computer knowledge	3(60.00)	3(60.00)	1(50.00)	1(50.00)	2(66.67)	3(100.00)	3(75.00)	16(66.67)	V
10. Lack of strict action against defaulters	3(60.00)	3(60.00)	2(100.00)	1(50.00)	3(100.00)	2(66.67)	-	14(58.33)	VII
11. Wrong sanctioning of loans by the previous managers	3(60.00)	1(20.00)	1(50.00)	2(100.00)	2(66.67)	1(33.33)	-	10(41.67)	XI
12. Lack of conveyance facility for farm visits for laon recovery	3(60.00)	2(40.00)	-	-	3(100.00)	3(100.00)	-	11(45.83)	X
13. Absence of linking of credit with marketing	1(20.00)	1(20.00)	2(100.00)	1(50.00)	1(33.33)	2(66.67)	-	8(33.33)	XIII
14. Defective lending policy	3(60.00)	2(40.00)	2(100.00)	2(100.00)	1(33.33)	2(66.67)	-	12(50.00)	IX

Figures in parentheses are the percentages by the total

of managers and 67 percent assistant managers of RRBs, too, expressed the same problem. This problem was not pointed out by any general manager of the co-operative societies in the study area. 60.00 percent each of the mangers and assistant managers, 50.00 percent of agricultural and marketing officers of commercial banks, 66.67 percent of managers and all of the assistant managers of RRBs and 75.00 percent general managers of co-operative societies pointed out that the computer knowledge of staff members was insufficient.

The problem of not in taking strict action against defaulters was more acute for agricultural officers (100 per cent), followed by managers and assistant managers (80 per cent) and marketing officers (50 per cent) of commercial banks. This problem was also faced by cent percent managers and 66.67 percent assistant managers of RRBs. It was not found in co-operative societies. Wrong sanctioning of loans by previous managers was another problem reported by 60 percent managers, 20 percent assistant managers, 50 percent agricultural officers and all the marketing officers of commercial banks. It was also faced by 66.67 percent managers and 33.33 percent assistant managers of RRBs. General Managers of co-operative societies did not report this problem.

The problem of mis-utilization of credit was another problem faced by all the agricultural officers, followed by 80 percent assistant managers, 60 percent managers and 50 percent marketing officers of the commercial banks. About 67 percent managers and assistant managers of RRBs and 25 percent general managers of co-operative societies also faced this problem. Lack of co-ordination among banks was another problem faced by 40 percent each of managers and assistant managers, 50 percent of agricultural officers and all the marketing officers of the commercial banks and 33.33 percent each of managers and assistant managers of RRBs. This problem was not faced by any general manager of co-operative societies.

So far as the problem of mass exemption of loan was concerned, 60 percent managers, 40 percent assistant managers and 50 percent each of agricultural and marketing officers of commercial banks pointed out that there were mass exemption of loan. About 67 percent managers and assistant managers of RRBs and 50 percent general managers of co-operative societies also reported to have faced this problem.

The problem of loan conversion was more acute for managers (66.67 per cent) of RRBs, followed by agricultural and marketing officers (50 per cent) of commercial banks, managers and assistant managers (40 per cent) of commercial banks and assistant managers (33.33 per cent) of RRBs. Eighty percent managers, cent percent assistant managers and agricultural officers and 50 percent marketing officers of commercial banks pointed out that most of the farmer borrowers were less educated. This problem was also faced by 66.67 percent of managers and assistant managers of RRBs and 75 percent general managers of co-operative societies in the study area.

As regards conveyance facility for farm visits for loan recovery, 60 percent managers and 40 percent assistant managers of commercial banks, all of the managers and assistant managers of RRBs pointed out that there was lack of vehicle facility for farm visits. The agricultural and marketing officers of commercial banks did not face this problem because they were already equipped with vehicle facility for farm visits. Twenty percent each of managers and assistant managers, all of agricultural officers and 50 percent of marketing officers of commercial banks disclosed that there was no linking of credit with marketing. 33.33 percent of managers and 66.67 percent of assistant manager of RRBs also reported to have the same opinion.

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Effect of different weedicides on yield attributing characters and micro-organisms in soybean crops

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Abstract

Field studies were conducted to evaluate the effect of different weedicide treatments on microbial population of soil in soybean. The experiment was carried out at College of Agriculture, Gwalior during Kharif season 2006-07. JS-335 variety was sown in 4.5 X 5.0 meter square plots, with three replications in RBD. There were sixteen treatments including weedy check. It was revealed that the application of weedicides affect the population count of Rhizobia and Phosphorus solublising bacteria than the initial level same dose of pendimethilin, chlorimuron ethyl, fenoxaprop, combination of chlorimuron ethyl + fenoxaprop and cultural operations enhanced the Rhizobial population after the crop however, application of Glaxy, trifluraline, imazathapyre, tergasuper and mulching caused reduction in the population.

Key words: Weedicides, Rhizobia, Chlorimuron ethyl, Fenoxaprop Glaxy, Trifluraline, Imazathapyre

Introduction

Soybean [Glycin max (L) Merril] is an one of the most important kharif oil seed crop of Madhya Pradesh. Besides high yield potential (20-30 q/ha) it also provides cholesterol free oil (20%) and high quality protein (38.42%). It is rich source of amino acid, vitamins, minerals, fats and dietary value. It is capable of fixing atmospheric nitrogen at the rate 85-115 kg/ ha/year (Alexander, 1977) with symbiosis through Rhizobium Japonicum bacteria, after fulfillment of its requirement. Low yield of soybean due to weeds have been considered to be prime importance. The losses caused by weeds exceed loss from any other category of agricultural pests (Subramaniam et al. 1995). Application of weedicides to control is imperative. A major portion of the weedicides applied as a foliar spray ultimately gets mixed with soil. The modern weedicides are organic in nature. The weedicides molecules may interact with soil constituents and get absorbed on the soil particles, which may be ultimately effect the availability of nutrients. Evaluation herbicide effects, especially from repeated and long term use, are essential to ensure optimum functioning of soil biota, nutrient availability and plant growth. Hence, this investigation was carried out to study the effect of different weedicides treatments on yield of soybean and nutrient content in the plant and soil.

Materials and Methods

The Experiment was conducted during the kharif seasons of 2007 and 2008 at the research farm, college of Agriculture, Gwalior (M.P.). The experiment was laid out in the randomized block design (RBD) with 16 treatments (including one control i.e. weedy check) having three replications. Treatments comprised of trifluralin @ 1.0 kg/ha as pre plant incorporation (T_1), clomazone + Pendimethalin 1.5kg/ha as pre-emergence (T_2), clomazone + @ 2.0kg/ha Pendimethalin as pre –emergence (T_3), clomazone +Pendimethalin @ 2.5kg/ha as pre–emergence (T_4), pendimethalin @ 1.0 kg/ha as pre-emergence(T_5), imazethapyr @ 100 g/ha as post-emergence (at 20 DAS) (T_6), chlorimuron ethyl @ 9 g/ha as post-emergence (20 DAS) (T_7) Fenoxaprop @ 90 g/ha as post-emergence (at 20 DAS) (T_8), quizalopfop ethyl 100 g/ha as post emergence (at 20 DAS) (T_9), chlorimuron ethyl + fenoxaprop 9+90 g/ha as post emergence (at 20 DAS) (T_{10}), hoeing once at 20 DAS (T_{11}), hand weeding once at 20 DAS (T_{12}), hand weeding +hoeing at 20 and 30 DAS (T_{13}) , weed free (3 hand weeding at 20,35 and 50 DAS) (T_{14}), mulching by green weeds at 20 DAS (T_{15}) and weedy check (T_{16}). The soil was sandy loam, having ph 7.8, EC 0.14 dS/m organic carbon 0.32 %, available N 210 kg/ ha, available P 12.50 kg/ha and available K 333 kg/ha. The soybean (C.V. J.S. 335) was sown @ 100kg/ha on 12 July in 2007 and was harvest 14 October in 2007. Nitrogen, Phosphorus and Potash through urea, single super phosphate (SSP) and muriate of potash. A uniform dose of nitrogen, phosphorus and potash at the rate of 20:60:20. Full dose of N, P and K applied at basal at the time of sowing.

For nodulation at 60 days of growth five plants were randomly uprooted from each treatment without damaging root system, then roots were washed and

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nodules were counted the dry weight. Nodules root and shoot were taken after drying at 80 ^{0}C. How ever yield attributing characters were recorded at maturity and seed, dry biomass were recorded at maturity and seed dry biomass were recorded after harvest the crop. The data were analysed after suitable compilation.

Results and Discussion

The major weeds in the experimental plot were *Panicum Colonum, Cyprus rotandus Eragrostis (among monocots), Euphorbia hirta, Commelina begnalensis, Digra aryensis* (among dicots). Density of Dicot weeds was more as compared to monocot weeds results depicted in table 1 were revealed that the yield attributing characters, viz. plant height, number of branches /plant, pods/plant, 100 grain weight were maximum and significantly more under T_{14} over as compared to T_{16} and other superior treatments (table 1) were T_5 and T_{13} which were statically at par with T_{14} for increasing the yield attributes. The 100 grain weight was not significantly affected by any of the treatments.

The yield of soybean enhanced significantly by all the herbicides and their mixtures and cultural weeds control treatments. The increase in yield with weed control treatments was due to considerable reduction in population of both monocot and dicot or grasses and broad leaves weeds. The seed and straw yield was also significantly improved by treatment $T_{5,}$ $T_{6,}$ $T_{7,}$ T_8 over T_{16}. Bhan et al. (2002) also reported in yield with pendimethalin (1.0-2.5 kg/ha) and chlorimuron ethyl (9 g/ha) herbicides. However, in the experiment herbicidal mixtures especially T_{10} resulted 141.12 per cent increase in seed yield. Which was much higher as compared to other herbicides treatments? The superiority of this herbicidal mixture treatment might be owing to better control of both types (narrow and broad leaves) of weeds. Over rest of the treatments including weedy check $T_{16.}$ The highest mean of seed and straw yield (1630 kg/ha and 2343 kg/ha) were recorded under weed free treatments $T_{14.}$ The higher yield in weed free treatments T_{14} was attributed mainly due to significantly improvement in yield attributes, reduction in crop weed competition and improved aeration, higher rate of nitrogen fixation by the soybean crop. Similar finding was reported by Bhan et al. (2002. It is evident from the results that the content of nutrient as well as uptake in seed and straw were significantly affected addition of herbicides as pre and post emergence than weedy check $T_{16.}$ Highest content and uptake of N, P and K in seed and straw under weed free (T_{14}) treatments compare an other herbicides treatments same result obtained by Jat et al. (2002). Application of T_{10} increased the content of nutrients and uptake in seed and straw over these herbicides applied alone. This might be due to proper management of monocot and dicot weeds and more availability of nutrients for soybean crop. Kurchania et al. (2001) also reported that fenoxaprop herbicide mixed with chlorimuron ethyl controlled monocot weeds. Application of different weedicides applied as pre or post emergence stage as well as cultural operations did not showed any changes in soil Ph, electrical conductivity, available phosphorus and potassium content, except nitrogen content. The population of the Rhizobium and phosphate solubilizing bacteria are indicated that application of weedicides

Table 1: Effect of different weedicide treatments on yield attributing characters and seed Straw yield of soybean (Means data of two years)

Treatments	Plant height (cm/plant)	No.of branches/ plant	No.of pods/ plant	100 seed weight (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
T_1	48.13	3.13	34.27	9.67	8.39	1503
T_2	51.8	3.80	32.27	9.00	796	1387
T_3	46.40	3.53	31.27	10.00	1066	1474
T_4	52.73	3.87	34.13	9.67	1301	1772
T_5	54.20	4.40	37.00	10.00	1371	1754
T_6	54.13	3.93	36.33	10.00	1324	1364
T_7	53.80	3.93	36.53	9.00	1309	1311
T_8	53.33	3.53	33.47	9.00	1039	1329
T_9	51.40	3.13	32.47	9.33	803	1474
T_{10}	50.10	3.70	35.13	9.00	1501	1795
T_{11}	47.53	3.47	35.33	9.00	886	1247
T_{12}	53.40	3.73	34.40	9.00	1218	1282
T_{13}	54.20	4.13	37.40	9.00	1346	1364
T_{14}	57.00	4.87	40.00	9.00	1630	2343
T_{15}	44.80	3.47	33.67	10.00	1146	1265
T_{16}	44.53	2.07	24.33	9.00	618	1189
SE (m)	1.47	0.17	1.23	0.51	128	105
CD at 5%	4.26	0.50	3.56	NS	365	303

Table 2: Effect of different weedicide treatments on soil properties after harvest of crop (Mean data of two years)

Tr.No.	**Initial Status** Treatments	**10.83X10 ^{3} /g** Rhizobium inoculation(X10^3/g soil)	**4.00X10 ^{4} /g** PSB inoculation(X10^4/g soil)
T_1	Trifluralin @ 1.0kg/ha	9.13	3.13
T_2	Clomazone+ Pendimethalin 1.5kg/ha	9.63	3.66
T_3	Clomazone+@2.0kg/ha pendimethalin	9.33	3.9
T_4	Clomazone +Pendimethalin @ 2.5kg/ha	9.50	4.25
T_5	Pendimethalin @ 1.0 kg/ha	10.03	4.23
T_6	Imazethapyr @ 100 g/ha	9.86	4.66
T_7	Chlorimuron ethyl @ 9 g/ha	11.03	3.86
T_8	Fenoxaprop @ 90 g/ha	11.67	4.13
T_9	Quizalopfop ethyl 100 g/ha	9.00	3.50
T_{10}	Chlorimuron ethyl + fenoxaprop 9+90 g/ha	11.00	4.33
T_{11}	Hoeing once at 20 DAS	10.66	4.00
T_{12}	Hand weeding once at 20 DAS	11.03	4.16
T_{13}	Hand weeding +hoeing at 20 and 30 DAS	11.66	4.66
T_{14}	Wweed free (3 hand weeding at 20,35 and 50 DAS)	11.83	5.33
T_{15}	Mulching by green weeds at 20 DAS	9.86	3.66
T_{16}	weedy check	10.33	3.00
SE± (m)		0.84	0.46
CD at 5%		10.83	4.00

affect the population of Rhizobia and phosphate solubilizing bacteria as compare to the initial population but some of the treatments like T_5, T_7, T_8, T_{10}, T_{11}, T_{12}, T_{13}, T_{14} and even weedy check enhanced the rhizobial population after the soybean crop. Application of Glaxy, trifluraline, imazethapyr, Terga super and mulching reduced the microbial status but it was numerical only.

A close look on the data of phosphate solubilizing bacteria in the soil also showed a significant variation under different treatment. Phosphorus solubilizing bacteria in the soil was ranges between 3.00 – 5.33 x 10^4 g^{-1} soil Maximum population was recorded under treatment weed free (T_{14}) and minimum under control or weedy check (T_{16}).

It was clear from the observations that the cultural operation enhanced the microbial population in the soil as compared to the control or weedicide application. Which indicates that application of weedicide in recommended dose did not affect the microbial population significantly?

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Hetrosis studies and identification of superior crosses in okra (*Abelmoscus esculentum* L. Moench.)

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Abstract

Eighteen genotypes consisting of 15 lines and three testers were crossed in line x tester mating design. The 45 hybrids and their parents were used to estimate of heterosis for 10 characters including pod yield per plant over three different environments. The crosses L_9 x T_1, L_4 x T_2, L_1 x T_2, L_{13} x T_1 and L_4 x T_1 were identified as potential crosses as they showed high per se *performance, heterobeltiosis over various environments.*

Key words: Lady finger, Heterosis, heterobeltiosis, hybrid, okra

Introduction

Okra commonly known as bhindi (*Abelmoschus esculantus* (L.) Moench) is an important annual vegetable crop and has a prominent position among vegetables due to its wide adaptability, year round cultivation, export potential and high nutritive value. It belongs to the family Malvaceae and genus *Abelmoschus.* There are 38 species of this genus in the world. The species *esculentus* (L.) Moench is most widely grown. The vitamin and mineral rich okra is a prized vegetable in the Indian sub-continent. High yielding capacity with medium long, tender, spineless, light green pods and resistance to biotic and abiotic stresses are considered to be the pre-requisites for breeding a good okra variety. Existing commercial varieties do not posses all the desirable characteristics. With the ease in fruit set and having capacity to produce more seeds in a single fruit, okra can be well exploited for hybrid seed production. The heterosis-breeding programme intended to develop a hybrid variety involves analysis of combining ability and identification of desirable parents. Producing F_1 hybrids having high level of economic heterosis, Therefore, present investigation was carried out to estimate the magnitude of heterosis for fruit yield and its contributing characters in okra.

Materials and Methods

Fifteen lines i.e. heritage Green, GO-2, BO-2, Punjab Padmini, Harbhajan, Nirmal-303, Co-3, Pusa Sawani, Swati-10, Swati-25, Ankur-40, VRO-5, VRO-6, Ratnaraj and Varsha Uphar as female parents and three testers i.e. Parbhani Kranti, Arka Abhay and Arka Anamika as male parents were mated in line x tester fashion. The 45 hybrids were raised in randomized block design with three replications in three environments namely summer 2005, rainy 2005 and summer 2006. A single row of 12 plants was allotted for each entry with a spacing of 45 cm between row and 30 cm between plants in a row in all the environments. The characters mean was used to estimate relative heterosis, heterobeltiosis and economic heterosis. Three checks i.e. Sel. 51, NB-55 and Nirmal-101 were used for estimation of the standard heterosis.

Results and Discussion

Higher yield is the basic objective of all crop improvement programmes and unless a new hybrid has a potential equal to or exceeding that of current cultivar or hybrid, it will fetch no success even if it has excellent quality. Appreciable amount of heterosis observed over the mid parent (38.25% in E_1) and better parent (31.52% in E_2) for yield per plant showed good scope of heterosis breeding in improvement of okra.

For important character like yield per plant, 10 hybrids in E_1 and 9 hybrids in E_2 exhibited significant and positive relative heterosis, out of which, L_1 x T_3 (38.25 %) in E_1 and L_{11} x T_1 (35.97%) in E_2 manifested highest heterosis whereas three crosses showed significant heterobeltiosis in each E_1 and E_2 environment. The maximum heterobeltiosis for this trait was observed for cross L_1 x T_3 (29.06%) in E_1 and for L_1 x T_2 (31.52%) in E_2. These findings were in agreement to the heterosis reported by Sood and Sharma (2001), Chauhan and Singh (2002), Yadav *et al* (2002), Rewale *et al.* (2003) and Bhalekar *et al.* (2004).

Cross L_1 x T_3 also showed high estimates of heterobeltiosis for other component traits viz. number of fruits per plant (E_1, E_2 and E_3), fruit length (E_1 and E_3), days to harvesting (E_2) and fruit weight (E_1, E_2 and E_3). Cross L_1 x T_2 also revealed high heterobeltiosis for traits viz. number of branches per plant (E_2), days to 50 % flowering (E_2), days to

Table 1: Comparative study of ten most heterotic crosses for fruit yield per plant (g) with their heterobeltiotic effects for yield components in okra for E_1 environment.

Crosses	Percent heterosis over better parent (Heterobeltiosis)										Av. of
	Yield/ plant (g)	Plant height (cm)	Branches /plant	Ht. of first effective fruiting node	Days to 50% flowering	No. of fruits /plant	Fruit length (cm)	Fruit girth (cm)	Days to harvesting	Weight of fruit (g)	fruit yield/ plant (g)
Heritage Green x Arka Anamika	29.06	5.36	3.19	-	-	22.44	10.95	-	-	14.85	355.57
VRO-6 x Arka Abhay	28.02	0.23	-	-8.34	-	4.32	12.47	-	-	17.63	330.17
BO-2 x Arka Anamika	17.50	-	-	-7.55	-	1.40	17.28	-	-	8.16	323.70
Punjab Padmini x Arka Anamika	14.86	13.52	24.47	-	-	22.39	14.32	-	-	3.97	330.57
Ankur-40 x Arka Abhay	14.58	10.02	13.48	-	-	4.88	-	-	-	8.14	318.23
Ankur-40 x parbhani Kranti	14.39	2.29	-	-	-	6.40	4.88	-	-	16.08	317.70
Ankur-40 x Arka Anamika	13.32	15.25	11.70	-	-	33.65	12.20	1.10	-	-	314.73
VRO-6 x Arka Anamika	11.42	5.41	-	-	-	18.64	12.23	-	-	-	306.97
VRO-5 x Arka Abhay	8.40	-	-	-3.18	-	-	11.19	-	-	17.43	278.33
Ratnaraj x Arka Anamika	6.42	-	-	-0.71	-	14.03	-	-	-	-	293.20

Table 2: Comparative study of ten most heterotic crosses for fruit yield per plant (g) with their heterobeltiotic effects for yield components in okra for E_2 environment.

Crosses	Percent heterosis over better parent (Heterobeltiosis)										Av. of
	Yield/ plant (g)	Plant height (cm)	Branches /plant	Ht. of first effective fruiting node	Days to 50% flowering	No. of fruits /plant.	Fruit length (cm)	Fruit girth (cm)	Days to harvesting	Weight of fruit (g)	fruit yield/ plant (g)
Heritage Green x Arka Abhay	31.52	-	34.67	-	-7.59	15.75	2.30	-	-6.87	26.39	404.70
Ankur-40 x Parbhani Kranti	25.17	0.41	-	-	-1.48	0.33	1.85	-	-1.99	37.36	401.10
Swati-25 x Parbhani Kranti	22.83	-	-	-	-	11.09	15.63	-	-	7.74	331.40
Ankur-40 x Arka Abhay	17.47	12.28	24.72	-8.62	-0.74	11.56	-	-	-1.32	38.14	376.40
Swati-10 x Parbhani Kranti	15.82	-	26.17	-1.91	-2.13	3.17	-	-	-2.55	18.50	422.53
Punjab Padmini x Arka Abhay	15.27	6.62	-	-0.56	-	3.17	4.93	-	-	15.53	408.60
VRO-6 x parbhani Kranti	13.86	-	-	-	-4.38	1.75	-	-	-3.29	16.12	386.10
Ratnaraj x Parbhani Kranti	12.76	-	-	-	-7.43	-	16.13	1.60	-5.56	14.99	344.10
VRO-5 x Arka Abhay	11.74	-	10.81	-	-	17.96	8.69	-	-	12.11	326.03
Pusa Sawni x Parbhani Kranti	11.09	-	12.35	-	-3.57	12.22	9.43	0.00	-2.60	5.62	329.10

harvesting (E_2) and fruit weight (E_1, E_2 and E_3). Besides, cross combinations L_{13} x T_2 in E_1 and L_{10} x T_1 and L_{11} x T_1 in E_2 also manifested good amount of heterobeltiosis for fruit yield

With respect to earliness, 2 hybrids in E_1 and 11 in E_2 for 50 per cent flowering and 3,13 and 2 hybrids in E_1, E_2 and E_3, respectively for days to harvesting showed negative and significant heterosis over mid parent. Whereas on better parent, only one cross L_1 x T_2 in E_2 for 50 per cent flowering and four crosses in E_2 for days to harvesting showed significant heterobeltiosis. Earliness for these two traits has also been reported by Yadav *et al.* (2002) and Bhalekar *et al*. (2004). In general, it might be inferred that magnitude of heterotic effects was good for the entire yield contributing traits in one or more environment. The possible reason for no hybrid vigor in E_1 and E_3 environments over better parent may be the use of early parents in calculating heterosis.

A perusal of yield contributing traits exhibited that crosses, L_{11} x T_3 for plant height in E_1 and E_2 environments; L_6 x T_3 (E_1 and E_2) and L_{13} x T_3 (E_3) for number of branches per plant; cross L_8 x T_2 (E_1) for height of first effective fruiting node; L_{11} x T_3 (E_1), L_{12} x T_2 (E_2) and L_9 x T_3 (E_3) for number of fruits per plant; L_{10} x T_1 (E_1 and E_3) and L_{14} x T_1 (E_2) for fruit length; L_{13} x T_2 (E_1), L_{11} x T_2 (E_2) and L_9 x T_2 (E_3) showed high heterobeltiosis. Pawar *et al*. (1999 a), Sood and Sharma (2001), Rewale *et al* (2003 a).

For most of the traits only a few hybrids exhibited significant relative heterosis in desirable direction, thereby indicating that the genes with negative effects were dominating, except fruit length and fruit weight where about 50 percent of the hybrids revealed desirable relative heterosis, thereby indicating that genes with negative and positive effects were almost equally distributed.

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Major Problems experienced by the rural families regarding Practicing and use of mass media in Aligarh & Hathras districts of western U.P.

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Abstract

In this research article an exercise has been done to short out the major problems being experienced by the respondents regarding media use for getting information related to agriculture and Rural development. This study was conducted in Hathras and Aligarh district covering four blocks, Eight Villages and 240 respondents. The primary data was collected by the Author himself with the help of well structured Interview schedule. The collected data were quantified, classified, tabulated, Analysed and presented accordingly. The out comes of the study clearly indicates that very high majority of the respondents i.e. more than 60% have explained regarding varieties of problems being experienced by the respondents. To mention some of the key problems are; lack of maintenance and repair of equipments, lack of time management in transmission of the T.V. programmes, power break-up during telecast, Far away of the Exhibition activities, lack of proper electricity supply, lack of proper television transmission, irregular power cuts, irrelevant contents of television programmes and non-availability of the newspapers.

Key words: respondents, Interview schedule, Exhibition, television transmission

Introduction

The effectiveness of mass media can be enhanced only through removing obstacles in their accessibility to and use by the farmers. So an attempt has been made to analyse the problems experienced by the farmers (respondents) in using of these mass media - telephone, radio, television, newspapers and computers. In addition, farmer's opinion of adequacy of infrastructure facilities of electricity supply, telephone networking, television broadcasting and transmission services, availability of mass media appliances in the market including accessories and maintenance and repair services were also analyzed. The present study was conducted with specific objective i.e. To study the major problems experienced by the rural families regarding practicing and use of mass media.

Research Methodology

The present study was conducted in Aligarh and Hathras districts of Uttar Pradesh. Out of five (5) region, Aligarh region was selected purposively Aligarh region have four (4) districts, out of which two district i.e. Aligarh and Hathras were selected purposively for this study as the researcher being a resident of Hathras district, well acquainted with the culture, language, social custom, situation prevailed.

There are 12 blocks in Aligarh district of which two blocks namely Iglas and Akrabad has been selected. In Hathras district there are 7 block, and of which 2 blocks i.e. Hathras and Sasni blocks were selected by random sampling technique. Two village from each block were selected randomly. In all 8 villages were selected for the present study. Thirty (30) families (respondents) from each village making total two hundred forty (240) respondents was finally selected by random sampling technique. The primary data was collected through personal interview with a well structured interview schedule. The variables as per the objectives were identified and grouped into two i.e. variables independents and dependent variables.

Result and Discussion

(i) Problems experienced by respondents in using mass media:

Four mass media were considered for analysing the problems experienced by respondents. A list of problems was made and the respondent's opinion was sought. The responses were recorded and analyzed. The results are presented in table 1.

It is evident from Table 1 that majority of the respondents i.e. 99.17 per cent respondents have

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Table 1: Problems experienced by the respondents regarding practicing and use of mass media in the area under study.

S.N	Problems	No. of Respondents	Percentage	Rank Order
1.	Lack of technical know--how to operate the phone calls.	68	28.33	XIX
2.	Lack of problems of maintenance and repairing of equipments.	238	99.17	I
3.	Lack of power connection and accessories required.	158	65.83	XIII
4.	Lack of handling of remote control.	174	72.50	IX
5.	Lack of proper electricity supply and services at the rural area.	183	76.25	V
6.	Irregular power cuts, at least five times in a day.	178	74.17	VI
7.	No proper attainment of complaints by the authority in the area.	69	28.75	XVIII
8.	Lack of proper transmission	175	72.92	VIII
9.	Viewing television was often disrupted by power break-downs.	194	80.83	III
10.	Programme content of television programmes was irrelevant.	178	74.17	VII
11.	Lack of time management in transmission of T.V. programmes.	198	82.50	II
12.	Lack of local resources.	159	66.25	XII
13.	Lack of formal education.	103	42.92	XVII
14.	Lack of higher education institutions near by the village.	149	62.08	XV
15.	Non-awareness of the respondents regarding availability of agricultural magazine and due to being costly packages is not affordable.	128	53.33	XVI
16.	Non-availability of the agriculture magazine and lack of money to purchase the magazine.	167	69.58	XI
17.	Non-availability of the newspapers and not capable to read the newspapers due to lack of education.	174	72.50	X
18.	Far away the exhibition activities being carried out by the agriculture Institutions and hence caused inconvenience to the farming community	192	80.00	IV
19.	Non-co-operative attitude of block personals regarding technical know-how of Agricultural innovations.	157	65.41	XIV

Note: More than one problem is being experienced by the respondents, hence total number and percentage exceed to actual (240) and 100%.

experienced the problem of "maintenance and repairing of equipments" followed by 82.50 per cent 'lack of time management in transmission of TV. Programmers' 80.83 per cent "viewing television was often disrupted by power" break down 80.00 per cent 'far away the exhibition activities being carried out by the Agriculture Institutions and Hence caused inconvenience to the farming community' 76.25 per cent, 'lack of proper electricity supply and services at the rural Area', 74.17 per cent, 'irregular power cuts at least five times in a day 74.17 per cent, 'programme content of television programmes was irrelevant,' 72.92 per cent, lack of proper television transmission' 72.50 per cent, 'lack of handling of remote control,' 72.50 per cent, 'non-availability of the newspapers and not capable to read the newspapers due to lack of education' '69.58 per cent, 'non-availability of the agriculture magazine,' 'lack of money to purchase the magazines.- 66.25 per cent, 'lack of local resources', 65.83 per cent, "lack of power connection and accessories required," 65.41 per cent, 'non-cooperative attitude of block personnel's regarding technical know-how of agriculture innovations,' 62.08 per cent, 'lack of higher educational institutions near by the village,' and 53.33 per cent, non-awareness of the respondents regarding availability of agricultural magazines and due to being costly and its purchase is not affordable,' 42.92 per cent, 'lack of formal education,' 28.75 per cent, 'no proper attainment of complaints by the authority in the area and 28.33 per cent, 'lack of technical know-how to operate the phone call respectively.

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Women empowerment through informal sector in India

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Abstract

Women constitute 48.2 per cent of the total population and the women workers constitute 25.68 per cent of the total workforce in the country (Census 2001). Majority of the women workers in the rural areas are employed in agriculture as labourers and cultivators. In urban areas, women workers are primarily employed in unorganized sectors such as household industries, petty traders and services, building and construction etc. In this paper Share of informal sector in GDP of India, growth rate of workers in informal sector in India and participation of labour in informal sector, Status of Women in Informal Sector has been analyzed, different schemes implemented by the Government of India for the women in Informal sector, Human Rights of Women in relation to global – Global Perspective and Role of SHGs in the economic empowerment of women workers in informal sector.

Key Words: Informal Workers, Empowerment, Collective Strength, Village Committees, Sustained Change

Introduction

The concept of the informal sector was introduced into international usage in 1972 by the International Labor Organization (ILO) in its Kenya Mission Report, which defined informality as a "way of doing things characterized by:

(a) Ease of entry;
(b) Reliance on indigenous resources;
(c) Family ownership;
(d) Small scale operations;
(e) Labor intensive and adaptive technology;
(f) Skills acquired outside of the formal **sector**;
(g) Unregulated and competitive markets"

NCEUS has defined the informal sector as:

"The informal sector consists of all unincorporated private enterprises owned by individuals or households engaged in the sale and production of goods and services operated on a proprietary or partnership basis and with less than ten total workers".

Though the Indian Constitution guarantees equality of opportunity related to work, equal rights for livelihood, equal pay for equal work etc., the condition of women in the unorganized sector is deplorable. Majority of women in the unorganized sector work for low and highly unequal wages compared to their male counterparts.

The household enterprises in the Indian Economy are generally recognized as unorganized sector in place of the international concept of informal sector. Informal sector or unorganized sector of India contributes approximately about 90% to the total Gross Domestic Product (GDP) Of India as recorded in 2009. The condition of women in India; specifically the rural areas are still ages old. They still follow the ages old custom of taking care of household chores and the males going out and working. But to some extent if we focus the women with their house hold chores also engage themselves to the economically productive activities. Therefore the participation of women in unorganized or informal sector is also accountable. The women in unorganized sector are facing many problems such as unemployment, low wages, irregular hours of work, irregular payment of wages, non availability of social security and welfare facilities, exploitative working conditions and sexual harassment at work place etc.

People's participation is not a one way interaction. It takes place by building skills among the people to understand and articulate their own problems. This process helps in the formation of *village groups and village committees*. The group organization always focuses on mobilization, organization and empowerment of the poor and the needy, which may or may not include provision of financial services, as a strategy for organization. Since a benefit to an individual may not benefit the group, so it is needed to build on their collective strength. At the same time in the field of development, building a movement for sustained change is not an easy one. It demands long sustained pressure to create alternative structures. Thus the main aim is to have development of the people, enabling them to lead fuller and more satisfying lives, rather than simply the delivery of material benefits. So SHGs (Self-help Groups) play a crucial role in it.

Based on the above said criteria our objectives will be:

1. To find out the share of informal sector in GDP of India
2. To analyze the growth rate of workers in informal sector in India.
3. To evaluate participation of labour in informal sector.
4. To analyze existing status of women workers and different schemes provided by the Government of India for the women in Informal sector.

Research Methodology

The data for this study have been collected from secondary source. Sources are as NCEUS, ILO,

NSSO, Delhi group, and Social Welfare magazines & journals are used for collection of data. For the Data analysis simple statistical techniques average and tabulation methods were applied. Main source of data is reports of NSSO on informal sector for the year 2004-05. The period of this study has been confined from the year 1999-00 to 2004-05 and data also included year 2009.

Results and Discussion

Share of informal sector in GDP of India:

It is evident form table 1 that informal/ unorganized sector contributes approximately about 90 percent to the total Gross Domestic Product (GDP) Of India as recorded in 2009 whereas the formal/ organized sector contributed only 10 per cent.

Table 1: Share of Unorganized/ Informal Sector in GDP

Sector	Share in per cent (approx.)
Organized Sector	10
Unorganized Sector	90
Total	100

Participation and Growth Rate of Workers in informal sector in India:

The share of informal workers, total number of workers including formal and informal both, Percent of industry wise informal worker to total informal workers and the growth rate of informal sector since 1999-00 till 2004-05. The table 2 showing number of Informal Workers, and Growth Rate by Industry Group between 1999-2000 and 2004-05. The Growth Rate of Informal Workers was recorded maximum of 171.26 for household, 92.06 for Finance, 66.52 for real estate, 63.27 for education but the important sector of Indian economy i.e. agriculture had shown a growth rate of only 9.06 which is extremely low. It is great matter of worry because highest workforce about 60 percent of the total workforce is engaged in agriculture.

Status and Participation of Women in Informal Sector

Table 3 state that the participation of informal workers in the rural areas was more about (79.58% in 1999-00) and (78.3% in 2004-05) where as their formal counterparts accounted for (36.73% in 1999-00) and (35.72% in 2004-05) out of which the participation of women was accorded from 35.33% (1999-00) to 36.78% (2004-05). On the contrary the urban sector recorded the participation rate of 20.42% (1999-00) and 21.77% (2004-05) whereas the formal sector recorded 63.22% in (1999-00) and 64.28% in (2004-05) out of which women participation was enumerated as 32.41% (1999-00) and 33.60% in (2004-05)

Different schemes provided by the Government of India for the women in Informal sector.

It is a recognized fact that there is still no society in the world in which women workers enjoy the same opportunities as men. The constitution opened a new horizon of hope for women with the inclusion of non-discrimination and special clauses intended to protect and promote the rights and legitimate aspirations of women as equal citizens of India.

Human Rights of Women – Global Perspective

International Covenants on Human Rights which entered into force in 1976. Despite amendments in the personal law concerning marriage, dowry, maintenance, guardianship, adoption etc. there is much to be desired in regard to social development and welfare measures for women workers such as

- Equal remuneration act, which is based on social justice
- Factories Act

Table 2: Participation and Percentage share of Informal Workers to Total Workers for the year 1999-00 and 2004-05

Industry Group	No of Informal workers (in millions)		Total no of workers (in millions)		% of informal worker to total informal workers		Industry wise growth	% of informal workers to total workers		Industry wise growth	Growth rate informal
	1999-00	2004-05	1999-00	2004-05	1999-00	2004-05	1999-00 to 2004-05	1999-00	2004-05	1999-00 to 2004-05	
Agriculture	234.79	256.07	237.67	258.94	64.91	60.59	-4.31	98.79	98.89	0.1	9.06
Mining	1.56	1.78	2.17	2.64	0.43	0.42	-0.01	71.75	67.39	-4.36	14.10
Manufacturing	36.85	49.3	44.05	55.78	10.19	11.67	1.48	83.65	88.38	4.73	33.79
Electricity	0.21	0.24	1.12	1.28	0.06	0.06	0.00	18.75	18.72	-0.03	14.29
construction	16.9	25.32	17.53	26.01	4.67	5.99	1.32	96.4	97.33	0.93	49.82
Trade	35.41	42.54	36.62	43.36	9.79	10.07	0.28	96.69	98.11	1.42	20.14
Hotels	4.35	5.8	4.61	6.10	1.20	1.37	0.17	94.3	95.02	0.72	33.33
Transport	11.44	15.28	14.61	18.48	3.16	3.62	0.45	78.3	82.7	4.4	33.57
Finance	0.63	1.21	2.27	3.08	0.17	0.29	0.11	27.8	39.24	11.44	92.06
Real estate	2.24	3.73	2.68	4.66	0.62	0.88	0.26	83.73	80.09	-3.64	66.52
Administration	1.6	1.19	10.48	8.84	0.44	0.28	-0.16	15.27	13.46	-1.81	-25.63
Education	3.24	5.29	8.48	11.43	0.90	1.25	0.36	38.22	46.28	8.06	63.27
Health	1.5	2.18	2.86	3.71	0.41	0.52	0.10	52.51	58.8	6.29	45.33
Community	9.28	7.97	9.75	8.39	2.57	1.89	-0.68	95.15	94.99	-0.16	-14.12
Household & Extra	1.74	4.72	1.85	4.76	0.48	1.12	0.64	93.86	99.23	5.37	171.26
Total	361.74	422.61	396.78	457.47	100.00	100.00	0.00	91.17	92.38	1.21	16.83

Table 3 Distribution of informal and formal workers by sector and sex between 1999-2000 and 2004-05 (in million and percent)

Sector	Sex	Informal Worker						Formal Worker						Total	
		in millions 1999-00	in % of the sector	% to the total	in millions 2004-05	in % of the sector	% to the total	in millions 1999-00	in % of the sector	% to the total	in millions 2004-05	in % of the sector	% to the total	in millions 1999-00	in millions 2004-05
Rural	Male	186.17	64.67		209.01	63.22		10.57	82.07		10.03	80.56		196.7 0	219.04
	Female	101.71	35.33		121.60	36.78		2.31	17.93		2.43	19.52		104.00	124.03
	Persons	287.87	100.00	79.58	330.62	100.00	78.23	12.88	100.00	36.78	12.45	100.00	35.72	300.80	343.07
Urban	Male	58.33	78.96		71.60	77.83		18.72	84.55		18.80	83.93		77.05	90.40
	Female	15.53	21.02		20.40	22.18		3.43	15.49		3.60	16.07		18.96	24.00
	Persons	73.87	100.00	20.42	91.99	100.00	21.77	22.14	100.00	63.22	22.40	100.00	64.28	96.01	114.40
Total	Male	244.50	67.59		280.61	66.40		29.28	83.61		28.83	82.73		273.80	309.44
	Female	117.24	32.41		142.00	33.60		5.74	16.39		6.03	17.30		123.00	148.03
	Persons	361.74	100.00		422.61	100.00		35.02	100.00		34.85	100.00		396.80	457.46

· Maternity Benefit act
· Minimum Wages act

As per the International Labour Organization Report "Time for Equality at Work" women constitute the single largest group discriminated against at the workplace with low wages, adverse working conditions, low rate of employment and greater insecurity on the basis of race, ethnicity, religion, age and disabilities. The report further that by the year 2050, about 33% of the people in developed countries and 19% in developing countries will be 60 or older and most of them will be incidentally will be women.

Employees Provident Fund organization:

The Employees Provident Fund organization, a pioneer in the social security sector in the country has made arrangements to bring the multiple benefits under one umbrella with the insurance companies. A worker or a self employed person engaged in any of the selected industries can join the scheme. The worker must be 18 and 35 years of age on the date of joining the scheme. Further, a worker who has attained more than 35 years but less than 50 years of age can also join the Scheme for a limited period of first five years of the Scheme coming into effect. The monthly income of the worker or Self employed person shall not be more than Rs. 6500 at the time of joining the scheme.

Policy Implecation

*It is the moral duty of the central and state government to solve the problems of the informal sector on priority basis.

* Government should facilitate the informal sector regarding as follows:

(a) Infrastructure Facility
(b) Education & training facility
(c) Arrangement of raw material at concessional rates
(d) Marketing facility of their end products.

*Working conditions should be improved like working hours, women security at workplace, creche facility should be provided for their children.

* Micro Finance should be provided at lowest interest rate.

*Insurance should be encouraged on group basis to the weaker section of the society.

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Effect of foliar application of NAA on growth and flowering behaviour of tuberose (*Polianthes tuberosa* L) var-Single

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Abstract

*A field experiment was conducted with five concentrations of NAA (0, 20, 40, 60, and 80 ppm) and three number of sprays (One, Two and Three times) giving thereby 15 treatment combinations with four replications at R. B. S. College, Bichpuri, Agra on tuberose (*Polianthes tuberosa L*) var-Single. The results indicated that the application of 60 ppm of NAA three times as foliar spray was found as the best treatment in respect to vegetative growth and floral characters behaviour.*

Key Words: Tuberose, NAA, Vegetative growth, flowering

Introduction

Among the ornamental bulbous plants tuberose (Rajnigandha) is one of the most beautiful, which produces long spikes of creamy white and waxy colour with a lingering fragrance. This plant is a native of Maxico and it belongs to family amaryllidaceae. It is important to enhance its productivity for best vase life of flowers, yield of concrete which is a source of essential oil formed after crushing with alcohol. The spikes are useful as cut flowers for vase decoration and bouquets, while individual flowers are used for making vent, garland and button holes. In India it is largely grown in Karnataka, Tamilnadu, Andhra Pradesh, Haryana and Gujrat.

Overwhelming importance of growth regulating chemicals in the field of floriculture is well recognised. Growth regulators are reported to co-ordinate and control of various phases of growth, flowering and bulb production in tuberose at optimum concentration. Keeping the above mentioned facts the study was undertaken to investigate the effect of foliar application of NAA on growth and flowering behaviour of tuberose.

Material and Methods

The field experiment was carried out at R.B.S. College, Agricultural Research Farm, Bichpuri, Agra (U.P.) with fifteen treatment combinations i.e. three number of foliar sprays viz. one (N_1), two (N_2) and three (N_3) and five concentrations of NAA viz. 0 (C_0), 20 (C_1), 40 (C_2), 60 (C_3) and 80 (C_4) which were allocated in Randomized Block Design with four replications. The mother bulbs, on an average of 2.25 cm diameter were planted 30x30 cm^2 apart on April 2nd.

The aqueous solution of NAA was applied as foliar spray in the afternoon on June 10th, 20th & 30th each day. The plants were drenched thoroughly. Periodical observations were recorded on three plants to various vegetative growth, floral and bulb production parameters.

Results and Discussion

The growth and flowering parameters were significantly influenced by different treatments (Table 1). The increase in number (65.5) and weight of leaves (142.03g) per clump and length of longest leaf (50.98 cm) showed significant increase with three times application of 60 ppm of NAA over its lower and higher rates which might be due to active cell division and cell elongation. The similar results have also been observed by Pate *et al*. (1989).

It is revealed (Table 1) that the number of the days required for spike emergence decrease with increased the level of NAA. The minimum number of days (120.58) were taken for spike emergence under highest concentration of 80 ppm of NAA as compared to control.

The floral behaviour as noted in terms of maximum length of spike and number of spikes per clump and florets per spike, length of floret and rachis also had the same trend as recorded for

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Table 1: Effect of foliar application of NAA on growth and flower behaviour of tuberose (*Polianthes tuberosa* L) var-Single

Treatments	No of leaves per clump	Length of the longest leaf (cm)	Weight of leaves/ clump(g)	Spike emergence	No. of spikes/ clump	No. of florets/ spike	Length of floret (cm)	Spike length (cm)	Rachis length (cm)
Concentration of NAA (ppm)									
0 ppm Co	57.89	49.01	119.30	127.86	1.70	26.05	5.73	77.97	30.86
20 ppm C_1	61.33	49.27	130.64	123.56	1.73	27.07	5.78	78.79	31.18
40 ppm C_2	63.11	50.29	135.78	123.53	1.77	27.72	5.82	80.14	31.47
60 ppm C_3	65.50	50.98	142.03	123.56	1.82	28.07	5.86	82.47	32.58
80 ppm C_4	63.08	50.30	135.81	120.58	1.77	27.73	5.82	80.15	31.47
CD at 5%	2.35	0.53	9.98	3.92	0.06	1.12	0.07	2.22	0.87
No of foliar spray									
One N_1	54.93	47.54	116.23	136.10	1.62	25.31	5.69	76.20	30.01
Two N_2	62.35	50.52	134.92	121.25	1.76	27.34	5.81	79.85	31.59
Three N_3	69.27	51.86	146.98	114.10	1.89	29.34	5.90	83.66	32.93
CD at 5%	1.82	0.41	7.73	3.04	0.046	0.87	0.05	1.72	0.67

growth parameters under three times application of 60 ppm of NAA which were broadly in accordance with the findings of Bhattacharjee and Mukharjee (1979), Idom (1981), Scott (1982) and Skogan *et al*. (1982).

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A study on marketing of apple in Baramulla district of Jammu and Kashmir

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Abstract

The present study on marketing of apple in Baramulla District of Jammu & Kashmir evaluates the marketing costs, margins, price spread, constraints and channels through which the producers dispose of their produce. The study is based on primary data collected from 100 respondent apple growers, 60 traders through pre- tested schedules during the year 2004-05. The results revealed that 55 per cent of the produce was marketed through channel III and rest buttressing the fact that forwarding agent is important market functionary among the apple growers. Further data revealed that marketing cost per box of 18 kg was highest Rs 172.40 in channel II, lowest Rs.48.84 in channel I, and Rs.163.71 for channel III & IV. Overall the marketing cost depicts increasing trend with increase in number of middleman. The highest producer share of 51 per cent was estimated in channel II and it reduced to 27 percent in channel IV. The channel II was found efficient from producers point of view, while channel I was from consumers point of view. The overall 90 per cent growers revealed lack of cold storage, 73 per cent reported absence of co-operative marketing , another main problem i.e. absence of crop insurance was also perceived by 72 per cent growers. On production aspect the main problems were regarding lack of intuitional support and lack of diseased free nursery plant material. These problems were reported by 62 and 54 per cent growers respectively.

Key words: marketing costs, pre- tested schedules, efficient, producers, intuitional support

Introduction

Jammu and Kashmir is the north-eastern state of India bestowed with favourable climate for Horticultural crops. This sector is the backbone of state economy, as it contributes about Rs. 2100 crores to state GDP. Among varieties of fruits grown, apple is the major fruit of the state, as it alone occupies about 50 per cent area and 84 per cent production of the total fruit of the state. Currently, the state contributes about 64 per cent to India's apple production. Its area, production and productivity have had a quantum leap during past three decades and have increased by about 173, 588, and 151 per cent, respectively. (Directorate of Horticulture J & K 2007-08). The bulk 97 per cent of apple production is exported, mainly to Delhi and other metropolitans (Amit- K et al., 2004). A weak marketing process not only affects the producer and consumers, but affects the total economy of a nation (Talukdar and Bhowmick, 1993), however marketing of apple is a complex job owing to their perishable nature, seasonality, bulkiness. Further additional excessive transportation costs prevent marginal and small apple producers of Kashmir from sending their crop to the desired markets. (Wani, M. H. et al,.1995). Justifies conducting the study on marketing aspect.

The prevailing marketing system in general is yet too inefficient to harness the full potential of agricultural trade and business. Studies on apple marketing revealed that marketing costs increased from Rs. 14.27 in 1975-76 to Rs. 119.05 per box in 2001-02 (Singh, R. et., al 2004), while the producer share in consumer rupee in apple ranges in between 33 to 54 per cent (Shaheen, F. et, al 2002). Therefore in this study an attempt has been made in this research work to expose the bottlenecks in the entire process of marketing system of apple in Kashmir and to identify the channels followed by the growers to dispose off their produce, and estimate the costs and margins involved in each channel. The various problems encountered by the growers in marketing of apple are also included.

Methodology

A prior survey was carried out to identify the apple producing areas of the state, and based on that district Baramulla was selected for its highest acreage under apple as compared to other districts. Ten villages having apple production as a main livelihood activity were selected from which ten growers from each village were selected randomly for final sample. All the growers were grouped into small, medium and large farmers on the basis of number of boxes produced in the preceding year. Similarly, sixty traders including 24 whole-sellers 12 sub- wholesalers and 24 retailers were selected on the basis of quantity dealt at Sopore

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and/or Delhi fruit market. Suitable estimates / methods were applied to meet the set objectives.

Result and discussion

Following four channels were identified being followed by the sample growers.

Producer - Wholesaler - Retailer - Consumer

Producer-J.K.H.P.M.C. Sgr- J.K.H.P.M.C. Delhi - Retailer - Consumer

Producer -Forwarding agent – Commission agent/Wholesaler –Mashakhoor -Retailer -Consumer

Producer-Pre-harvest Contractor-Commission agent/ Wholesaler-Mashakhoor-Retailer-Consumer

Disposal pattern

It was observed that growers may opt for more than one channel. As revealed in table 1. Channel I was reported by 28 cases, channel II by 12 cases, channel III by 31 cases and channel IV by 53 cases. Table also reveals that none of the small farmer has chosen channel II. The quantum of produce channelled is shown in respective columns. Total produce sold by sample growers during the study year summed up to 135940 boxes (18 kg each), out of which the highest 54.54 per cent of the produce was sold through channel III. Rest of the produce was almost equally channelled 14-21 per cent through other three channels, which reflects that selling the produce through forwarding agent is a most preferable among the apple growers. This practice seems to be more common among large and medium farmers as the quantity sold through forwarding agent by these two groups is about 64 and 59 percent of total quantity sold by them, respectively; whereas among small farmers about 44 per cent of the total quantity has been sold to pre-harvest contractors and about 32 and 24 per cent through forwarding and wholesalers, respectively.

Price spread

The number of market functionaries varies from one marketing channel to other. It ranges from two to five in the different channels followed by the sample growers in the study. Number of functionaries affects the total marketing costs, margins, and producers share. As revealed in table 2, the net price received by growers per standard box ranges from 129.77 rupees in channel IV to 273.55 rupees in channel II. However, it is noteworthy that in channel III and IV the marketing cost and consumer price was same at all stages but in channel IV the growers does not incur any marketing cost, and the orchard was given to the pre-harvest contractor on contract which effected the producer share by 15 per cent as compared to channel III where the producer share in consumer rupee was 42 per cent. The highest share of 51 per cent in consumer rupee was found in channel II as the commodity was stored in controlled atmosphere at Delhi for three months which increased the share by 9 per cent as of channel III, therefore it is noted that more investment helps a grower to realize more returns. This generalization is again supported by the analysis of channel I where the growers incurred only 48.84 rupees per box which reduced the producer share by 12 per cent as in channel II. Channel II was found efficient from the producers point of view while channel I was most efficient from the consumers point of view.

Marketing cost

The marketing cost is the amount spent at every step when product is moved from one place to another until the product reaches in the hands of its ultimate consumer, which ultimately increases producer share. The total marketing cost was found highest of rupees 172 in channel II of which 141 rupees was included at producers level which includes the major cost heads of Rs. 25, 32, 30 and 25 on shook's, transportation, C.A. storage and commission charges respectively, the same major costs were also observed in channel III and IV excluding the C.A. storage charges. Whereas the lowest marketing charges were found in channel I of around rupees 49 as the commodity was not moved to different locations of the country and was sold within the valley Kashmir. In case of channel III and IV the total marketing cost was same of rupees 163.71, of which 116.81 rupees was at producer level, but in channel IV the charges of producers were incurred by contractor as the standing orchard was sold to contractor on contract, after analyzing the

Table: 1. Disposal pattern of apple through different channels

Standard boxes of 18 kg

	Small		Medium		Large		Overall	
	No. of growers	Quantity sold	No. of growers	Quantity sold	No. of growers	Quantity sold	No. of growers	Quantity sold
Ch. I	20	8013(24.11)	5	6055(12.92)	3	5006(8.96)	28	19074(14.04)
Ch. II	-	—	8	10200(21.76)	4	3825(6.85)	12	14025(10.32)
Ch. III	10	10553(31.76)	15	27608(58.91)	6	35991(64.45)	31	74152(54.54)
Ch. Iv	30	14664(44.13)	13	3002(6.40)	10	11023(19.74)	53	28689(21.10)
Total	60	33230	41	46865	23	55845	124	135940

The No. of growers increases the sample size on account of opted more than one channel.

Table: 2. Marketing cost and margins of various functionaries

S.No Particulars	Chanel I	Chanel II	Chanel III	Chanel IV
1. Net price received by growers	137.45	273.55	196.57	129.77
2. Pre-harvest contractor (P.P.)	-	-	-	129.77
Expenses born by grower/Contractor				
a. Picking and assembling	6.80	6.80	6.80	6.80
b. Grading and packaging	7.70	7.70	7.70	7.70
c. Cost of shooks	25.00	25.00	25.00	25.00
d. Cost of packaging material	2.34	2.34	2.34	2.34
e. Carriage up to forwarding point	1.00	3.00	4.00	4.00
f. Forwarding charges @2% of (G.S)	-	-	6.26	6.26
g. Freight upto market	4.00	32.50	34.50	34.50
h. State Tax-Octori	-	-	-	
i. Loading unloading	2.00	4.00	2.00	2.00
j. C.A. Storage @ Rs. 10 per month.	-	30.00	-	-
k. Commission of com.agent/wholesaler @9% of the Gross sale	-	-	28.21	28.21
l. J.K.H.P.M.C. Srinagar (forwarding)	-	5.00	-	-
m. J.K.H.P.M.C.Dehli (commission char.)	-	24.89	-	-
Sub Total	48.84	141.23	116.81	116.81
3. Wholesaler Purchase price.	186.29	-	-	-
Expenses of wholesaler.				
Market Fee @ 1%	1.71	-	-	-
a. Go down charges	2.30	-	-	-
b. Transitory Loss and other	3.68	-	-	-
c. Sub Total	7.69	-	-	-
Net Margin of wholesaler	27.98	-	-	-
Mashakoor Purchase Price	-	-	313.38	313.38
4. Net Margin of Contractor	-	-	-	66.80
Expenses incurred by Mashakoor.				
a. Market fees @ 1%	-	-	3.14	3.14
b. Carriage, Handling and repacking	-	-	7.60	7.60
c. Transitory Loss and other	-	-	5.96	5.96
Sub Total	-	-	16.70	16.70
5. Retailer purchase price	221.96	414.77	342.94	342.94
Net margin of Mashakoor	-	-	12.86	12.86
Expences of Retailer.				
a. Carriage and Handling	5.00	7.50	7.50	7.50
b. Retailer Loss in Transit.	18.09	24.22	22.70	23.32
Sub.Total	23.10	31.17	30.20	30.20
Net marigin of Retailer	97.49	90.14	92.70	92.70
Total Marketing cost	79.63	172.40	163.71	163.71
Consumer Price	352.57	536.17	465.84	465.84

Note: In channel I the commodity was sold in Srinagar ,II was sold through J.K.H.P.M.C. at Dehli after three months and apple boxes were stored in controlled atmosphere for three months.

available data obtained from contractors it was noted that the producer had sold per box of 18 kg standard @ rupees 129 to contractor.

Problems of growers

The problems encountered by the growers were also identified and analyzed. The major problem reported by the sample growers was regarding lack of cold storage which force the grower's to sell their produce at lower prices and this problem was almost reported by 90 per cent growers. Another problem like absence of co-operative marketing which increase the marketing cost and reduce the producer share in consumer rupee, it was reported by 73 per cent growers, about 72 per cent producers revealed that

Table: 3. Price spread and margins

Functionary	Particulars	Channel I	Channel II	Channel III	Channel IV
Producer	Cost incurred	48.84	141.23	116.81	—-
	Net price received	137.45	273.55	196.57	129.77
Whole-seller	Purchase price	186.29	—	—	—
	Cost incurred	7.69	—	—	—
	Net margin	37.99	—	—	—
Contractor	Purchase price	-	—	—	129.77
	Cost incurred	—	—	—	116.81
	Net margin.	—	—	—	66.80
Mashakhoor	Purchase price	—	—	313.38	313.38
	Cost incurred	—	—	16.70	16.70
	Net margin	—	—	12.86	12.86
Retailer	Purchase price	221.96	414.77	342.94	342.94
	Cost incurred	23.10	31.71	30.20	30.20
	Net margin	97.49	90.14	92.70	92.70

* Acharaya's Method of (M.E) = Net price received by producer / (Total marketing charge+ margins)

Table: 4. General problems in marketing of apple as perceived by growers.

S.No. Problems	Small	Medium	Large	Overall
1. Facility of storage not available.	45(90.00)	29(90.62)	16(88.89)	90(90.00)
2. Absence of co-operative marketing.	39(78.00)	21(65.62)	13(72.22)	73(73.00)
3. Absence of crop insurance facility	38(76.00)	22(68.75)	12(66.66)	72(72.00)
4. Late information regarding to market price.	32(64.00)	13(40.62)	9(50.00)	54(54.00)
5. Multiplicity of charges by commission agents.	37(74.00)	18(56.25)	11(61.11)	66(66.00)
6. Higher transportation charges.	33(66.00)	16(50.00)	11(61.11)	60(60.00)
7. Material not available on credit.	27(54.00)	12(37.50)	8(44.44)	47(47.00)
8. Higher prices of packaging material.	27(54.00)	11(34.37)	9(50.00)	47(47.00)
9. Lack of intuitional support regarding apple cultivation.	32(64.00)	20(62.50)	10(55.55)	62(62.00)
10. Lack of diseased free plant material.	29(58.00)	17(53.12)	8(44.44)	54(54.00)
11. Others	23(46.00)	16(50.00)	9(50.00)	48(48.00)
Total sample	**50(100.00)**	**32(100.00)**	**18(100.00)**	**100(100.00)**

Figures in parenthesis indicate percentage to total.

Note: No. of growers in different size exceed the sample size on account of reporting more than one problem.

absence of crop insurance facility is one of the main factor which limit the growers to expand the apple cultivation because the fruit cultivation is mainly dependent on nature. About 62 per cent growers complained lack of intuitional support regarding apple cultivation and 54 per cent stresses that there is need for the supply of diseased free nursery plants.

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Production and economics of farm school demonstrations in Agra district of Uttar Pradesh

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Abstract

The study production and economics of farm school front line demonstrations in the multicut green fodder production in summer season for the year 2012 was carried out at Krishi Vigyan Kendra, Bichpuri, Agra under ATMA yojana funded by Sate Agriculture Department. The motives of farm school aware of dairy farmers grow more sufficient amount of green fodder in summer season through adopt the multicut fodder production technology. In the farm school village Nagla Vishnu selected one achiever and 25 members of dairy farmer. Frontline demonstration at farm school conducted was 4 hectare area of multicut fodder hybrid sorghum sowing last week of March. The recorded production of multicut hybrid sorghum after three time cutting was 1350 q/ha in demonstration and 1020 q/ha in control plots (local check). The multicut green fodder hybrid sorghum yield enhancement due to technological intervention was to the tune of 24 percent over local check. The economics and Benefit Cost Ratio (BCR) of both demonstrated and local check was worked out. On an average Rs. 10000 per hectare was recorded as additional income in this demonstration in comparison to local check. BCR of demonstrated and local check was 2.08:1 and 1.77:1 respectively. Conducting front line demonstration of multicut green fodder production technologies under farm school demonstrations to a great extent with increase in the production and income level of the dairy farmers.

Keywords: Farm school; demonstration; multicut green fodder; production; net income; BCR;

Introduction

The emerging trend in growth of the livestock sector, especially the dairy sector suggest that demands in fodder will be very high in coming years and to meet such a demand from available land is a challenge. The present emphasis on feed and fodder in inadequate and require intervention to bridge the fodder deficits and also bring down cost of fodder components in the livestock production systems. The livestock production based on green fodder in not only good for the general health of the animals but also economical and environment friendly. Thus the costs incurred in feeding of livestock are too high, 60-70 percent of the total cost of milk production.

India has over 15 percent of world's livestock population and 16 percent of human population but the land area is only 2 percent. The present livestock population (2007 Census) of the country in 529.7 million heads of livestock (199.1 m cattle; 105.34 m buffaloes; 71.5 m sheep and 140.5 m goats). The growth rate during last 56 years (1951-2007) shows increasing trend in cattle (28.25%), buffaloes (142.7%), sheep (82.9%) and goats (69.2%). The overall growth rate in livestock numbers is 81 percent (GOI, 2011). Increased livestock population has resulted in considerable increase in the feed and fodder requirements. This increased requirement is not only due to rise in animal numbers but also due to shifting some of the population from exclusively range foraging to semi-intensive system and increase in productive female population, reared mainly under intensive management systems. It is interesting to note that during 1987-2003, the yield of milk increased by 85 percent, mainly due to 96 percent rise in cross bred cattle and 36 percent rise in buffalo population (Roy, 2012).

Based on supply-demand projections (2015-2025) anticipated deficits in green fodder, dry fodder, crude protein (CP) and total digestible nutrients (TDN) is depicted. The deficits are very high in green fodder and will increase over time 69.6-75.9 percent (IGFRI, 2006). In a diverse climate of India a variety of forage crops are used but the area under fodder production is

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below 5 percent of the cultivated area. However, Uttar-Pradesh such crops account for 3-4 percent of cultivated area. The reason for stagnation of area under cultivated fodder in on account of pressure of human population for food and other cash crops.

The Krishi Vigyan Kendra as an institutional innovation for application of agricultural and allied science & technology on the farmer's field. The KVKs are also linkage in line department of state and central government, NGOs and other agency. Agriculture Technology Management Agency (ATMA) is the innovative scheme for the knowledge and technological development of farmer's community in the field of agriculture, horticulture, animal husbandry and fisheries in the district. ATMA yojana are also operationalzing farm school at block and gram panchayat level and conducted crops, green fodder, poultry and others frontline demonstration under the guideline of Government of India, National Food Security Mission (NFSM) and guidelines for modified "Support to State Extension Programmes for Extension Reforms" Scheme-2010. Farm school in the working is main objects "Learning by Doing". The present study was taken up to assess the production and economics of multicut green fodder demonstration for the hybrid sorghum.

Methodology

The present study was conducted under the farm school demonstration program funding by Atma yojana at Krishi Vigyan Kendra, Bichpuri, Agra for enhancement and benefited of green fodder production. The frontline demonstration conducted on multicut fodder production hybrid Sorghum in summer season 2012. First of all KVK adopted village Nagla Vishnu in Kheragarh block of Agra district was purposively selected for demonstrated multicut green fodder production farm school because a higher percentage of dairy animals in the village. In this farm school were selected one achiever and 25 member farmers in the village. Thus, the provided all facility under this farm school viz; fodder seed, trainings, printed literature service charge, meals and refreshment, technological input etc. Frontline demonstration at farm school conducted was 4 hectare area (1 ha. achiever and 3 ha. member's farmer) of multicut fodder hybrid sorghum sowing last week of March. Well before the conduct of farm school demonstration were organized six training to the achiever and members farmer of respective farm school was imparted with respect to envisaged technological interventions. Field day and visits of the farmers and the extension functionaries were organized at demonstration plots to disseminate the message at large. Yield data was collected from control (local check) and demonstration plots and cost of cultivation, net return and Benefit Cost Ratio (BCR) were computed and analyzed. The BCR formula was calculated in given below:

$$BCR = \frac{\text{Gross return}}{\text{Gross cost}}$$

Results and Discussion

The results of the study were divided into three parts: (i) Production of multicut green fodder, (ii) Economics of demonstration and (iii) Provided facility under farm school.

(i) Production of multicut green fodder:

The yield performance of multcut green fodder production in summer season (Table 1) under demonstration plot yield was found to substantially higher than that local check/control. The yield multicut green fodder hybrid sorghum under farm school demonstration recorded was 1350 q/ha in comparison 1020 q/ha of local check yield. The yield enhancement due to technological intervention was to the tune of 24 percent over local check. The observed other parameters of multicut green fodder yield of hybrid sorghum was 3 cutting in the summer season in both demonstration and local check. Yield enhancement in different crop in frontline demonstration has amply documented by Tiwari and Saxena (2001), Tomar et al. (2003) and Mishra et al. (2009).

Table 1: Production and Economics of farm school demonstration

Crop/Variety	Name of the technology demonstrated	No. of farmers	Area(ha)	Yield (q/ha)		%Increase
				Demo	Local Check	
Hybrid Sorghum (MFSH-4)	Multicut green fodder production technology	26	4	1350	1020	24

Economics of demonstration (Rs. /ha.)				Economics of local check (Rs. /ha.)			
Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
35000	72000	37000	2.08:1	35000	62000	27000	1.77:1

Table 2: Provided facility and other extension activity under farm school

S. No.	Particulars	Nos./Kg.	Participant/ No. of copy	Expenses/ Amount (Rs.)
1	Training of farm school members (meals)	6	26	5040
2	Provided demonstration seed to achiever farmer	60	1	3420
3	Provided demonstration seed to member farmer's (under kit item)	125	25	7125
4	Honorarium for trainer/scientist	12	2	3000
5	T. A. expenses for trainer/scientist	12	3	2080
6	Contingency	-	-	1985
7	Printed literature (Folder)	1	500	1400
8	Service charge to achiever farmer	1	1	2674
9	Banner	2	-	289
10	Field day (refreshment)	1	80	1050
11	Wall panting	1	-	1000
12	Photography	2	49	735

(ii) Economics of multicut green fodder production:

Economic indicators i. e. gross cost, gross return, net return and benefit cost ratio of farm school multicut green fodder hybrid sorghum demonstration are presented in Table 1. The data clearly revealed that, the net return from farm school demonstration were substantially higher than local check. The net return from farm school hybrid sorghum demonstration was Rs. 37000 per hectare in comparison to local check Rs. 27000 per hectare. On an average Rs. 10000 per hectare as additional income is attributed to the technological interventions provided in demonstration.

Economic analysis of the yield performance revealed the BCR of demonstration plots were observed significantly higher than control plot/local check. The BCR of multicut green fodder hybrid sorghum demonstrated and local check was 2.08:1 and 1.77:1 respectively. Hence, favorable benefit cost ratio proved the intervention made under demonstration and convinced the farmers on the utility of intervention. Similar finding were reported by Gurumukhi and Mishra (2003) in sorghum and Singh and Singh (2011) in barseem and oat.

(iii) Provided facility under farm school:

The farm school was provided all necessary facility to achiever and member's farmer are presented in Table 2. In this farm school conducted 6 training program for members and achiever farmer, field day for disseminated the technology, service charge for achiever farmer for input of crop, printed literature, demonstration seed of hybrid sorghum, honorarium and TA of trainer/scientists, contingency, banner and wall panting, photography, meals and refreshment of farmers etc. The total expenses in this farm school were Rs. 29798 (NFSM and SSEPERS-2010).

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Identification of primary minerals in the fine sand fractions of associated red and black soils in north Karnataka

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Abstract

Six soil profiles from three study sites of Northern Karnataka were collected to identify the dominant minerals present and also for understanding the weathering status and development of the soils originated on different parent materials. Identification of minerals in fine sand was identified by Petrographic method. Weathering status was assessed based on SiO_2/R_2O_3 molar ratios. Petrographic analysis of fine sand fraction revealed that the quartz content was more followed by mica, K and Na-feldspar in all the associated red and black pedons and also the Presence of weathering resistant mineral like zirconium in all the red pedons and in black pedon of Mantagani indicating that pedon has undergone prolonged weathering as that of red pedons. The SiO_2/R_2O_3 molar ratios of the soils was higher for black soils compared to associated red soils indicating red soils are more weathered than black soils.

Key words : Associated red, Associated black, Fine Sand, Mineralogy, Petrography

Introduction

Associated Red and Black soils have a considerable agricultural significance and potential. These associated red and black soils in close proximity have been observed at various locations in the peninsular India. Bhattacharyya *et al.* (1993) and Pal and Deshpande (1987) reported close association of these kinds of soils as distinct entities with clear lines of demarcation under almost similar topographical and climatic conditions have been rare. In India these soils accounts to 10% of the total geographical area of India.

They occupy a vast area in the northern part of Karnataka and the knowledge of its fine sand mineralogy is extremely poor. Hence the present investigation is an attempt to identify the primary minerals assemblage in the fine sand fraction of the associated Red and Black soils in north Karnataka. It is hoped that such studies will help us to understand the processes of soil renewability through the geochemical weathering of soil minerals for better soil management.

Methods and Materials

Six soil profiles, two each in three locations having different geological formations. They are located at Main Research station – Dharwad (Pedon 1 Red soil, Pedon 2 black soil, at the Latitude - $15^0 26^{'}$ N and Longitude - $75^0 07^{'}$ E) comes under Northern transitional Zone of Karnataka that is Zone – 8. The Geology of the site is Dharwad shale and banded haematite quartzite, (Dharwars) and physiography is undulating to rolling topography and mean annual rainfall is 839.73mm.

Bhimarayanagudi (Pedon 3 Red soil, Pedon 4 black soil, at the Latitude - $16^0 48^{'}$ N and Longitude $76^0 47^{'}$ E) comes under Northern Dry Zone of Karnataka, Zone -2 the Geology of the site is Granite-gneiss and physiography is nearly level to very gently undulating plains broken by granite hills and mean annual rainfall is 729.7mm.

Mantagani (Pedon 5 Red soil, Pedon 6 black soil, at the Latitude -$14^0 58^{'}$ N and Longitude - $75^0 21^{'}$ E) comes under Northern transitional Zone of Karnataka, Zone – 8, the Geology of the site is Chlorite schist and banded haematite quartzite (Dharwars) and physiography is undulating to rolling topography and mean annual rainfall is 623 mm.

The soil samples were collected horizon wise, air dried and processed for chemical and mineralogical analysis. The soil samples were analysed for the particle size distribution by fallowing international pipette method after removal of organic matter, calcium carbonate and free iron oxide. Fine Sand (2000-50 micron), silt (50-2 micron) and clay (2-0.2 micron) fractions were separated from the samples after dispersion according to the size segregation procedure

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of Jackson (1979) and Gjems (1967). The fine sand fractions were further fractionated into 100-50 micron fractions by dry sieving, and separated into light and heavy fractions using bromoform (specific gravity 2.82). Mineralogy of fine sand fractions was determined by Petrographic analysis.

Results and Discussion

Morphological features of the soils

Horizon differentiation in red pedons was relatively better as compared to black pedons because of argillo-pedoturbation in the latter. Horizons were identified in the red pedons based on colour, texture, abundance of coarse fragments and presence or absence of clay skins on ped surfaces (Table 1). In black pedons horizon differentiation was mostly based on prominent abundance and intersection of slickensides. Based on this, three to four horizons could be identified namely self-mulching surface, blocky peds with pressure faces and wedge shaped slickensided sub-soil. In general all the black Pedons are deep when compared to red Pedons attributed to their more chemical weathering.

Dharwad red pedon exhibited redder hue of 2.5 YR (Table 1) throughout the solum and same was seen in Mantagani pedon. But in Bhimarayanagudi pedon hue of 5 YR was observed because it contained less CBD extractable Fe_2O_3. In addition it also depends on type of iron oxides and its intimate mixture with clay compared to Dharwad and Mantagani pedon might be attributed to the nature and kind of iron oxides in that pedon. Bhattacharyya *et al.* (1993) observed the same trend in the associated red soils and Chakravarty *et al.* (1979) observed 2.5 YR hue in subsurface horizons and 5 YR in surface horizon. All the black pedons exhibited hue of 10 YR throughout the profile and the colour ranged from dark greyish brown to very dark greyish brown due to the clay-humus complex in the presence of lime. Similar finding were also reported by Rao *et al.* (1983). In Bhimarayanagudi colour value of black pedons at lower depths was higher due to high $CaCO_3$ content at that depth. In red pedons chroma was commonly between 3 and 4 whereas in black pedons it was two or less than two which indicated the poor internal drainage.

Structure in both red and black pedons was predominantly sub-angular blocky (Table 1). The black pedon of Bhimarayanagudi was angular blocky due to formation of prominent intersecting slickensides in subsoil. Thin patchy clay skins were visible on the ped surfaces of Bhimarayanagudi red pedons, whereas in other red pedons they were not conspicuous because of redder hue. In Bhimarayanagudi red pedons clay skins were present even at lower depths indicated the less disturbance of subsurface horizons. Pressure faces were observed on ped surfaces of Mantagani red

Table 1: Morphological features of the Pedons

	Main Research Station, Dharwad				Bhimarayanagudi (Gulbarga)					Mantagani (Haveri)				
	Pedon 1 (Red soil)		Pedon 2 (Black soil)		Pedon 3 (Red soil)		Pedon 4 (Black soil)			Pedon 5 (Red soil)			Pedon 6 (Black soil)	
Horizon	Ap	B_2	A_p	A_3, A_4, A_5	Ap_1	Bt_2	Ap_1	A_4	C_{Ca}	Ap, B_1	B_1t_1	C_1	Ap_1, A_2	A_5
Depth (cm)	0-20	55-67.5	0-20	40-105	0-15	43-69	0-9	47-96	118-148	0-35	33-59	107-122	0-31	89-102
Colour (Dry)	2.5 YR 4/4	2.5 YR 3/4	10 YR 4.5/2	10 YR 4/2	5 YR 5/6	5 YR 5/3	10 YR 3/1	10 YR 4/1	ND	2.5 YR 3/4	2.5 YR 3/4	2.5 YR 3/4	10 YR 4/2	10 YR 4/2
Colour (Moist)	2.5 YR 3/4	2.5 YR 3/6	10 YR 4/2	10 YR 3.5/2	5 YR 4/6	5 YR 4.5/3	10 YR 3/1	10 YR 3.5/1	ND	2.5 YR 3/4	2.5 YR 3/4	2.5 YR 3/4	10 YR 3.5/2	10 YR 3/2
Texture	scl	c	c	c	sl	scl	scl	c	c	c	c	sl	c	c
Structure	2m sbk	1f sbk	3m sbk	3m sbk	1m sbk	1vc sbk	3m sbk	3m abk	0c sbk	2m sbk	1m sbk	1m sbk	2m sbk	3m sbk
Salient morphological	-	-	-	Very prominent slickensides	-	Thin patchy clay skins on ped	-	Prominent intersecting	Prominent intersecting	Pressure faces on pad surface	Pressure faces on pad surface	-	Indistinct non-interscting slickensides	Indistinct non-intersecting slickensides

Scl – sandy cly, C- Clay, sbk – Sub angular blocky, abk – angular blocky; ND – Not determined

Table 2: Total elemental composition and their molar ratios in the fine sand fractions

Horizon	Depth (cm)	SiO_2(%)	Al_2O_3(%)	Fe_2O_3(%)	SiO_2/Al_2O_3	SiO_2/Fe_2O_3	Al_2O_3/Fe_2O_3	SiO_2/R_2O_3
Pedon – 1 (Red soil – MRS, Dharwad)								
Ap	0-20	54.8	11.2	4.8	8.32	30.06	3.61	6.51
B_2	55-67.5	56.2	11.2	3.3	8.58	44.85	5.25	7.17
Pedon – 2 (Black soil – MRS, Dharwad)								
Ap	0-20	66.9	8.9	4.2	12.78	41.95	3.28	9.79
A_3, A_4, A_5	40-105	68.2	8.3	3.2	13.97	56.12	4.10	11.18
Pedon – 3 (Red soil - Bhimarayanagudi)								
Ap_1	0-15	54.8	9.5	5.1	9.81	28.29	2.84	7.25
Bt_2	43-69	56.2	10.0	3.4	10.05	43.53	4.56	8.17
Pedon – 4 (Black soil – Bhimarayanagudi)								
Ap_1	0-9	66.9	10.6	4.8	10.73	36.70	3.42	8.30
A_4	47-96	68.2	9.5	4.2	12.20	42.76	3.50	9.49
C_{Ca}	118-148	72.2	9.5	3.1	12.92	61.33	4.75	10.67
Pedon – 5 (Red soil – Mantagani)								
Ap B_1	0-35	57.5	11.2	5.2	8.73	29.12	3.34	6.71
B_1t_1	33-59	60.2	11.2	4.7	9.14	33.73	3.69	7.19
C_1	107-122	62.9	11.8	4.3	9.07	38.52	4.25	7.34
Pedon – 6 (Black soil – Mantagani)								
Ap_1, A_2	0-31	69.6	9.5	3.8	12.45	48.23	3.86	9.89
A_5	89-102	74.9	8.9	3.1	14.31	63.62	4.52	11.68

Table 3: Primary minerals in the fine sand fractions and their relative abundance based on Petrographic analysis

Horizon	Depth (cm)	Light minerals						Heavy/ weathering resistant mineral
		Quartz	Biotite mica	Na-feldspar	K-feldspar	Apatite	Fe-Ti oxides	Zircon
Pedon-1 (Red soil – MRS, Dharwad)								
Ap	0-20	D	++	++	+	-	Tr	+
B_2	55-67.5	D	+++	+++	+++	Tr	Tr	++
Pedon-2 (Black soil - MRS, Dharwad)								
Ap	0-20	D	+++	+++	+++	-	-	-
A_3, A_4, A_5	40-105	D	++	++	+++	-	-	-
Pedon-3 (Red soil – Bhimarayanagudi)								
Ap_1	0-15	D	++	++	+++	-	Tr	-
Bt_2	43-69	D	++	++	+++	Tr	Tr	+
Pedon-4 (Black soil – Bhimarayanagudi)								
Ap_1	0-9	D	++	++	+++	-	-	-
A_4	47-96	D	++	++	+++	-	-	-
C_{Ca}	118-148	D	++	++	+++	-	-	-
Pedon-5 (Red soil – Mantagani)								
Ap B_1	0-35	D	+	++	+++	Tr	Tr	++
B_1t_1	33-59	D	+++	++	+	-	Tr	-
C_1	107-122	D	++	++	+	-	Tr	++
Pedon-6 (Black soil – Mantagani)								
Ap_1, A_2	0-31	D	++	++	+	-	-	+
A_5	89-102	D	++	++	+	-	-	+

D – Dominant (e"++++); + – Relative abundance; Tr – Traces

pedons might be due to the smectite type of clay. Slickensides were common feature in all the black pedons was due to argillopedoturbation. Abundance and intensity of slickensides were more in the middle of the solum because of maximum swelling pressure generated there as described by Bhargava *et al*. (1973).

Elemental composition and molar ratios of the soils

The Molar ratios of the soils are presented in Table 2 .The elemental composition shows that SiO_2 content is higher in all the Red and associated black Pedons fallowed by Al_2O_3 and Fe_2O_3. SiO_2 content increased with depth in all the pedons which was due to movement of silica down and depositions at lower layers. Black Pedons had more SiO_2 content than

that of red Pedons this was due to geomorphic position of the Pedons in the landscape that is transportation and deposition of SiO_2 as reported by Bhattacharyya *et al.* (1993). Mantagani Pedons had more SiO_2 content than Dharwad and Bhimarayanagudi Pedons because soils of Mantagani developed on Chlorite – Schist and soils from the Schist are to be silicious in nature as reported by Singh *et al*. (1998). SiO_2/R_2O_3 ratio was lower in red Pedons as compared to black Pedons that could be due to desilication and fertilization as reported by Singh *et al*. (1998). It revealed that red Pedons are more weathered than black Pedons. Among these sites Dharwad Pedons had less SiO_2/R_2O_3 ratio than Mantagani and Bhimarayanagudi Pedon indicating that Dharwad Pedons are more weathered than others as it existed in high rainfall area.

Fine Sand mineralogy by Petrographic analysis

The relative dominance of primary minerals as indicated from the Petrographic analysis is presented in (Table 3). In the fine sand fractions of the pedons of all the sites studied showed dominance of quartz throughout the depths indicated its resistance to weathering. Apart from quartz, Biotite mica, Na-feldspars and K-feldspars are predominant in surface horizon of Dharwad black pedon and their abundance was less in surface horizon of red pedon indicated that black pedon has not undergone intense weathering compared to red pedon. However, Bhimarayanagudi and Mantagani pedons showed no difference in these minerals abundance indicated the similar weathering status of both red and black pedons. Apatite and iron ores were found in red pedons as traces but not noticed in black pedons indicated more weathering status of red pedons. In all the red pedons weathering resistant mineral zircon constitutes its place. The presence of zircon in fine sand fractions has been regarded as a sign of higher degree of maturity of the pedon as reported by Chakravarty *et* al. (1979) and Rao *et al. (1983)*.

The presence of zirconium in fine sand fractions of black pedon of Mantagani is an indication of prolonged weathering of the pedon compared to other two associated black pedons. Similar findings were also made by Bhargava *et al*. (1973). The fine sand mineralogy of these three pairs of associated red and black soils is more or less similar though the soils derived from different parent material. Quartz remained as the dominant mineral in all the pedons. Biswas *et al*. (1966) reported that accumulation of quartz as dominant mineral is due to its resistance to weathering.

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Studies on energy budgeting in pearl millet (*Pennisetum glaucum*)–wheat (*Triticum aestivum*) cropping system under semi-arid condition of Agra region of Western U.P. (aesr 4.1)

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Abstract

*A field experiment was conducted during 1998-99 to 2005-06 (8 years) at the R.B.S. College, Agril. Research Farm in Cropping Systems Research Project (ICAR), Bichpuri, Agra (U.P.) in a continuous cropping of 'pearl millet (*Pennisetum glaucum*)–wheat (*Triticum aestivum*)' system. The results indicated that the maximum energy input was utilized by 50% N though WRC, integrated with 50% NPK through fertilizers (40-20-20) in pearl millet, followed by 100% NPK, i.e. 120-60-40 kg ha^{-1} through fertilizers in wheat crop grown in sequence. The minimum energy input was used in Control i.e. No fertilizers and No organics, say $N_0P_0K_0$, whereas, energy output was noticed maximum with 100% NPK through fertilizers in both pearl millet and wheat sequence. The energy ratio of the 'pearl millet-wheat' sequence – as a whole was computed maximum (10.57) with 50% NPK through fertilizers, integrated with 50% N through FYM in pearl millet, followed by 100% NPK (120-60-40 kg ha^{-1}) through fertilizers in wheat crop grown in the system.*

Key words : Energy-input, Energy-output and Energy ratio.

Introduction

An increase in agricultural production is possible mainly through intensive cropping systems, where seed, fertilizer, weeding, irrigation, chemicals (pesticides) and efficient management of power machinery affect the energy budgeting. The efficient management of overall farm resources may increase the farmer's income by way of intensive cropping system, being adopted by them. Research efforts in energy budgeting in cropping system gathered momentum from Nineteen seventies due to global fossil fuel crises and rapidly increasing demand for food. Energy relationship in cropping system may vary and constitute a dependent function of the crops knitted in sequence, yield level, nature of power use, soil type, energy input and agro-climate. Keeping in view these facts, the present investigation was carried-out to assess the energy-input, energy-output and their ratio for energy budgeting in various fertility treatments adopted in 'pearl millet-wheat' system.

Materials and methods

A field experiment was conducted at the Agricultural Research Farm of Raja Balwant Singh College, Bichpuri, Agra (U.P.) AESR-4.1 in Cropping Systems Research Project (ICAR) during 1998-99 to 2005-06 (8 years). The experiment was laid in 'Randomized Block Design', having 12 treatments, as given below and 4 replications in continuous 'pearl millet-wheat' cropping system.

The pearl millet and wheat crops were sown between 20-25 July and between 15-20 November, respectively in eight years of experimentation. As per the fertility treatments, quantities of FYM, waste-residue of crops (WRC), green manure (*dhaincha – Sesbania aculeate*) having 0.5% N in FYM, 0.6-0.62% N in WRC and 1.0-0.75% N in green manure during 1998-99 and 2005-06 were applied before sowing of pearl millet crop and required quantity of nitrogen (half at sowing and rest half at knee-high stage in pearl millet and at the time of first irrigation in wheat crop) as top dressing was applied through urea (46% N). All the practices including basal doses of P and K were applied in both the crops.

Results and discussion

Energetic approach in cropping system focuses acceleration of the pace of crop production on one-hand and efficient energy utilization particularly in the intensive cropping system on the other.

In the present investigation, the direct energy refers to both operational and non-operational energy. Operational energy constitutes manual (labourers), ploughing (fuel, machinery) etc.; whereas, non-operational energy encompasses seed, fertilizers, insecticides etc. No statistical analysis was done and average data (mean) for different treatments

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Treatments:

Treatments	*Kharif* (Pearlmillet)	*Rabi* (Wheat)
T_1	Control (No fertilizers, no organics)	Control (No fertilizers, No organics)
T_2	50% recommended NPK through fertilizers (40-20-20)	50% recommended NPK through fertilizers (60-30-20)
T_3	50% recommended NPK through fertilizers (40-20-20)	100% recommended NPK through fertilizers (120-60-60)
T_4	75% recommended NPK through fertilizers (60-30-30)	75% recommended NPK through fertilizers (90-45-30)
T_5	100% recommended NPK through fertilizers (80-40-40 kg/ha)	100% recommended NPK through fertilizers (120-60-40 kg/ha)
T_6	50% recommended NPK through fertilizers + 50% N through FYM @ 8 t/ha	100% recommended NPK dose through fertilizers
T_7	75% recommended NPK through fertilizers + 25% N through FYM @ 4 t/ha	75% recommended NPK dose through fertilizers
T_8	50% recommended NPK through fertilizers + 50% N through waste residue of crops (WRC) @ 6.6 t/ha	100% recommended NPK dose through fertilizers
T_9	75% recommended NPK through fertilizers + 25% N through waste residue of crops (WRC) @ 3.3 t/ha	75% recommended NPK dose through fertilizers
T_{10}	50% recommended NPK through fertilizers + 50% N through green manure (*dhaincha*) @ 5.50 t/ha	100% recommended NPK dose through fertilizers
T_{11}	75% recommended NPK dose through fertilizers + 25% N through green manure (*dhaincha*) @ 2.75 t/ha	75% recommended NPK dose through fertilizers
T_{12}	Farmer's practice (40-0-0 kg NPK/ha) only	Farmer's practice (40-0-0 kg NPK/ha) only

considered for total production, energy-input, energy-output and energy input/output ratio for different fertility treatments.

Energy Coefficient, Energy Equivalent, Common/ Fixed/Various Energy Inputs:

The concerning figures are given in Table 1 to 5.

Energy Inputs in pearl millet and wheat crop :

Pearl millet : The maximum energy input was noted with T_8 (50% N substitution through WRC), followed by T_9 (25% N substitution through WRC), T_{10} (50% N substitution through green manure) and T_{11} (25%N substitution through green manure *dhaincha*). These treatments (T_8 to T_{11}) showed higher energy-input, compared to treatments of FYM substitution (T_6 and T_7) and T_5 (100% NPK through fertilizers). The farmer's practice also showed lower energy-input and the lowest with control ($N_0P_0K_0$).

Table 1: Unit energy co-efficient for bullock and tractor power source

Operation	Unit energy co-efficient (MH ha^{-1}) of pearlmillet/wheat crop
	(A) Bullock Power Source
Ploughing	281
Harrowing	173
Planking	60
	(B) Tractor Power Source
Ploughing	416
Harrowing	444
Planking	126

These results clearly indicated that substitution of organics increased the energy-input, compared to other treatments.

Table 2 : Energy Equivalent for various inputs

Particular	Unit	Equivalent energy (MJ ha^{-1})	Remarks
Adult man	Man-hr	1.96	1 adult women = 0.8 adult man
Diesel	1 litre	56.31	
Electricity	KW-hr	11.93	
Chemical fertilizers			
(i) N	Kg	60.00	Through urea fertilizer
(ii) P_2O_5	Kg	11.10	Through DAP
(iii) K_2O	Kg	6.70	Through MOP
(iv)Phorate	Kg	120.00	Super Chemial (insecticide)
By products			
Grain			
Pearlmillet	Kg	14.70	
Wheat	Kg	14.70	
Stover/wheat straw			
Pearlmillet	Kg	12.50	
Wheat	Kg	12.50	

Note: 1000 killo caloric (KCa physiological unit = 4.184, Mega Joule (MJ)

Wheat : As the level of NPK reduced from 100% recommended to 75% or to 50% NPK, there was reduction in energy-input utilization. Farmer's practice

Table 3 : Common/Fixed energy input (MJ ha^{-1}) under operational and non-operational operations performed in pearlmillet-wheat during 1998-99 to 2005-06

Operations	Pearlmillet (Energy input MJ ha^{-1})	Wheat (Energy input MJ ha^{-1})
Common/Fixed energy input		
1. Operational :		
i. Ploughing (2)	834.00	834.00
ii. Ploughing by cultivator (2)	888.00	88.00
iii. Planking (1)	126.00	126.00
iv. Ridging (4 labourers)	7.84	7.84
v. Fertilizer & Phorate (10G) application and sowing (11 labourers)	21.56	21.56
vi. Weeding, thining and transplanting	34.49	34.49
vii.20 labourers (12 women + 8 men)	—	4000.00
viii. Harvesting – 2 labourers in pearlmillet and 20 labourers in wheat	39.20	30.20
ix. Ear cutting – 20 women in pearlmillet	31.36	—
x. Threshing – 12 men in pearlmillet and 20 labourers in wheat	23.52	39.20
2. Non-operational :		
i. Seed energy for 6 kg (pearlmillet), 120 kg (wheat)	88.20	1764.00
ii. Chemical energy phorate (10G) @ 10kg ha^{-1} @ 120	1200.00	1200.00
Total	3294.17	8954.29

and control indicated lower energy-input.

Energy budgeting of 'pearlmillet-wheat' sequence :

The significantly higher energy input in pearlmillet in T_8 treatment, fertilized with 50% N through WRC was mainly due to its residual effect on the crop, being grown in a long term experiment for 8 years (i.e. 1998-99 to 2005-06). Contrary to this, pearlmillet yield in control (T_1) required less energy in agricultural operations, particularly for no fertilization, showed the minimum energy inputs employed in this treatment. The results were quite obvious, because of low cost of cultivation under poor supply of nutrients.

Table 4: Variable energy input (MJ ha^{-1}) through fertilizers treatment in pearlmillet during 1998-99 to 2005-06 (mean over 8 years)

Treat	Fertilizers			Organics			Total
	N	P_2O_5	K_2O	FYM	WRC	Green	
T_1	Control	-	-	-	-	-	-
T_2	2400	222	134	-	-	-	2756.0
T_3	2400	222	134	-	-	-	2756.0
T_4	3600	333	201	-	-	-	4134.0
T_5	4800	444	268	-	-	-	5512.0
T_6	2400	222	134	720	-	-	3476.0
T_7	3600	333	201	360	-	-	4494.0
T_8	2400	222	134	-	24750	-	27506.0
T_9	3600	333	201	-	12375	-	16509.0
T_{10}	2400	222	134	-	-	12000	14756.0
T_{11}	3600	333	201	-	-	6000	10134.0
T_{12}	2400	-	-	-	-	-	2400.0

(A) Common/Fixed Energy Input (MJ ha^{-1}) = 3294.17
(B) Variable energy input (MJ ha^{-1})
WRC – Waste Residue of Crops.

Energy Input (MJ ha^{-1}) :

In wheat crop, the maximum energy input was noted in treatments fertilized with 100% recommended NPK, followed by 75% and 50% NPK and lowest with control ($N_0P_0K_0$), which was the resultant of balanced fertilizer.

Increased modernization, in general, involves lesser input of energy in crop production. Further results indicated that higher energy-input in terms of fertilizers under recommended fertilizer treatments from T_5 to T_{11}, than inadequate, poor supply or no supply of nutrient (control). These results are in close conformity with the findings of Freeman (1980), Baishya and Sharma (1990), Padhi (1993), Jaipal *et al.* (1993) and Billore *et al.* (1994), they found higher energy-input with recommended fertilizer than reduced level of fertility.

Table 5: Variable energy input (MJ ha^{-1}) through fertilizer treatments in wheat during 1998-99 to 2005-06 (mean over 8 years)

Treatments	Fertilizers			Total
	N	P_2O_5	K_2O	
T_1	Control	-	-	-
T_2	3600	333.00	134	4067.00
T_3	7200	666.00	268	8134.50
T_4	5400	499.50	201	6100.50
T_5	7200	666.00	268	8134.00
T_6	7200	666.00	268	8134.00
T_7	5400	499.50	201	6100.50
T_8	7200	666.00	268	8134.00
T_9	5400	499.50	201	6100.50
T_{10}	7200	666.00	268	8134.00
T_{11}	5400	499.50	201	6100.50
T_{12}	2400	-	-	2400.00

(A) Common/Fixed Energy Input (MJ ha^{-1}) = 8954.29
(B) Variable Energy Input

Table 6 : Energy-input (MJ ha^{-1}), energy-output (MJ ha^{-1}) and energy output/energy input ratio as affected by various fertility treatments in 'pearlmillet-wheat' system (pooled over eight years i.e. 1998-99 to 2005-06)

Treatments	Energy-input (MJ ha^{-1})			Energy-output (MJ ha^{-1})			Energy output/input ratio		
	Pearlmillet	Wheat	Total of sequence	Pearlmillet	Wheat	Total of sequence	Pearlmillet	Wheat	Total of sequence
T_1	3294.70	89.54.29	12248.99	48331.70	55546.20	103878.90	14.6	6.20	8.48
T_2	6050.17	13021.29	19071.46	71855.80	126075.90	197931.70	11.87	9.68	10.37
T_3	6050.17	17088.29	23138.46	74688.50	162371.70	237060.20	12.34	9.50	10.24
T_4	7428.17	15043.79	22482.96	68403.70	140006.80	208410.50	9.20	9.29	9.26
T_5	8806.17	17088.29	25894.46	91367.50	168440.20	259808.00	10.37	9.85	10.03
T_6	6770.17	17088.29	23858.46	89320.40	162868.80	252189.20	13.19	9.53	10.57
T_7	7788.17	15054.79	22842.96	90584.80	149776.60	240361.40	11.63	9.94	10.52
T_8	30800.00	17088.29	47888.46	91156.60	158855.10	250011.70	2.95	9.29	5.22
T_9	19803.17	15054.79	34857.96	90704.00	144221.30	244925.30	4.58	10.24	7.20
T_{10}	18050.17	17088.29	35138.46	89933.40	160968.20	250902.60	4.98	9.41	7.14
T_{11}	13428.17	15054.79	28482.96	8856.30	14698.50	234424.80	6.59	9.76	8.26
T_{12}	5694.17	11354.29	17048.46	63752.40	101984.51	165736.90	11.19	8.96	9.72
CD(p=0.05)	515	1100	950	915	1500	1750	1.7	1.9	1.8

Energy Output (MJ ha^{-1}) :

The energy-output from the crops grown in 'pearlmillet-wheat' sequence varied from treatment to treatment under different levels of fertilization. The 100% recommended NPK through fertilizers (T_5) as well as 50% N substitution through FYM/WRC or green manure treatments enhanced the energy output due to their higher yield and this was reduced with reduction in level of NPK and farmer's practice as well as control (no fertilization). In general, wheat crop showed higher energy output than pearlmillet, because of higher grain and straw yields of wheat, therefore, the energy output of total main products (TMP) and total harvested bio-mass (THB) was obtained higher with 100% NPK through fertilizer and treatments integrated with organics.

Energy Output/Input ratio :

Higher energy output/input ratio in treatment T_6 and T_7, wherein 25% to 50% N was substituted by FYM in pearlmillet followed by 100% NPK fertilizers in wheat was the resultant of higher grain and straw yields of both crops obtained, which had direct relationship with energy output/input ratio, along with low cost of cultivation. Padhi (1993) was of the opinion that the sequences, which achieved highest energy output would give the maximum energy output ratio (Table 6).

It may be concluded that substitution of organics increased the energy output (MJ ha^{-1}) as well as energy-input and was decreased with reduced fertility levels. The increasing cost of input and energy crises, the substitution of 50% N through FYM @ 4 t ha^{-1} with 50% NPK (40-20-20 kg ha^{-1}) – fertilizers in pearlmillet, followed by 100% recommended NPK (120-60-40 kg ha^{-1}) – to wheat in the system recorded maximum (10.57) energy-output/input ratio.

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Effect of Integrated nutrient management in soil physical properties and organic carbon status at the topsoil horizon of a Inceptisols of eastern Uttar Pradesh after 25 years of continuous cropping

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Abstract

Balanced application of inorganic fertilizer and organic amendments greatly influence the accumulation of organic matter in soil and also influence the soil physical environment. An investigation was carried out to study the long-term impact of fertilizer and manure application in a rice–wheat cropping system on soil organic carbon status and physical properties of Inceptisols in humid sub-tropical region India. Nine treatments namely, control (no fertilizer and manure), 50 % NPK, 100 % NPK, 50 % NPK+ 50 % N through FYM, 75 % NPK+ 25 % N through FYM, 50 % NPK+ 50 % N through WS, 75 % NPK+ 25 % N through WS, 50 % NPK+ 50 % N through GM and 75 % NPK+ 25 % N through GM at 8 Mg ha^{-1} (50 % NPK+ 50 % N through FYM), 3 Mg ha^{-1} (50 % NPK+ 50 % N through WS) and 10 Mg ha^{-1} (50 % NPK+ 50 % N through GM) from a long-term fertilizer experiment continuing at Varanasi, India, were chosen for this study. Soil samples were collected from the topsoil horizon (0–15 cm) of all the four replications of the selected nine treatments in October 2011 after 25 crop cycles and analyzed for physical and chemical properties. The results showed that the soil organic carbon (SOC) content in 100% NPK and 50 % NPK+ 50 % N through FYM, treatments increased, respectively, by 17.64 and 88.24% over the initial level (3.40 g kg^{-1}). The electrical conductivity, hydraulic conductivity, SOC content, microporosity and available water capacity of the soil were increased while the bulk density was reduced significantly with the 100% NPK + FYM treatment over all other treatments. However, the use of imbalanced optimal rate of inorganic fertilizer (50% NPK) as compared to the unfertilized control showed significant effect on the physical properties of the soil. The study indicates that application of balanced rate of fertilizers in combination with organic manure could sequester soil organic carbon in the surface layer, improve the soil physical environment and sustain higher crop productivity under this intensive cropping system.

Keywords: Long-term fertilizer experiment; Bulk density; Porosity; Available water capacity, rice–wheat

Introduction

Introduction of inorganic fertilizers along with the entry of high yielding and fertilizer responsive cultivars have largely replaced traditional practices, such as recycling of organic materials and application of organic manures in India. This has raised concerns about the potential long term adverse impacts on soil productivity and environmental quality, particularly in systems where imbalanced fertilization is practiced over a long period. Higher rate of subsidy on nitrogenous fertilizers artificially reduced their cost compared to P and K fertilizers in India, which encouraged farmers to use only nitrogenous fertilizers in many parts of the country. Besides this, the poor and marginal farmers often use optimal rates of NPK fertilizers due to scarcity of resources available to them (Nambiar and Abrol 1989). In long-term fertility experiments in India, decline in soil organic matter is generally implicated as one of the causes for yield stagnation, particularly where N is the only fertilizer, irrespective of cropping system and soil type (Swarup *et al.* 2000). Losses and gains of soil organic matter could be influenced by land management practices such as cropping frequency, tillage, fertilizer application, manure application and also by cultivation of perennial legumes and grasses (Manna *et al.*, 2005). Maintenance of optimum soil physical conditions is an important component of soil fertility management. Organic matter affects crop growth and yield, either directly by supplying nutrients, or indirectly by modifying soil physical properties that can improve the root environment and stimulate plant growth (Kononova 1961). However, Mulla *et al.* (1992) could not establish a relation between the organic matter and physical properties of a sandy loam soil under conventional and

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alternative farming. Since soil fertility management practices may influence soil physical environment, it is important to determine the effect of manure and fertilizer application on soil physical properties such as porosity, bulk density and water holding capacity. Most of the studies in the past evaluated only the short-term effects of separately applied organic matter on soil properties. In deed, little is known about the long-term impact of intensive cropping with chemical fertilization and organic manuring on soil physical properties particularly for high clay soil (Nambiar and Abrol 1989). Long-term experiments provide the best possible means for studying changes in soil properties and processes and thus, for obtaining valuable information required for formulating future strategies for maintaining soil health. Against this background, the present study was undertaken to quantify the long-term changes in soil organic carbon, porosity and water holding capacity of a Inceptisols as a result of continuous intensive cropping with different soil fertility management practices.

Materials and methods

A long-term fertilizer experiment continuing since 1985-86 at the experimental research farm at the Institute of Agricultural Sciences., B.H.U, Varanasi (U.P.). India ($25^0 20^{`}$N, $83^0 00^{`}$E and 448 m above mean sea level) was chosen for this study. This experiment has been under the supervision of the All India Co-ordinated Research Project on Long term Fertilizer Experiments (AICRP-LTFE) of the Indian Council of Agricultural Research. The soil of the experimental site is clayey in texture with a cation exchange capacity of 16 cmolc kg^{-1} and is classified as Typic Ustochrepts (Incetisols). The clay content varied between 23.10 and 19.20%, while sand content ranged from 26.13 and 20.90%. The experiment was continued with an annual two crop rotation of rice (*Oryza sativa L.*) and wheat (*Triticum aestivum L.*) up to 1985-86. In the rotation, rice was grown as a rainfed crop in the rainy season (June–September). Wheat was grown in the winter season (December–March) with six irrigations applied during crown root initiation, maximum tillering and flowering stage of the crop. Irrigations based on the crops need. Recommended weed control and plant protection measures were adopted in all the crops throughout the period of experimentation. The climate of the experimental site is humid sub-tropical with dry hot summer and cold winters. The mean monthly minimum temperature varies from 9.00^0C in January to 24.24^0C in May and a monthly mean maximum temperature varies from 22.18^0C in January to 44.98^0C in May, with wide diurnal variations. The average annual precipitation is about 1153 mm of which more than 80% is normally received during the rainy season (June–September). The experiment was laid out in a randomized block design with twelve treatments replicated four times with a plot size of 11 m x 6 m. For the present investigation 9 out of the 12 treatments were selected to answer some specific questions like whether long-term application of nitrogen fertilizer optimal rate of NPK fertilizer and organic manure will affect soil properties specially soil water holding capacity, porosity and organic carbon status and productivity of crops under intensive cultivation in humid sub tropical regions of India. The treatments selected were control (treatment where crops were raised without any nutrient application), The amounts of N, P, and K applied to plots under each treatment are given in Table 1. The fertilizer rates applied to the crops in the rotation were worked out on the basis of soil test values determined at the beginning of the experiment. Rates are expressed as the percentage of the optimum rate. Urea, diammonium phosphate and muriate of potash were the sources of N, P and K, respectively. Farmyard manure, wheat straw and green manure was applied once in every year only to the rice at 8 Mg ha^{-1}, 3 Mg ha^{-1} and 10 Mg ha^{-1} (on dry weight basis). On an average, the FYM contained 0.76% N, 0.20% P and 0.34% K, WS contained 0.58% N, 0.11% P and 0.86% K and GM contained 2.0% N, 0.32% P and 0.52% K on a dry weight basis.

Soil sampling and analysis

Soil samples were collected from the topsoil (Ap) horizon (0–15 cm) of all the four replications of the selected five treatments after harvest of rice in October 2011 (after 25 cycles of annual crop rotations). In each replication the soil samples were collected from four points and were mixed to get a composite sample. About 500 g soil was sub-sampled from the mixed composite sample by quartering. Of this, approximately 200 g soil was taken for and bulk density analysis and the remaining portion was air dried at room temperature and passed through 2-mm sieve for estimation of soil organic carbon, pH, electrical conductivity and hydraulic conductivity. Hydraulic conductivity of intact cores of 7.5 cm diameter and 15 cm length were measured by constant head method. The quantity of water flowing through the sample for a given hydraulic head was measured for 60 minutes. Hydraulic conductivity (K) was calculated from the formula obtained from Darcy's law method of Black (1965). The organic carbon content of the soil was determined by wet digestion method of Walkley and Black (Nelson and Sommers 1982). Soil organic carbon was then expressed on volume basis using the bulk density data and depth of the topsoil (0.15 m). Electrical conductivity (EC) and pH of the soil were estimated in 1:2.5 soil: water suspension. The bulk density of the soil was determined by clod method (Blake and Hartge 1986).

Table 1. Rates of N, P and K (kg ha^{-1}) applied in different treatments

Treatments	Rice			Treatments	Wheat		
	N	P	K		N	P	K
T_1-Control*	0	0	0	T_1-Control*	0	0	0
T_2-50%RF	60	30	30	T_2-50% RF	60	30	30
T_3-100% RF	120	60	60	T_3-100% RF	120	60	60
T_4-50 % RF + 50% N Through FYM	60+60 FYM	30	30	T_4-100% RF	120	60	60
T_5-75%RF + 25%N Through FYM	90+30 FYM	45	45	T_5-75%RF	90	45	45
T_6-50 % RF + 50 % N Through CR	60+60 CR	30	30	T_6-100% RF	120	60	60
T_7-75 % RF + 25 % N Through CR	90+30 CR	45	45	T_7-75% RF	90	45	45
T_8-50 % RF + 50 % N Through GM	60+60 GM	30	30	T_8-100% RF	120	60	60
T_9-75 % RF + 25 % N Through GM	90+30 GM	45	45	T_9-75 % RF	90	45	45

*No fertilizer, No organic manure
RF: Recommended fertilizer (120 kg N + 60 kg P_2O_5 + 60 kg K_2O ha^{-1})
FYM- Farmyard manure, CR- Crop residue (wheat straw), GM-Green manure (Sasbania aecuelata L.)

Plant available water content (AWC) was estimated as the difference between the volumetric water retention at -0.033 and -1.5 MPa, multiplied by depth of the soil. Total porosity was estimated from the bulk density and particle density of the soil using the equation:

$$\text{Total porosity} = \frac{1 - pb}{ps} \times 100$$

Where, *pb* is the bulk density and *ps* is the particle density of soil solids. Microporosity (consisting of pores with equivalent radius <30 mm) was assessed from the volumetric water content at -0.01 MPa. Analysis of variance (ANOVA) was carried out using the randomized complete block design.

Results and discussion

Soil organic carbon

Soil organic carbon (SOC) was significantly influenced by the fertilizer and organic manure applied over 25 years of cropping (Table 2). The SOC content (6.40 g kg^{-1}) in 50 % NPK + 50 % N through FYM treatment was significantly higher compared to its values in all other treatments. The 100% NPK treatment also recorded significantly higher SOC (4.00 g kg^{-1}) than control and 100% NPK and control treatments. Further, the SOC content in control and 100% NPK plots remained around the initial SOC level (3.40 g kg^{-1}), while the SOC content in 50 % NPK + 50 % N through FYM treatments attained a new equilibrium that was 88.24% higher than the initial SOC level. Generally, intensive cropping causes a decline in SOC over time (Lal 1989). But in the present study, the SOC status in unfertilized plots showed no decline even after 25 years of cropping, apparently because of low SOC equilibrium (3.40 g kg^{-1}) already attained by the experimental soil at the initiation of experiments in 1985-86. Maintenance of higher levels of organic carbon in the surface soil of the 100%NPK and 100%NPK + FYM treated plots had also been reported earlier by Reddy *et al.* (2001) for Vertisols. The beneficial effects of recommended rate of fertilizer application over the control, 100% N and 50% NPK treatments on the SOC was ascribed to better crop growth with concomitantly higher root biomass generation and higher return of leftover surface plant residues. In case of 50 % NPK + 50 % N through FYM treatment, direct addition of organic matter from the farmyard manure, containing 30 % carbon, was the reason for the increase in organic carbon content (Acharya *et al.* 1988; Benbi *et al.* 1998).

Table 2: Effect of fertilizer and organic manure application under intensive cropping on soil organic carbon content (SOC), electrical conductivity (EC) and pH of the top soil (0–15 cm) after 25 crop cycles of rice–wheat crop rotation

Treatments	SOC (g kg^{-1})	EC (dSm^{-1})	pH
T_1	3.20	0.12	7.61
T_2	3.80	0.16	7.89
T_3	4.00	0.18	7.84
T_4	6.40	0.23	7.62
T_5	6.10	0.18	7.53
T_6	5.10	0.20	7.66
T_7	4.80	0.19	7.65
T_8	5.80	0.22	7.71
T_9	5.40	0.21	7.60
CD at (5 %)	0.17	0.008	0.109

Electrical conductivity (EC) and pH

Long-term application of fertilizer and manure significantly affected the electrical conductivity (EC) of the soil but their effect on soil pH was not significant (Table 2). The EC in 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK+50 % N through WS and 100% NPK treatments was significantly higher than in control treatments. In the 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments the EC was 0.23 and

0.22, 0.20 and 0.18 dS m^{-1}, respectively, higher than the initial value (0.12 dS m^{-1}). This small increase in EC might be due to increase in base saturation of the soil where optimum rate of fertilizer and manure was applied compared to the control plots. Soil pH did not change significantly with application of manure and fertilizer. High buffering capacity of the clayey soil and nominal presence of weak salts namely carbonates or bicarbonates, which on dissolution release free cations, might be the possible cause for the stability of the soil reaction.

Saturated hydraulic conductivity

The hydraulic conductivity in 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments was significantly higher over in control treatments (Table 3). The saturated hydraulic conductivity (HC) of soil after harvesting of rice and wheat crop was significantly influenced by organic and inorganic treatment combinations. The hydraulic conductivity ranged from 9.48 to 32.77 mm day^{-1} and was greatly influenced by organic matter addition. However when 50% of N was substituted by organic manures, the hydraulic conductivities increased significantly over control or 100% NPK fertilized plots. The results of this study indicate that organic materials that decompose slowly had a greater effect in increasing hydraulic conductivity. Substituting 25% of the recommended N as organic manure (either as wheat straw, FYM or green manure) also significantly increased hydraulic conductivity of the soil as compared to inorganically fertilized plots after rice. This increase was highest (32.73 mm day^{-1}) for FYM treated plots (T_4), followed by GM treated plots (T_8), (29.70 mm day^{-1}) and wheat straw treated plots (T6), (22.77 mm day^{-1}). However combined application of organic manure with inorganic fertilizer improved water infiltration characteristics, whereas inorganic fertilization alone reduced water infiltration in soil. Mandal *et al*. (2003) reported an increase in hydraulic conductivity by *Sesbania* green manuring and green gram residue incorporation due to reduction in bulk density and increase in organic C concentration in soil that led to better transmission properties of the soil. They reasoned that use of organic sources might have increased the stability of aggregates, which could have improved pore size distribution along with total porosity, resulting in greater saturated hydraulic conductivity.

Soil physical properties

Bulk density

The bulk density (BD) in 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments was significantly lower than in control by 0.03, 0.15, 0.16 and 0.16 Mg m^{-3} (Table 3). The reduction in BD could be attributed to higher organic matter content of the soil (Tiarks *et al.* 1974).

Table 3: Effect of fertilizer and organic manure application on bulk density and hydraulic conductivity after 25 cycles of rice–wheat crop rotation

Treatments	Bulk density (Mg m^{-3})	Hydraulic conductivity (mm day^{-1})
T_1	1.51	9.48
T_2	1.30	11.44
T_3	1.35	16.07
T_4	1.48	32.73
T_5	1.39	31.38
T_6	1.35	22.77
T_7	1.33	19.72
T_8	1.36	29.70
T_9	1.39	27.52
CD at (5 %)	0.04	0.48

Soil available water capacity

The 50 % NPK + 50 % N through FYM plots retained significantly higher available water capacity than control and 50% NPK plots (Table. 4). Following addition of organic matter either through crop residue or application of organic manures, the specific surface area increases which results in increased water holding capacity (Gupta *et al.* 1977). The available water capacity (AWC) up to 15 cm depth under 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through WS and 50 % NPK + 50 % N through GM were significantly higher than control, 100% NPK and 50% NPK treatments (Table 4). In 100% NPK + FYM treatment the AWC was significantly higher than in 100% NPK treatment. Hudson (1994) reported that soils high in organic matter have greater available water holding capacity than the soils of similar texture with less organic matter.

Table 4: Effect of fertilizer and organic manure application on porosity and available water capacity (AWC) after 25 cycles of rice–wheat crop rotation

Treatments	Micro-porosity (%)	Total porosity (%)	AWC up to 15 cm depth
T_1	29.50	40.10	1.56
T_2	30.10	41.10	1.51
T_3	31.30	42.32	1.69
T_4	36.50	51.20	2.20
T_5	36.00	48.20	2.16
T_6	33.00	44.10	1.85
T_7	32.00	43.00	1.76
T_8	35.10	47.10	2.00
T_9	33.60	45.00	1.86
CD at (5 %)	0.72	1.14	0.11

Porosity

The manure and fertilizer application exhibited a positive effect on the micro- (equivalent pore diameter <30 mm) and total porosity of the soil (Table 4). In the

plough layer, the 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments plots had significantly greater microporosity than control. The 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments registered 23.30, 18.98, 11.86 and 6.10% higher microporosity than the control. The total porosity under 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments was significantly higher than control. Increase in total and micro-porosity of the soil with fertilizer and/or manure treatments could be attributed to higher organic matter content, better aggregation and change in pore size distribution of the soil (Aggelides and Londra 2000).

Crop yields

The grain yield of rice and wheat during the study year (1985–86) and mean of crop yields of rice and wheat between 1985-86 and 2010-11 (data not shown). During the study year significantly higher grain yields of both rice and wheat were obtained in 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments over 100% NPK, indicating the benefits of organic manure on the crops performance. The 50 % NPK + 50 % N through FYM, 50 % NPK + 50 % N through GM and 50 % NPK + 50 % N through WS and 100% NPK treatments registered significantly higher crop yields than 50% NPK and control. This showed the benefit of balanced rate of fertilizers even at optimal rates vis-à-vis imbalanced use of only nitrogenous fertilizers. The long term average grain yield also showed a similar trend in crop yield as was observed in 2010-11.

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Integrated weed management in rain fed chickpea (*Cicer arietinum*)

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Abstract

An experiment was conducted at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalay, Chitrakoot, Satna, Madhya Pradesh in the year Rabi 2009-10. The experiment containing 12 treatments (mechanical as chemical treatments) laid out in randomized block design. Growth parameters were recorded at successive crop growth stages , yield and yield contributing character recorded at maturity and economics of study was done after harvest. On the basis of research results pre-emergence application of Pendimethalin @ 0.75 kg/ha + 1 hand weeding at 25 DAS was found suitable for higher seed production and economically viable in rain fed chickpea.

Key words: Mechanical, Pendimethalin, Production, Pre-emergence, Chickpea

Introduction

India is the largest producer, importer and consumer of pulses in the world, accounting for 25% of the global production, 15% trade, and 27% consumption, as sizeable population in the country still depends on vegetarian diets to meet its protein requirement. The country produces a variety of pulses including chickpea (40%), pigeon pea (18%), black gram (11%), green gram (9%), lentil (8%), field pea (5%) and others (9%), to the tune of 13-15 million tons annually from an area of 22-23 million ha with an average yield of 600-650 kg/ha (Ali and Kumar, 2007). The crop of chickpea which has highest contribution in total pulse production in the country may play an important role in this direction. Among pulse crops, chickpea is grown on largest area of 6.4 million ha with the production of 5.10 million tons in India (Pramanik *et al.*, 2009). The state of Madhya Pradesh grows chickpea on largest area in the country. It is occupying the highest average of 2.74 million ha under chickpea and contributes 46 per cent of the total chickpea production in the country (Singh *et al.* 2003). Thus, any effort made in increasing the productivity of chickpea in the state of Madhya Pradesh will certainly help in increasing total pulse production in India.

In chickpea production, one of the major constraint is weed infestation. Weeds compete with crop plants for space, water and nutrients and hence, it causes considerable yield losses. Thus weed is one of the major constraints to obtain high grain yield of improved crop cultivars if they are not controlled timely and properly. Singh and Bajpai (1996) studied the effect of different crop production inputs on chickpea and found that maximum yield reduction of 87% was observed due to elimination of weed control. Bhalla *et al.* (1998) also recorded considerable yield losses in chickpea to the extent of 88 per cent if weeds are not controlled within critical growth period of crop. Chickpea is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of growth and establishment. Weeds affect growth, yield and quality of crop plants adversely and reduce soil fertility, compete with the crop plants for soil moisture, nutrients, space and sunlight. Farmers of Madhya Pradesh grow chickpea on larger area but seldom adopt weed control practices in it. It is the main cause of low crop productivity of chickpea inspite of favourable soil and weather conditions for producing chickpea in the state. Therefore, it is imperative to eliminate weeds from chickpea field at proper time and with suitable technique.

Materials and Methods

The field experiment was conducted during Rabi 2009-10 at Rajaula Agriculture Farm of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalay, Chitrakoot, Satna. The farm is located in Bundelkhand region of Northern Madhya Pradesh. Geographically the place of experiment Chitrakoot is situated at 25^0 10' N latitude and 80^0 85' E longitudes. The elevation from mean sea level is in between 190 and 210 meters. The soil of the experimental area is almost neutral but poor in organic matter content, low in phosphorus and high in available potassium. The climate of the region has mean maximum temperature is 4-5 ^{0}C during winters whereas May and June are the hottest months while January is the coldest. The total average annual rainfall is 950 mm. The experiment containing 12 treatments (T_1 – Weedy check, T_2 – Weed free check 3 hands weeding 15,

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30, 50 DAS, T_3 -One hand weeding at 25 DAS,T_4 – Two hands weeding at 25 and 50 DAS, T_5- Alachlor @ 2 kg a.i./ha Pre-emergence, T_6 -Pendimethalin @ 1 kg a.i./ha Pre-emergence, T_7 -Oxyfluorfen @ 0.2 kg a.i./ha Pre-emergence, T_8- Imazethapyr @ 100 g a.i./ha Post-E at 30 DAS, T_9 - Alachlor @ 1.5 a.i./ha Pre-E + 1 HW 25 DAS, T_{10} - Pendimethalin @ 0.75 kg a.i./ha Pre-E + 1 HW 25 DAS, T_{11}- Oxyfluorfen @ 0.15 kg a.i./ha Pre-E +1 HW 25 DAS, T_{12} - Imazethapyr @ 75 g a.i./ha Post-E 30 DAS +1 HW 50 DAS) was laid in simple randomized block design.

Results and Discussion

Effect of weed control treatments on growth contributing characters of chickpea crop

It can be observed from the Table 1 that at 60 DAS, weedy check treatment showed significantly maximum weed density as no weed control treatment was applied. Among herbicidal treatments, post-E application of Imazathapyr sowed minimum weed population which might be due to better weed control efficiency of Imazathapyr compares with other herbicides. Plant height was recorded highest in the treatment of weed free check and lowest in weedy check. Treatments of Imazethapyr and one hand weeding 25 DAS could not increase pant height significantly over weedy check treatment. It might be due to the reason that in Imazethapyr treatment plots, crop plants were suppressed by weeds in easly critical stage wchich could not resume their height even under effective weed control in later stages after 30 days of sowing. In the plots of one hand weeding treatment, crop plants faced competition with weeds in later stages which might have checked the plants height. Almost similar findings have also been reported by Singh et al. (2003). Number of branches/plant were recorded maximum in weed free check and significantly minimum in weedy check treatment plots. The treatments of 2 hand weeding, lone Pendimethalin and integrated use of

Table 1: Effect of weed control treatments on growth contributing characters of rainfed chickpea

Treatments	No. of weeds/ $m^{2(60DAS)}$	Plant height(cm)	No. of branches/ plant at maturity
T_1	9.47(89.9)	27.45	4.54
T_2 k	0.71(0.0)	33.50	8.00
T_3	3.38(11.9)	29.60	6.00
T_4	3.13(9.3)	31.00	7.33
T_5	5.34(28.0)	30.00	7.00
T_6	4.38(18.7)	31.00	7.33
T_7	4.67(21.3)	30.50	7.00
T_8	3.61(12.5)	29.75	6.33
T_9	4.22(17.3)	30.90	7.67
T_{10}	3.19(9.7)	31.60	7.67
T_{11}	3.44(11.3)	31.10	7.67
T_{12}	2.91(8.3)	30.20	6.67
SEm ±	0.41	1.24	0.70
CD 5%	0.84	2.57	1.44

herbicides except Imazethapyr + 1 HW produced branches at par with weed free check treatment. It might be due to reduced crop-weed completion for growth resources and space, which increased the number of branches. In the treatment plots of Imazethapyr, later application of herbicide might has affected the production of primary branches, but secondary branches produced at par with weed free check treatment.

Effect of weed control treatments on yield contributing characters of chickpea

Numbers of pods/plant were recorded significantly maximum in treatment plots of weed free check and significantly minimum in weedy check plots (Table 2). Among other treatments one hand weeding and Imazathapyr treatments produced significantly lesser pods than others which remained almost at par with each other. Numbers of pods seem to be associated with number of branches/plant which also behaved in a similar manner under different treatment. Increased number of branches may provide more points for pod formation, thus it increased the number of pods/plant. Weed control efficiency of different weed control treatments particularly in critical stage of crop growth might has responsible for all these effects. These results collaborative with the findings of Chaudhary and Singh (1987). Number of seeds/ pod was recorded maximum under weed free check treatments, but it was significantly more than only weedy check and Imazathapyr treatments (Table 2). It might be due to better development of pods in weed free and controlled weeds atmosphere which was provided by most of the weed control treatments. In weedy check plots, crop plants much competition with weeds throughout life period which may restrict the pod development resulting in minimum number of seeds/pod increased number of seeds/pod in pulse crops due to effective weed control by herbicides or manual weeding has also been reported by Chaudhary and Singh (1987). Harvest index was worked out significantly highest in the plots of weed free check which might be due to proper reproductive growth due to timely translocation of photosynthesis from source to sink. Such condition may increase the seed production ration in total produce. In other treatments, formation and translocation of photosynthesis might have limited due to crop-weed competition which may restrict the reproduction growth of crop plants, thus harvest index reduced. Similar explanation stands for minimum harvest index in weedy check treatment. Grain yield was recorded highest under weed free check treatment. It might be attributed to different yield attributes in general and to seed weight/plants in particular. As the plant stand was not affected by treatments, seed weight/plant is mainly responsible for grain yield per unit area. The treatment of Pendimethalin @ 0.75 kg/ha + HW 25 DAS also produced grain yield at par with weed free treatment. It also might be attributed to seed weight/plant. Single application of herbicides reduced grain yield compared

with their integrated use with one hand weeding. Such yield reduction might be attributed to crop-weed competition particularly in later stage of crop when effect of herbicides was diluted. Grain yield was produced lowest in weedy check treatment which was due to maximum crop-weed competition throughout crop life. It is proved from yield attributes also. It is thus proved that integrated application of Pendimethalin @ 0.75 kg/ha as pre-E + 1 HW 25 DAS yielded at par with weed free checks treatment. These findings are collaborative with Dadhich and Mali (1991)

Table 2: Effect of weed control treatments on yield contributing characters of rainfed chickpea

Treatments	No. of pods/plant	No. of seeds/pod	Seed yield (q/ha)	Harvest index (%)
T_1	18.02	1.10	5.27	35.75
T_2	46.33	1.36	16.19	45.43
T_3	30.66	1.25	10.94	39.13
T_4	34.40	1.33	13.39	43.19
T_5	32.60	1.23	11.47	42.41
T_6	35.00	1.30	12.65	41.11
T_7	33.67	1.26	11.52	38.45
T_8	31.20	1.23	12.09	43.66
T_9	34.80	1.33	13.84	41.57
T_{10}	38.33	1.35	14.89	41.67
T_{11}	36.13	1.33	13.96	40.51
T_{12}	31.60	1.21	13.02	40.51
SEm ±	2.08	0.07	1.05	0.81
CD 5%	4.32	0.14	2.18	1.67

Effect of weed control treatments on economics of chickpea

Cost of cultivation was involved maximum in weed free treatment (Table 3) and it was due to cost of labour engages in repeated three hands weeding. Integrated treatments of herbicides + HW required higher cost than single application of herbicides and only one hand weeding treatment because of extra labour cost engaged in hand weeding. Weedy check treatment showed minimum cost as no extra cost was involved other than common cost of crop cultivation. Walia (2009) also states similar effects on cultivation cost under manual and herbicidal weed control methods .Gross return was found maximum in weed free check which being at par with the return in Pendimethalin + HW treatments was significantly higher than all other treatments. The net return form chickpea was obtained maximum under the treatment of pre-emergence application of Pendimethalin @ 0.75 kg/ha plus HW at 25 DAS (table -3). It was found at par with the net returns obtained under weed free check and pre-emergence application of Oxyfluorfen @ 0.15 kg/ha + 1 HW 25 DAS, but significantly higher than all other treatments. Though gross return was maximum in weed free check, their higher cost involved reduced the net return as compared with Pendimethalin + HW treatment which required lesser cost. Among herbicides, post-emergence application of Imazethapyr treatments gave lesser net return than other herbicides. Integrated use of herbicides + HW gave significantly higher net return than lone application of herbicides except Imazethapyr. These results may be well supported by the findings of Singh *et al.* (2003).

Table 3: Effect of weed control treatments on economics of rainfed chickpea

Treatments	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net Return (Rs/ha)	C : B ratio
T_1	12400	14311	1578	0.15
T_2	18580	42617	24237	1.30
T_3	14460	29392	14932	1.03
T_4	16520	35588	19068	1.15
T_5	13368	30545	17177	1.28
T_6	13121	33799	20678	1.58
T_7	13121	31013	17892	1.36
T_8	12874	32097	19223	1.49
T_9	15263	36934	21671	1.42
T_{10}	15078	39726	24648	1.63
T_{11}	15078	37360	22282	1.48
T_{12}	14893	34844	19951	1.34
SEm ±			1.593	0.09
CD 5%			3.305	0.19

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Effect of dehydration of spinach on chlorophyll content

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Abstracts

The fresh spinach were dehydrated in mechanical tray dryer and open sun drying after pretreatment by (i) Dipping in solution containing 0.1% magnesium chloride, 0.1% sodium bicarbonate and 2% potassium metabisulphite in distilled water for 15 min. at room temperature (ii) Blanching in boiling water for 2 min (iii) Blanching in boiling water containing 0.5% sodium metabisulphite for 2 min. The ratio of spinach to pretreatment mixture was maintained at 1:5 (w/w). Pretreated spinach samples were dehydrated in mechanical tray dryer at 40, 50, 60 and 70^{0}C temperatures and in open sun drying with loading density 2.0, 2.5 and 3.0 kg/m^2. It was found that maximum chlorophyll content (0.952 mg/g tissue) was in chemical treated sample dried at 40 ^{0}C temperature and 3.0 kg/m^2 loading density whereas minimum (0.788 mg/g tissue) was obtained in blanched sample dried at 70 ^{0}C and 2.0 kg/m^2 loading density in tray dryer. However, in case of open sun drying 2.0 kg /m^2 loading density, the chlorophyll content was obtained as 0.540 mg/g tissue. The loss in chlorophyll content when compared with fresh sample was found in the range of 7.587 to 47.568 % which indicates more losses at higher drying temperature. Samples were stored for 180 days and the chlorophyll content (mg/g tissue) at 0, 15, 30, 45, 60, 75, 90, 105, 120, 135, 150 and 180 days of storage is shown in Table 2 and Fig. 1. It was observed .The chlorophyll content varied from 0.912 mg/g tissue (0 day) to 0.846 mg/g tissue (180 days), 0.952 mg/g tissue (0 day) to 0.878 mg/g tissue (180 days) and 0.913 mg/g tissue (0 day) to 0.861 mg/g tissue (180 days) in S1, S2 and S3 samples respectively. The total chlorophyll reduction (%) percent was calculated as 7.236 % (S1), 7.425% (S2) and 5.695 % (S3). The Organoleptic results for stored samples (180days) showed that colour, appearance, taste, flavour and overall acceptability were rated between 7 to 9 on hedonic score which indicated their better suitability for storage

Keywords**;** blanching, loading density, tray dryer, open sun, dehydration, chlorophyll content,

Introduction

The fresh spinach is more commonly used after cooking because of its perishable nature. The most commonly used leafy vegetables are green and red amaranth, spinach (palak), chakota, fenugreek leaves, coriander leaves, kachi leaves, pudina, drumstick and curry leaves, which contribute to flavour, green colour, minor nutrients as well as medicinal properties. The conventional cooking of these vegetables results in the losses of water soluble vitamins and minerals and change in colour. However, the changes that occur during processing of leafy vegetables with regard to vitamins and colour are less understood. Secondly because of perishable nature, leafy vegetables are more commonly used immediately after harvest .The leafy vegetables are seasonal and available in plenty at a particular area bringing complexity in its post harvest processing. In peak season, prices fall steeply. The producer have to sell at throw away prices, delay leads to sharp fall in market prices, enormous deterioration in quality as well as quantity of vegetables. There are many methods of preservation of foods. Among these, the techniques of drying is well accepted and probably the oldest method of food preservation practiced by the mankind. It is relatively economical method, as concentration of solids become high, water activity reduces greatly, and product becomes chemically stable and free from insect-pest attack and mould- yeast growth during storage. Drying has been practiced at domestic level by utilizing solar energy. Long drying time, variation in weather and exposer to direct sun light leads to poor quality of the end product. Tray dryers operated by electrical energy, solar energy and gasifires are commonly used for dehydration of vegetables, Mandhyan et al.(1988),. The study was conducted to see the effect of drying temperature, loading density and pretreatment on drying characteristics of spinach

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Material and methods

Preparation of samples

The fresh spinach was washed thoroughly in tap

water so as to remove roots and stem. Leaves and soft stem were separated from the rest parts. Care was taken to avoid bruised and discolored leaves. Pretreatment were given by three methods (i) Dipping in solution containing 0.1% magnesium chloride, 0.1% sodium bicarbonate and 2% potassium metabisulphite in distilled water for 15 min. at room temperature (ii) Blanching in boiling water for 2 min (iii) Blanching in boiling water containing 0.5% sodium metabisulphite for 2 min. The ratio of spinach to pretreatment mixture was maintained at 1:5 (w/w).

Drying of Spinach

After pretreatments, the spinach were loaded in perforated stainless steel trays at the rate of 2.0, 2.5 and 3.0 kg/m^2 tray area and dried at 40, 50, 60 and 70^{0}C temperature in tray dryer with constant air velocity of 2.0 m/s. The open sun drying was also carried out during the day time (temp: 37-45^{0}C, RH: 25-37%). The untreated samples of spinach were dried as control samples. Spinach was dried from 91% ± 1 percent moisture content to about 5±1 moisture content (wb).

Determination of Chlorophyll

Total chlorophyll was measured by the following method described by Arnon (1949). Chlorophyll pigment was extracted from 1 g dry matter in 80 % acetone and was determined using spectral analysis (Beckman) by measuring the absorbance at 663 and 645 nm.

Extraction

1. 1 g of well mixed sample was taken into a clean mortar and pestle.
2. The tissue was grinded to a fine pulp with the addition of 20 ml of acetone.
3. Then the sample was centrifuged at 5000 rpm for 5 min and the supernatant was transferred to a 100 ml volumetric flask.
4. The residue was grinded with 20 ml of 80% acetone, centrifuged and supernatant was transferred to the volumetric flask.
5. This procedure was repeated until the residue became colourless. The mortar and pestle was thoroughly washed with 80% acetone and the clear washing was collected in the volumetric flask.
6. The volume was made up to 100 ml with 80% acetone.
7. The absorbance of the solution at 645 and 663 nm was recorded against the solvent (80% acetone) as blank.

Measurement

Two clean matched cuvettes were taken and ensured that they give same reading with acetone. In one cuvette, acetone was taken as blank, and in other diluted 80% acetone extract of chlorophyll. Readings were taken between 642 - 665 nm. Instrument was adjusted till the maximum adsorption of 663nm. The readings were noted at 663 and 645 nm for each unknown solution.

Calculations

The following equation was used for the calculation of chlorophyll content.

Total chlorophyll (mg/g tissue) =

$$[20.2\ (A_{645}) + 8.02\ (A_{663})] \times \frac{V}{1000 \times W}$$

Where,

A = absorbance at specific wavelengths.

V = final volume of chlorophyll extract in 80 % acetone.

W = fresh weight of the tissue extracted

Sensory Evaluation

Sensory evaluation was carried out for rehydrated spinach by a ten-member panel of different age group and different food habits for surface appearance, colour, and taste of rehydrated sample, flavour and overall acceptability. The sensory evaluation was done on 9 - point hedonic scale recommended by Indian Standard (Anon., 1971).

Storage study

Storage of best three sets of sample as obtained from sensory evaluation were carried out for determination of quality characteristics like colour change in term of chlorophyll content, ascorbic acid and rehydration characteristics at 0, 15, 30, 45, 60, 75, 90, 105 , 120, 135,150, 165 and 180 days of storage at room temperature.

Results and Discussion

The chlorophyll content of fresh and dried spinach samples was determined by spectrophotometer analysis. The chlorophyll content of fresh spinach was found to be 1.03 mg/g tissue. The experimental data for chlorophyll content of dried spinach are presented in Table 1. It reveals that chlorophyll content of dried spinach ranged from 0.626 to 0.952 mg/g tissue, 0.540 to 0.881mg/g tissue, 0.564 to 0.873 and 0.605, to 0.914 mg/g tissue for chemical treated, chemically blanched, blanched and untreated samples, respectively.

Maximum chlorophyll content (0.952 mg/g tissue) was found in chemical treated sample dried at 40 ^{0}C and 3.0 kg/m^2 loading density and minimum (0.788 mg/g tissue) was obtained in blanched sample dried at 70 ^{0}C and 2.0 kg/m^2 loading density in tray dryer. However, in case of open sun drying 2.0 kg /m^2 loading density the chlorophyll content was obtained as 0.540 mg/g tissue. The loss in chlorophyll content when compared with fresh sample was found in the range of 7.587 to 47.568% which indicates more losses at higher drying temperature. This may be to the fact that chlorophyll degradation in leafy vegetables is temperature dependent and followed first order reaction kinetics (Ahmed *et al*. 2004). Under open sun drying the losses observed was higher due to the fact that drying by direct Sun resulted insignificant loss of pigments due to long time taken for drying, leading to more oxidation of carotene (Jayaraman et al. 1991).

Table1: Experimental data on chlorophyll content of dried spinach samples

Drying Temp (^{0}C)	Loading Density	Treatment (kg/m^2)	Chlorophyll Content (mg/g of tissue)	Percent loss in Chlorophyll
40	2.0	CT	0.932	9.524
		BC	0.881	14.495
		B	0.873	15.265
		UT	0.914	11.291
	2.5	CT	0.943	8.458
		BC	0.886	13.978
		B	0.882	14.357
		UT	0.917	10.948
	3.0	CT	0.952	7.587
		BC	0.891	13.457
		B	0.884	14.145
		UT	0.919	10.754
50	2.0	CT	0.915	11.158
		BC	0.868	15.687
		B	0.874	15.142
		UT	0.904	12.214
	2.5	CT	0.912	11.457
		BC	0.855	16.978
		B	0.863	16.248
		UT	0.900	12.658
	3.0	CT	0.890	13.548
		BC	0.837	18.745
		B	0.846	17.895
		UT	0.873	15.245
60	2.0	CT	0.913	11.345
		BC	0.866	15.948
		B	0.859	16.584
		UT	0.899	12.678
	2.5	CT	0.894	13.215
		BC	0.845	17.985
		B	0.848	17.678
		UT	0.874	15.145
	3.0	CT	0.896	12.987
		BC	0.846	17.895
		B	0.852	17.245
		UT	0.873	15.235
70	2.0	CT	0.882	14.368
		BC	0.799	22.458
		B	0.788	23.456
		UT	0.863	16.245
	2.5	CT	0.873	15.265
		BC	0.819	20.489
		B	0.825	19.926
		UT	0.862	16.264
	3.0	CT	0.882	15.348
		BC	0.828	19.658
		B	0.818	20.625
		UT	0.861	16.397
OSD	2.0	CT	0.626	39.254
		BC	0.540	47.568
		B	0.564	45.265
		UT	0.605	41.254
	2.5	CT	0.643	37.598
		BC	0.574	44.265
		B	0.564	45.235
		UT	0.617	40.124
	3.0	CT	0.655	36.425
		BC	0.584	43.265
		B	0.574	44.256
		UT	0.623	39.487

Table 2: Chlorophyll content of dried spinach at room temperature storage

Storage time (days)	Chlorophyll Content, mg/g tissue at different days		
	S1	S2	S3
0	0.912	0.952	0.913
15	0.895	0.945	0.908
30	0.887	0.940	0.903
45	0.879	0.935	0.897
60	0.875	0.931	0.892
75	0.871	0.926	0.887
90	0.868	0.919	0.883
105	0.864	0.911	0.879
120	0.861	0.903	0.873
135	0.856	0.896	0.869
150	0.852	0.889	0.865
165	0.849	0.881	0.862
180	0.846	0.878	0.861

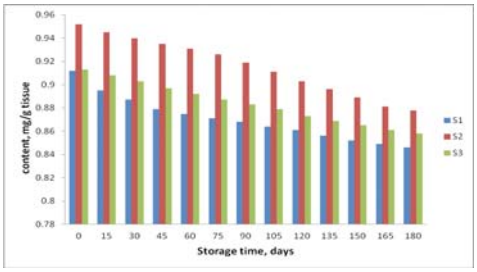

Fig 1: Effect of storage time on chlorophyll content of dried spinach

Lakshmi et al. (2000) reported that loss of â - carotene from green leafy vegetables after drying was found in the range of 24-40 % in sun- dried leaves and 6-25% in cabinet dried leaves. The results of the present study are thus in agreement with the results of the above studies, Total chlorophyll decreased for the dehydrated samples blanched under boiling water. The colour retention in chemical treated samples might have been due to KMS treatment with faster drying under tray dryer.

The ANOVA performed to estimate the effect of drying condition on chlorophyll content. It showed that all the variables viz. temperature, loading density and treatment were highly significant at 5% level of significance as F_c for all variables were more than F_{tab}. This showed that chlorophyll content is significantly influenced by the treatment. Higher chlorophyll content obtained for chemical treated samples may be because of KMS treatment. The lower chlorophyll content obtained at higher temperature and OSD was due to inactivation of chlorophyllase enzyme which may be responsible for degradation of chlorophyll.

Effect of storage time on chlorophyll content

The data on chlorophyll content (mg/g tissue) at 0, 15, 30, 45, 60, 75, 90, 105, 120, 135, 150 and 180 days of storage is shown in Table 2 and Fig. 1. It was observed that the chlorophyll content varied from 0.912 mg/g tissue (0 day) to 0.846 mg/g tissue (180 days), 0.952 mg/g tissue (0 day) to 0.878 mg/g tissue (180 days) and 0.913 mg/g tissue (0 day) to 0.861 mg/g tissue (180 days) in S1, S2 and S3 samples respectively. The total chlorophyll reduction (%) percent was calculated as 7.236 % (S1), 7.425% (S2) and 5.695 % (S3). The decrease in chlorophyll content during storage was due to the oxidation of chlorophyll pigments. Similar results had been reported by Ahmed *et al.* (2004) for coriander leaf paste. The Organoleptic score for stored samples (180days) showed that colour, appearance, taste, flavour and overall acceptability were rated between 7 to 9 on hedonic score which indicated their better suitability for storage stored at room temperature

1. The chlorophyll content increased with decrease in temperature and increased with loading density at all temperature including open sun drying.
2. The total loss of chlorophyll content during storage were observed as 7.236%, 7.425%, and 5.695% in S1 (50 ^{0}C, 2.5 kg/m^2 loading density, chemical treated), S2 (40 ^{0}C, 3.0 kg/m^2 loading, density chemical treated) and S3 (60 ^{0}C, 2.0 kg/m^2 loading density, chemical treated) samples, respectively.
3. The Organoleptic score for stored samples (180days) showed that colour, appearance, taste, flavour and overall acceptability were rated between 7 to 9 on hedonic score which indicated their better suitability for storage.
4. The quality of stored samples were found to be most acceptable when spinach were treated with solution of 0.1% $MgCl_2$ + 0.1% $NaHCO_3$ + 2% KMS, with dried at 50 ^{0}C and 2.5 kg/m^2 loading density.

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A study of price spread and marketing efficiency of buffalo milk in western plain zone of Uttar Pradesh

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Abstract

Despite the fact that India is the largest producer of milk, the milk producing units are not economically viable. This is substantiated by the fact that usually milk producers become do wealthy as manufacturers do. The researches in the area, generally aim at breed improvement, feeding, milking, animal health care, etc. the economic aspect of researches generally evaluate cost and benefits. However, the failure lies in the milk marketing. The present paper endeavors to capture the marketing manners of milk producing units of the Meerut region of Uttar Pradesh India based on a sample of size 280 drawn randomly from the region using a questionnaire. The questionnaire contained, besides general information such as yearly value of milk, number of animals and their diet, questions regarding marketing that included type of marketing. It is found that there are miles to go in the direction of marketing. People are generally not aware of the fact that marketing can add to the performance. They have no marketing strategies. Marketing variables are playing negative role in getting the proper value of out put.

Key words: Milk producing units, marketing, emerges, quantity of output, questionnaire

Introduction

India is the world's largest milk producing country. Milk has achieved a unique status in terms of its out put value and contribution to the national economy with output, value exceeding Rs.100,000 crores. It has made rapid strides both in term of number of milk producers and quantity of milk produced. Over the last 2 decades, while both population and food grain production grew at around 2%, milk production grew at more than double the rate of growth of the population, thereby increasing per capita availability of milk by 112 to 232 gm/day during the period of 1970-1971 to 2004-2005, respectively (Prabhat, 2005). The country has predominant vegetarian population, therefore milk and milk product have a significant place in the people's diet in general and sick people in particular. The minerals in milk are essential for body building and its maintenance. On the other hand, dairying plays a very important role in rural economy. It provides income and employment not only to the weaker section of the society but also to the farming community. In this way dairying improves socio-economic condition of village based population, of which a sizeable portion is living below poverty line.

Still today, most of the milk producing units are not economically viable in the sense that they are not able to provide what can be termed as profit. The other dimensions of viability such as market expansion, growth, price are seldom taken into consideration. This is despite the fact that milk producing units can multiply to grow as number of animals grow automatically. The people involved in this business are mostly those who have been traditionally there in and continuing the activity because there are no alternatives. This is substantiated by the fact that most of the owners are of same caste people of other caste are not opting for this trait.

The milk producing activity is not taken as entrepreneurial activity and is any a time considered as subsidiary to agriculture in other neighboring countries such as Bangladesh, the story is not different. The study conducted on marketing aspect of milk producing units, at large, concentrate on marketing channels such as Cooperatives, Vendors middlemen, hotel and restaurants. A survey of such studies have been made by CAPLI. A similar study by Ghose and Maharajan (2002) also deals with channels. The researches in the area have been limited to aiming at breed improvement, health care, feeding, milking, etc. Researches on economic aspects mostly aimed at computing cost and benefits with limited notion of cost as well as of benefits.

It is also assumed that prices are given and the seller is a price accepter. Therefore, benefits can be reaped only by reducing the cost. A question can be reasonably asked at this juncture what marketing can contribute in the development of dairying. Marketing is an integral functional activity of all human being in their day to day life. It is a body of knowledge capable of influencing the development of individuals and also organization. Presently marketing has occupied a predominant role. Thus the present study has been conducted to know the marketing channels prevailing in the locality and to know the marketing cost and margins taken by middlemen in the different channels of milk marketing.

Research Methodology

A purposive random sampling technique was adopted to the select the sample districts, villages and

animals holders. A sample of 7 villages (one village from each district) was selected randomly. A farmer having atleast two milch animals (milch buffaloes) were considered for the present study. A list of all the milch animals keepers households was prepared with the help of Gram Pradhan as well as progressive farmers along with their size of land holding. These animals' keepers were categorized into four categories i.e. marginal, small, medium and large on the basis of their land holding. Then, a sample of 140 animals keeper households were selected randomly from the universe of 7 villages. The present study was conducted during the agricultural year 2006-07 i.e. 1st July 2006 to 30th June 2007. Primary data were collected by survey method with the help of pre-prepared and well tested questionnaire and schedule.

Results and discussion

This paper deals with the marketing cost, price spread and marketing efficiency of crossbreed cow milk under different channels of milk marketing under the following subheads:

1. Marketing channels prevailing in the locality are as under:

S. No. Marketing channels

A. On farm sale/ marketing

1. Milk producer households-consumers
2. Milk producer households-milk vender (Dudhiaya)-consumers

B. Out of farm sale/ marketing

3. Milk producer households-milk purchase/collection centres of recognized dairies – milk processing plant-retailers-consumers
4. Milk producer households-sweetshops/hotels-consumers
5. Milk producer households-consumers

The Price spread and marketing efficiency of milk were estimated of the main milk marketing channels:

Marketing cost and margin of milk

The perusal of Table 1 shows that on overall basis the marketing cost incurred by milk producers under channels-II, IV and V came to Rs 62.40, Rs 232.25 and Rs 290.70/100 litres of buffalo milk, respectively whereas in channels I and II, no cost incurred by milk producer

Table 1: Sale price, marketing cost and margin of various intermediaries under different milk marketing channels of milk (Rs/ 100 litres)

S. No. Particulars	Channels				
	I	II	III	IV	V
A. Cost incurred by producer					
1. Transportation cost	-	-	14.50	44.20	54.20
2. Quantity loss	-	-	16.80	36.80	58.50
3. Labour charges	-	-	19.50	121.50	141.60
4. Utensil charges	-	-	4.90	12.50	14.60
5. Other expenses	-	-	6.70	17.25	21.80
Total charges	-	-	62.40	232.25	290.70
6. Sale price of milk producer	1712.40	1526.30	1658.40	1848.60	1954.20
7. Net price received by producer	1712.40	1526.30	1596.00	1616.35	1663.50
B. Cost incurred by middleman					
1. Purchase price of middleman	-	1526.30	1658.40	1848.60	-
2. Transportation cost	-	45.30	31.60	0.00	-
3. Quantity loss	-	31.60	32.80	27.75	-
4. Labour charges	-	121.40	41.50	19.60	-
5. Utensil charges	-	14.80	19.80	4.80	-
6. Heating, Cooling, packing etc	-	4.60	111.70	9.85	-
7. Others	-	17.90	44.60	7.80	-
Total charges of middleman	-	235.60	282.00	69.80	-
8. Sale price of middleman	-	1954.60	2050.00	2108.40	-
9. Net price received by middleman	-	1719.00	1768.00	2038.60	-
10. Margin of middle man	-	192.70	109.60	190.00	-
C. Cost incurred by retailers					
1. Retailers purchase price	-	-	2050.00	-	-
2. Retailers transport cost	-	-	5.00	-	-
3. Quantity loss	-	-	22.00	-	-
4. Labour charges	-	-	20.00	-	-
5. Utensils charges	-	-	5.00	-	-
6. Cooling, packing etc	-	-	6.00	-	-
7. Others	-	-	5.00	-	-
Total charges of retailers	-	-	63.00	-	-
9. Margin of retailer	-	-	87.00	-	-
10. Sale price	-	-	2200.00	-	-
11. Producer's share in consumer's price (%)	100.00	78.09	72.55	76.66	85.12

Table 2: Price spread of milk under different marketing channels of milk (Rs/100 litres)

S. No. Particulars	Channels				
	I	II	III	IV	V
1. Producers sale price	1712.40	1526.30	1658.40	1848.60	1954.20
2. Marketing cost of producer	-	-	62.40	232.25	290.70
3. Net price received by producer	1712.40	1526.30	1596.00	1616.35	1663.50
4. Purchase price of middle man	-	1526.30	1658.40	1848.60	-
5. Marketing charges incurred by middleman	-	235.60	282.00	69.80	-
6. Margin of middleman	-	192.70	109.60	190.00	-
7. Sale price of middle man	-	1954.60	2050.00	2108.40	-
8. Retailers purchase price	-	-	2050.00	-	-
9. Marketing cost incurred by retailers	-	-	63.00	-	-
10. Retailers margin	-	-	87.00	-	-
11. Retailers sale price	-	-	2200.00	-	-
12. Producer's share in consumer's price (%)	100.00	78.09	72.55	76.66	85.12

Table 3: Marketing efficiency of buffaloes milk under different channels of marketing of milk (Rs/100 litres)

S. No. Particulars	Channels				
	I	II	III	IV	V
1. Price paid by ultimate consumer	1712.40	1954.60	2200.00	2108.40	1954.20
2. Marketing costs and margins	-	428.30	604.00	492.05	290.70
3. Marketing efficiency	-	3.56	2.64	3.28	5.72

household due to on farm sale of milk. The net price received by milk producer household worked out to the maximum of Rs 1712.40/100 litres milk in channel-I followed by Rs 1663.50, Rs 1616.35, Rs 1596.00 and Rs 1256.30/100 litres milk under channels-V, IV, III and II, respectively. The marketing cost paid by middleman came to Rs 282.00, Rs 235.60 and Rs 69.80/ 100 litres milk whereas marketing margin of middleman worked out to Rs 109.60, 192.70 and Rs 190.00/100 litres milk under channels-III, II and IV, respectively. The marketing cost and margin of retailer's came to Rs 63.00 and Rs 87.00/ 100 litres milk, respectively under channel-III. The producer's share in consumer's price worked to the highest of being of cent- per- cent in channel-I followed by 85.12, 78.09, 76.55 and 72.55% under channels-V, II, IV and III, respectively. The producer's share in consumer's price clearly indicated that it decreases with the increase in number marketing functionaries under marketing channels.

Price spread of buffalo milk

The perusal of Table 2 shows that on an average sale price of buffalo's milk came to Rs 1954.20/100 litres under channel-V, followed Rs 1848.60, Rs 1712.40, Rs 1658.40 and Rs 1526.30 /100 litres under channels IV, I, III and II, respectively. The producers share in consumer's price came to the highest being 100 per cent in channel-I due to absence of involvement of market functionaries, followed by channel-V, channel-II, channel-IV and channel-III accounted to 85.12, 78.09, 76.66 and 72.55 per cent, respectively. Lower producer's share in consumer's price was found due to involvement of large market functionaries in the channel. This clearly shows that producer's share in consumer's price decreases with the increase in chain of market functionaries in the channel and vise-versa in case of minimum chain of functionaries or no chain of market functionaries.

Marketing efficiency

Table 3 clearly reveals that amongst the various milk marketing channels, the marketing efficiency of buffalo milk was found to the highest of 5.72 in channel-V followed by channel-II, IV and III accounted 3.56, 3.28 and 2.64, respectively. The marketing efficiency of buffalo milk was found highest in channel-V due to direct selling of milk by the producer to consumers in the cities. The marketing efficiency of channel-I was found cent-per-cent due to on farm sale of milk direct to consumers which not required involvement of any cost.

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Influence of Phosphorus and Sulphur fertilization on root studies and yield of Pigeonpea [*Cajanus cajan* (L.) Millsp.] genotypes

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Abstract

A field experiment was conducted on pigeonpea during kharif season of 2004 and 2005 to study the effect of phosphorus and sulphur fertilization on root studies and yield of pigeonpea genotypes. Four levels of phosphorus (0, 30, 60 and 90 kg P_2O_5/ha), three levels of S (0, 20 and 40 kg S/ha) and three genotypes (UPAS-120, Pusa-992 and Pusa-855) were used in the study. Pusa-855 was found significantly better in respect of root studies and yield as compared to all other genotypes. Application of 60 kg P_2O_5/ha gave significantly higher length of roots, roots nodules and dry weight of roots over 30 kg P_2O_5/ha and control. Significantly higher length of roots, roots nodules and weight of roots were obtained with 20 kg S/ha over control. Application of phosphorus up to 60 kg P_2O_5/ha and application of sulphur up to 20 kg/ha increased seed and straw/stalk yields. Although the highest seed, straw/stalk and biological yield were obtained with 90 kg P_2O_5/ha but this was statistically at par with 60 kg P_2O_5/ha. Application of sulphur up to 20 kg/ha increased seed and straw/stalk yields. Application of phosphorus 90 kg P_2O_5/ha resulted 46.78% higher yield than control. Application of 40 kg S/ha gave significantly higher seed over 20 kg S/ha and control.

Key words: Phosphorus, sulphur fertilization, biological yield, straw/stalk yields

Introduction

Pulses are wonderful gift of nature. Pulses are the rich source of protein, specially for vegetarian. Being rich in protein (22-23%) pigeonpea is a good source of nutrition to the pre dominantly vegetarian population in our country. It is mostly consumed in the form of *dal* (split cotyledons). Pigeonpea is an important pulse crop. The evolution of short duration varieties to pigeonpea have provided the opportunity for multiple cropping in irrigated as well as in rainfed areas. Even its short duration varieties responded highly to phosphorus and sulphur. Recently some short duration varieties of about 130-160 days have been developed which have high yield potential (20-30 q/ha) and harvested by end of November. These varieties fit very well under double cropping system with wheat and other *rabi* crops. In India, pigeonpea among the *kharif* grain legumes, occupies first place is the second most important pulse crop next to chickpea as a whole.

The adequate supply of phosphorus to legume is more important than that of nitrogen, as it has beneficial effect on nodulation, growth and yield. It plays an important role in energy transfer reactions as well as in oxidation reduction processes. Phosphorus application increases cell division, as a result of which growth is increased in legumes. Pigeonpea being a leguminous crop shows special response to phosphatic fertilizers, because of additional need of phosphorus for multiplying *Rhizobia* in the nodules. Phosphorus also improves the crop quality and make the crop resistance to diseases. Phosphorus application to pulses not only benefit the particular crop by increased nodulation, but also favourably affects the soil nitrogen content for the succeeding non legume crop which over all reduce the dose of inorganic nitrogen application.

Sulphur is an important essential secondary plant nutrient. Importance of sulphur in Indian agriculture is being increasingly emphasized and sulphur has been considered 4th important nutrient has a great impact on production of legumes as most of Indian soils are being reported sulphur deficient in extensively cultivated tracts. In fact, a major factor responsible for sustaining soil productivity in India has been the highly diversified nature of the cropping patterns which either include a pulse or a legume crop as one of the component. Sulphur plays an important role in many physiological process in plant *viz*; synthesis of sulphur containing amino acids (Cysteine, Cystine and Methionine), synthesis of certain vitamins (Biotine and Thiomine), co-enzyme A and in the metabolism of carbohydrates, proteins and fats. Sulphur also promotes nodulation in legumes. Although not a constituent, sulphur is required for the synthesis of chlorophyll. Sulphur application increases drought and cold tolerance in plants due to the process of disulfide linkage. It also helps in the control of diseases and pest. The sulphur deficiency has been recognized as a factor in limiting the yield and quality of grain legumes as around 70% of the S is found in the chloroplast and thus plays vital role in carbon assimilation (Aulakh and Pasricha, 1990). Therefore the present investigation was conducted to evaluate the performances of

different short duration pigeonpea genotypes to phosphorus and sulphur fertilization in respect of root studies and yield.

Material and Methods

The experiment was conducted during the *kharif* seasons of 2004 and 2005 at Agricultural Research Farm of Raja Balwant Singh College, Bichpuri, Agra, (27.2^0 N Latitude and 77.9^0 E Longitude, 168 m above mean sea level). The maximum and minimum atmospheric temperatures during crop period were 30.8 to 48.6 and 9.8 to 27.5^{0}C, respectively. Rainfall received during 2004 and 2005 was 536.3 and 630 mm, respectively. The treatments consisted of three genotypes (UPAS-120, Pusa-992 and Pusa-855), four levels of phosphorus (0, 30, 60 and 90 kg P_2O_5/ha) and three levels of sulphur (0, 20 and 40 kg S/ha). The experiment was conducted in split plot design, where genotypes and levels of phosphorus kept in main plot and sulphur levels in sub plot, replicated three times.

The soil was sandy loam, having pH 7.90, electrical conductivity (EC) 1.86 dS/m, organic carbon 0.34% and available N, P_2O_5, K_2O and S 182.0, 29.50, 253.0 and 15.0 kg/ha, respectively. A uniform dose of nitrogen for pigeonpea @ 20 kg N/ha (urea) and potassium @ 40 kg K_2O/ha (MOP) were applied to all plots, at the time of sowing.

Extraction of sulphur in seed was done by procedure developed by Williams and Steinbergs (1959) and was analyzed as per methodology of Chesnin and Yien (1951), protein content in seed was calculated by multiplying N content (%) in seed by a factor 6.25.

Results and Discussion

Genotypes

Pusa-855 recorded significantly higher length of roots at 75 per cent flowering stage as compared to all other genotypes during both the seasons. Root length was lowest in Pusa-992. Dry weight of roots play an important role in increasing nutrient use efficiency and its productivity. Pusa-855 recorded higher root weight (25.23%) over UPAS-120. Pusa-992 showed significantly inferior performance as compared to other genotypes. The same observations have been observed by Govil *et al.* (2000). The genotype Pusa-855 produced significantly higher number of nodules per plant over other two genotypes. Genotype UPAS-120 also produced significantly more number of root nodules per plant than Pusa-992. This may be due genetic nature of cultivars. Genotype Pusa-855 scored significantly higher seed productivity over UPAS-120. UPAS-120 was short duration genotype over Pusa-992 and Pusa-855. General longer the duration, yielding ability would be higher. Similar results were obtained by Govil *et al.* (2000).

Effect of phosphorus

The beneficial effects of increasing rates of phosphorus up to 60 kg P_2O_5 ha^{-1} increased significantly root characters viz. root length, nodule numbers and dry weight of roots in pigeonpea in both years of experimentation. The increasing level of P_2O_5 (30 to 90 kg ha^{-1}) increased the root length, dry weight and nodules in pigeonpea. Thus, higher doses of P_2O_5 were over and above better than lower doses. The higher value of root length and root weight might be due to better utilization of phosphorus. The role of phosphorus in increasing nodulation has also been advocated by several workers such as Baboo and Mishra (2004), Parihar *et al.* (2005) and Singh *et al.* (2007). Application of phosphorus up to 60 kg/ha increased 17.08% length of roots, 33.61% roots nodules and 29.77% dry weight of roots over control, respectively.

Table 1: Effect of phosphorus and sulphur levels on root studies and yield in pigeonpea

Treatment	Length of roots (cm)		No of root nodules		Dry weight of roots (g)		Biological yield (kg/ha)		Grain yield (kg/ha)		Straw/stalk yield (kg/ha)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Genotypes												
UPAS-120	22.83	23.35	30.88	29.56	8.74	8.62	6865	6008	1426	1303	5439	4705
Pusa-992	21.15	20.24	29.46	28.15	7.84	7.59	6253	5383	1379	1273	4874	4110
Pusa-855	26.08	25.45	33.28	32.77	11.18	10.57	7396	6911	1646	1539	5750	5372
CD (P=0.05)	1.01	1.00	1.35	1.24	0.42	0.42	183	187	52	51	181	177
P levels (kg P_2O_5/ha)												
0	20.70	20.28	23.58	22.57	7.29	6.90	5881	5259	1162	1043	4719	4216
30	23.77	23.03	30.40	29.45	9.11	8.67	6800	6093	1451	1354	5349	4739
60	25.16	24.25	35.56	33.97	10.27	9.95	7326	6475	1643	1523	5683	4952
90	25.20	24.63	35.93	34.66	10.33	10.18	7365	6623	1680	1558	5685	5065
CD (P=0.05)	1.17	1.16	1.55	1.43	0.48	0.48	212	216	61	59	209	204
S levels (kg S/ha)												
0	22.84	22.20	28.88	27.97	8.63	8.22	6394	5721	1312	1217	5083	4504
20	24.10	23.30	32.37	31.04	9.42	9.19	7054	6260	1547	1428	5507	4832
40	24.12	23.66	32.87	31.47	9.71	9.37	7169	6309	1599	1470	5570	4839
CD (P=0.05)	0.73	0.78	0.98	0.90	0.27	0.28	73	78	23	13	69	76

The maximum grain and stalk yields were recorded with 90 kg P_2O_5 ha^{-1} but this was found statistically at par with 60 kg P_2O_5 ha^{-1}. The beneficial effect of phosphorus application on yields obtained in the present investigation. Similar results were obtained by Prasad *et al*. (2007) and Sharma and Abrol (2007). The seed production is dependent on yield attributes and all these traits were favorably affected by phosphorus application. Seed yield of pigeonpea increased significantly up to 60 kg P2O5/ha. The maximum straw/stalk yield was observed under 90 kg P_2O_5/ha but this was found statistically at par with 60 kg P_2O_5/ha. The greater value of straw/stalk yield at higher dose of P is significantly higher pace of growth in the plots enjoying higher phosphorus. However, the higher value of seed yield was result of higher value of different yield contributing characters. These findings are in the conformity with the result of Kumar and Kushwaha (2006) and Sharma and Rana (2006).

Effect of sulphur

It was observed that number of nodules, root length and dry weight of roots were also affected significantly by the S application. The number of nodules, root length and dry weight of roots increased with increase in the level of S up to 40 kg S ha^{-1}, but the superiority of this highest S dose over 20 kg S ha^{-1} was not found significant. Vishwakarma *et al.* (1998) and Prasad *et al.* (2007) also found similar results.

Yield of seed and straw/stalk being the effect of sulphur fertilization brought about significant improvement. The increase was noted in the seed yield (kg ha^{-1}) significantly with the increase in level of sulphur up to 40 kg ha^{-1}. However, 40 kg ha^{-1} of applied sulphur did not attribute any significant change over 20 kg S ha^{-1} with regard to straw/stalk yield, but the advantageous effects of various doses of sulphur over control was equally significant in both the years. The beneficial effect of sulphur application on the yield of seed and straw/stalk obtained in the present investigation, is in close conformity with the findings of Shivran *et al.* (2000) and Kumawat *et al*. (2006). The boldness of seed of pigeonpea is, thus, promoted appreciably under the application of sulphur (Tripathi and Verma 2007). Application of 20 kg sulphur increased 4.98% length of roots, 10.35% roots nodules and 9.45% weight of roots over control.

On the basis of two years data, it was concluded that the pigeonpea genotype Pusa-855 showed the superiority over rest of genotypes in respect of root characters and seed yield. Higher yield could be obtain with the application of phosphorus 60 kg P_2O_5/ha and sulphur 40 kg/ha. From the present study, it was concluded that Pusa-855 was the most suitable genotype of pigeonpea for cultivation in Agra region.

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Performance of promising sugarcane genotypes under varying levels of row spacing, irrigation and fertility in calcareous soil

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Abstract

*Sugarcane (*Saccharum *spp. Hybrid complex) is major cash-cum-industrial crop of India. Field experiments were conducted for three consecutive years at Seorahi, Kushinagar (U.P.), to study the response of four promising sugarcane genotypes (UP 0096, UP 0097, CoSe 01232, CoSe 01421) with six input standards (different row spacing-cum-fertility levels-cum-irrigation) in a calcareous soil. Experimental results based on three years pooled data indicated that planting of sugarcane at 90 cm row spacing with 6 irrigations along with 225 kg N/ha and 60 kg P_2O_5/ha (S_5), being at par with planting of sugarcane at 75 cm row spacing with four irrigations and 150 kg N/ha (S_2), produced significantly higher cane and sugar yield as compared to input standards S_4 (90 cm row spacing with fur irrigations and 150 kg N/ha), S_3 (90 cm row spacing with two irrigations and 150 kg N/ha) and S_1 (75 cm row spacing with tow irrigations and 75 kg N/ha). Input standards did not affect CCS (%) cane significantly. Input standard S_5 and S_2 also gave the higher net returns of Rs 42769 and Rs 40720/ha, with B:C ratio 0.91 and 0.92, respectively. Among sugarcane genotypes, UP 0097 produced the highest cane yield (88.9t/ha), which was significantly higher than CoSe 01421, CoSe 01232 and UP 0096. Sugar yield was also significantly higher in UP 0097 (10.48 t/ha), however it was at par with CoSe 01421. The highest net return (Rs 45025/ha) and B:C ratio (1.03) was recorded with genotype UP 0097.*

Key words: Sugarcane, row spacing, irrigation, fertility, cane and sugar yield

Introduction

India will need 27·29 million tonnes (t) of refined sugar by 2020 for its growing population (Anonymous, 1997) as well as 20·69 million t of jaggery (a non-centrifugal form of sugar mainly produced in the Indian subcontinent) to fulfil its domestic demand. In order to achieve these targets, 415 million t of sugarcane would be required as raw material (Singh and Singh, 2004). However, the present production level is only 290 million t. Since the probability of increasing the area under sugarcane in the country is remote, one option to help meet the requirement is through increasing productivity. Sugarcane varieties play very important role in achieving higher cane yield at farmer's field and sugar recovery in the mill. A number of genotypes are available which may be superior to the existing varieties. However, these need to be tested agronomically before being recommended to the growers. In addition, the most significant variable involved in the production of sugar and the yield from a genotype is number of millable canes per unit area of land at harvest (Yadav, 1991). These could be achieved by manipulating densities to a larger extend. Nitrogen, the motive power of plant growth is the true mass producer. Judicious application of nitrogen and availability of soil moisture are the pre-requisite for profitable successful cultivation of sugarcane. Better supply of nitrogen by virtue of increasing its rate and irrigation water creates the most favorable conditions for vigorous and luxuriant vegetative growth that correspondingly increases the tonnage of cane and sugar both. The cane population per unit area changes rapidly with the change in row spacing (Irvine and Benda, 1980) and play a pivotal role in enhancing the yield of cane. Thus, the performance of genotypes may vary under varying inputs of row spacing, irrigation and fertility levels. Therefore, the present study was carried out to evaluate the performance of promising sugarcane genotypes to varying inputs of row spacing, irrigation and fertility levels in calcareous soil.

Materials and methods

Field experiments were conducted to evaluate the performance of different early and mid late maturing genotypes in 2002-03, 2003-04 and 2004-05 at the research farm of Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Kushinagar (U.P.). The soil of experimental plot was sandy loam

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in texture, calcareous in nature with pH 8.4 containing 0.51% organic carbon and 190, 16.2 and 127 kg/ha available nitrogen, phosphorus and potash, respectively. The treatments consisted of five input standards, viz., 75 cm row spacing with 2 irrigations and 75 kg N/ha (S_1), 75 cm row spacing with 4 irrigations and 150 kg N/ha (S_2), 90 cm row spacing with 2 irrigations and 150 kg N/ha (S_3), 90 cm row spacing with 4 irrigations and 150 kg N/ha (S_4), 90 cm row spacing with 6 irrigations alongwith 225 kg N/ha and 60 kg P_2O_5/ha (S_5) as main plot treatments and 4 genotypes viz., UP 0096 (midlate), UP 0097 (midlate), CoSe 01232 (early), CoSe 01421 (early) as sub-plot treatments. The experiment was laid out in split plot design replicated thrice. Crop was planted in the first fortnight of February. The healthy two budded cane setts having viable buds, taken were treated with 0.25% solution of Emisson-6 to prevent fungal infection. One third of the nitrogen and full dose of phosphorus as per treatment schedule were applied at planting and remaining two third of nitrogen was side dressed in two equal splits at two months after planting (just after first irrigation) and at earthing up. Uniform dose of potassium @ 40 kg K_2O/ha was applied in all the treatments with basal dose of nitrogen and phosphorus. The harvesting was done in the last week of February. The observations on number of shoots were done at 150 days after planting and yield attributes, cane yield and quality at the time of harvesting. The sugar yield was obtained by multiplying the commercial cane sugar (%) with cane yield.

Results and Discussion

Experimental data pooled for three years in Table 1 indicated that planting of sugarcane at 90 cm row spacing with 6 irrigations along with 225 kg N/ha and 60 kg P_2O_5/ha (S_5), being at par with planting of sugarcane at 75 cm row spacing with four irrigations and 150 kg N/ha (S_2), produced significantly higher cane yield as compared to other levels of input standards. The lowest cane yield was recorded where the planting was done at 75 cm row spacing with two irrigations and 75 kg N/ha (S_1). Significantly higher cane yields recorded in S_5 and S_2 levels of input standards were due to significantly higher number of shoots and millable canes under these two treatments. Similar response of spacing and nitrogen fertilization on cane yield was recorded by Singh *et. al*. (1996) and Singh *et. al*. (2006). Planting of sugarcane at 90 cm row spacing with four irrigations and 150 kg N/ha (S_4) gave at par number of millable canes to S_5, but failed to compensate a remarkable loss in the yield of cane due to reduction in cane weight. Saini *et. al.* (2005) have also reported similar results. Input standard S_5 being at par with S_2, resulted in significantly higher sugar yield compared to other input standards. However, differences in CCS (%) cane were non-significant due to different input standards. Sugarcane planted at 90 cm spacing with 6 irrigations along with 225 kg N/ha and 60 kg P_2O_5/ha (S_5) and planting of sugarcane at 75 cm row spacing with four irrigations and 150 kg N/ha (S_2) recorded higher net returns (Rs 42769 and Rs 40720/ha, respectively) compared to

Table 1: Effect of various levels of input standards and sugarcane genotypes on growth, yield, quality and economics (Pooled data of three years)

Treatments	Germination (%)	No. of shoots at 150 DAP (000/ha)	No. of millable canes (000/ha)	Cane yield (t/ha)	CCS(%) at harvest	Sugar yield (t/ha)	Cost of production (Rs/ha)	Net return (Rs/ha)	B:C ratio
Level of input standards									
S_1	43.9	171.2	83.2	64.9	12.13	7.89	38046	28387	0.74
S_2	44.3	217.0	101.5	82.8	12.01	9.96	44149	40720	0.92
S_3	42.8	179.8	88.7	72.2	12.30	8.84	38737	35156	0.90
S_4	41.5	195.5	95.0	77.7	12.20	9.46	41813	37829	0.91
S_5	40.4	215.1	100.9	87.4	12.18	10.61	46755	42769	0.91
SE ±	2.42	4.75	4.37	3.91	0.14	0.47	-	-	-
CD	NS	10.95	10.05	9.02	NS	1.08			
Genotypes									
UP 0096	39.7	156.8	80.9	68.5	11.51	7.81	40216	28264	0.70
UP 0097	45.2	206.4	97.0	88.9	11.83	10.48	43895	45025	1.03
CoSe 01232	38.5	190.2	92.2	73.7	12.31	9.08	41460	35925	0.86
CoSe 01421	46.8	229.5	105.3	76.9	13.00	9.98	42028	38675	0.91
SE ±	2.84	2.52	2.63	2.43	0.18	0.35	-	-	-
CD	5.81	5.16	5.36	.96	0.37	0.72			

Note: Interaction effect between levels of input standards and genotypes was found non-significant.

· Cost of production includes harvesting, loading and transportation charges in addition to cost of cultivation.

· Market Prices (Rs/q): Sugarcane, 95; Sugarcane green top, 45.

others. Input standards S_5 and S_2 realized 13.1 and 7.6%, respectively, higher net returns compared with S_4. Slightly higher B:C ratio was found under S_2 (0.92) compared to S_5 (0.91).

Cane yield was significantly influenced by different genotypes. Highest cane yield of 88.9 t/ha was recorded from UP 0097, which was significantly higher than that of CoSe 01421, CoSe 01232 and UP 0096. Significantly higher number of shoots and millable canes were found under CoSe 01421 compared to other genotypes, but due to comparatively thinner and smaller cane it could not compensate the loss in the cane yield. Sharma and Singh (1993) have also reported significant genotypic variations in cane yield. Highest sugar yield of 10.48 t/ha was obtained in UP 0097, which was at par with CoSe 01421 (9.98 t/ha). The more sugar yield in UP 0097 was attributed to higher cane yield. Genotype CoSe 01421 being at par with CoSe 01232 attained significantly higher CCS (%) compared to UP 0096 and UP 0097. Highest net returns (Rs. 45025/ha) and B:C ratio (1.03) were realized with UP 0097 which might largely due to higher yielding potential of UP 0097.

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Women participation in dairying in Akola block of Agra district

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Abstract

The study was conducted in Akola block of Agra district during the year 2008-2009. The study covered 120 cases (40 small, 40 marginal farmers and 40 landless labourers). The major work was performed by women labour in the block being about 50 percent. Thus women played a significant role in dairy in the area. The study further, indicates that participation of women has increased with decrease in farm size.

Key words: Marginal farmers, women, participation of women `

Introduction

Animal husbandry and dairy farming are vital sector of rural economy. Dairy provides a significant proportion of self employment opportunity in agriculture through livestock sector. Landless milk producer, marginal and small farmers engaged themselves in dairying for gainful employment for supplementing their income. Indian woman has a multi-factual personality. She in the pivot around whom the whole household or evolves. She shares most of the duties and responsibilities of a family. Housekeeping, child rearing, assisting in agriculture and cattle rearing is also a part of her duties. She strongly influences the moral, social and creative development of her children. However, she herself continues to be under developed and oppressed. Rural women participate in several agricultural activities like sowing, weeding, transplanting, manuring, harvesting, winnowing, shelling and storing of crops. Though women make a substantial contribution to the family income through home based activities, these are treated as supplemental and hence it goes unnoticed since along time, it is generally believed all over the world that, the place of a woman is at home. One of the most challenging tasks in our country is to provide adequate opportunities for self employment which ensures proper monetary returns for the women workers. For achieving improvement in the status of women, it becomes important to secure for them, a fair degree of employment opportunities in various sectors of economy. The animal husbandry plays a crucial role in shaping the rural economy of India. It is a major continuous income generating activity for the rural households. India is endowed with largest livestock population in the world. Thus it is essential to know the contribution of women in dairy activities in the block.

Methodology

The present study covered Akola block of Agra district and ten villages. The total number of cases under study was 120 (40 small, 40 marginal farmers and 40 landless labourers). The small farmers, marginal farmers and landless labourers were classified in to three herd size groups viz I herd size – (having one milch animal), II herd size-(having two milch animal), and III herd size-(having three and more milch animal). The number of cases falling in I, II, and III herd size groups was 14, 10, and 16 respectively in small farm size group. The number of cases falling in I, II, and III herd size groups was 18, 12, and 10 respectively in marginal farm size group while in case of landless labourers the number of cases in I, II, and III herd size group came to 16, 14 and 10 respectively. The data were related to year 2008-2009.

Results and discussion

The Table 1 shows that in case of small farmers, the overall average number of earners per family came to 1.77 (28.40 per cent), helpers 1.50 (24.00) and dependents 2.98 (47.60). In case of marginal farmers, the overall average number of earners, helpers and dependents per family came to 1.35 (24.88 per cent), 1.65 (30.42 per cent) and 2.42 (44.70 per cent), respectively. While in case of landless labourers, the overall average number of earners, helpers and dependents per family came to 1.87 (32.19 per 1.55 (26.61 per cent) and 2.40 (41.20 per cent) respectively. It can be concluded from the table that number of earners was more in case of landless labourers as compared to small and marginal farmers and the number of helpers was lowest in cases of small farmers in comparison to marginal farmers and landless labourers. The number of dependents was more in

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Table 1: Economic status of families under study

Herd size group	Sample size	Small farmers Earners	Helpers	Dependents	Total
I	14	1.57	1.28	3.07	5.92
		(26.51)	(21.68)	(51.81)	(100)
II	10	1.60	1.60	3.00	6.20
		(25.81)	(25.81)	(48.38)	(100)
III	16	2.06	1.62	2.88	6.56
		(3143)	(24.76)	(43.81)	(100)
Overall	40	1.77	1.50	2.98	6.25)
		(28.40)	(24.00)	(47.60)	(100)
Marginal farmers					
I	18	1.39	1.55	2.39	5.33
		(26.04)	(29.17)	(44.79)	(100)
II	12	1.33	1.58	2.00	4.91
		(27.12)	(32.20)	(40.68)	(100)
III	10	1.30	1.90	3.00	6.20
		(20.97)	(30.64)	(48.39)	(100)
Overall	40	1.35	1.65	2.42	5.42
		(24.88)	(30.42)	(44.70)	(100)
Landless labourers					
I	16	1.69	1.50	2.25	5.44
		(31.03)	(27.59)	(41.38)	(100)
II	14	2.00	1.64	2.21	5.85
		(34.15)	(28.05)	(37.80)	(100)
III	10	2.00	1.50	2.90	6.40
		(31.25)	(23.44)	(45.31)	(100)
Overall	40	1.87	1.55	2.40	5.82
		(32.19)	(26.61)	(41.20)	(100)

(Figures in parenthesis indicate percentage)

case of small farmers as compared to marginal farmers and landless labourers.

The Table 2 indicates that the overall average number milch animal (buffalo) per family came to 2.15 in case of small farmers. The overall average number of young stock came to 1.95. The number of milch animal (buffalo) per family in different herd size groups came to 1.00, 2.00, and 3.25 per family respectively in I, II and III herd size groups. The number of young stock came to 1.07, 1.50 and 3.00 respectively. The table further indicates that the overall average number of milch animals (Buffalo) per family came to 1.85 in case of marginal farmers. The overall average number of young stock came to 1.75. The number of milch animal (buffalo) per family in different herd size groups came to 1.00, 2.00 and 3.20 per family in I, II and III herd size groups respectively. While the number of young stock came to 1.1, 1.66 and 3.00 in Ist, IInd and IIIrd herd size groups respectively. The table further shows that the overall average number of milch animals per family came to 1.52 in case of landless labourers. The overall average number of young stock came to 1.60. The number of milch animal per family in different herd size groups came to 1.00, 2.00, land 3.30 per family respectively in I, II and III herd size groups. While the number of young stock came to 1.00 1.57 and 2.60 in I, II and IIIrd herd size groups respectively. It cane be concluded from the table that only buffaloes were maintained for milk production on the farms under study the number of milch animals increases with increase in herd size groups.

Table 2: Number of milch animals per family in case of small, marginal farms and landless labourers in different herd size groups

Herd size	Sample size	Small farmers No. of milch animals (buffalo) per family	No. of young stock/family	Total No. of animals
I	14	1.00	1.07	2.07
		(48.31)	(51.69)	(100)
II	10	2.00	1.50	3.50
		(57.14)	(42.86)	(100)
III	16	3.25	3.00	6.25
		(52.00)	(48.00)	(100)
Overall	40	2.15	1.95	4.10
		(52.44)	(47.56)	(100)
Marginal farmers				
I	18	1.00	1.11	2.11
		(47.37)	(52.63)	(100)
II	12	2.00	1.66	3.66
		(54.55)	(45.45)	(100)
III	10	3.20	3.00	6.20
		(51.61)	(48.39)	(100)
Overall	40	1.85	1.75	3.60
		(51.39)	(48.61)	(100)
Landless labourers				
I	16	1.00	1.00	2.00
		(50.00)	(50.50)	(100)
II	14	2.00	1.57	3.57
		(56.00)	(44.00)	(100)
III	10	3.30	2.60	5.90
		(55.93)	(44.07)	(100)
Overall	40	1.92	1.60	3.52
		(54.55)	(45.45)	(100)

(Figures in parenthesis indicate percentage)

The Table 3 shows that per family overall average value of farm assets came to Rs. 124785.72 incase of small-farmers. The buffalo, young stock animals, cattle shed and chaff cutter and other equipment value came to Rs. 63675.18 (51.03%), Rs. 1324.92 (1.06%), Rs. 57425.27 (46.02%) and 2360.35 (1.89%), respectively. The herd size wise analysis indicates that the value of farm assets came to Rs. 79582.00, Rs. 120906.50 and Rs. 166763.50 in Ist, IInd and IIIrd herd size groups respectively. The result presented in table further indicate that on marginal farms, the overall average value of farm assets came to Rs. 111814.90 per family. The buffalo, young stock, cattle shed and chaff cutter and other equipments value came to Rs. 54,281.78 (48.55%), Rs. 1098.75 (0.98%) Rs. 54216.32 (48.49%) and 2218.05 (1.98%) respectively. The group-wise analysis indicates that the value of farm assets came to Rs. 78130.67, Rs. 118718.42 and Rs. 164162.30 in

Table 3: Value of fixed assets in different herd size groups on the farms (excludind land) (In Rs.)

Herd sizes	Sample size	Small farmears				
		Buffalo	Young stock & other	Cattle shed	Chaff cutter & other equipments	Total
I	14	29500.50	695.50	47560.50	1825.50	79582.00
		(37.07)	(0.88)	(59.76)	(2.29)	(100)
II	10	59220.50	990.00	58140.00	2556.50	120906.50
		(48.98)	(0.82)	(48.09)	(2.11)	(100)
III	16	96362.50	2085.00	65610.25	2705.75	166763.50
		(57.78)	(1.25)	(39.34)	(1.62)	(100)
Overall	40	63675.18	1324.92	57425.27	2360.35	124785.72
		(51.03)	(1.06)	(46.02)	(1.89)	(100)
Marginal farmers						
I	18	29110.50	688.89	46556.28	1775.00	78130.67
		(37.26)	(0.88)	(59.59	(2.27)	(100)
II	12	58710.83	1041.67	56615.42	2350.50	118718.42
		(49.45)	(0.88)	(47.69)	(1.98)	(100)
III	10	94275.20	1905.00	65125.50	2856.60	164162.30
		(57.43)	(1.16)	(39.67)	(1.74)	(100)
Overall	40	54281.78	1098.75	54216.32	2218.05	111814.90
		(48.55)	(0.98)	(48.49)	(1.98)	(100)
Landless labourers						
I	16	29090.62(39.79)	616.25(0.84)	41665.62(56.99)	1735.94(2.38)	73108.43(100)
II	14	58538.57(53.89)	987.14(0.91)	46761.43(43.04)	2346.42(2.16)	108633.56(100)
III	10	97856.50(63.24)	1691.00(1.09)	52478.50(33.91)	2715.40(1.76)	154741.40(100)
Overall	40	56588.87(53.41)	1014.75(0.96)	46152.37(43.56)	2194.48(2.07)	105950.47(100)

(Figures in parentheses indicate the percentage)

Table 4: Male, Female and Children hours used in dairy per family in different herd size groups of small and marginal farmers and Landless labourers (In hours)

Herd Size	Small farmers			
	Male	Female	Children	Total
I	164.00(44.99)	182.50(50.07)	18.00(04.94)	364.50(100.00)
II	240.50(33.71)	397.50(55.71)	75.50(10.58)	713.50(100.00)
III	365.00(32.09)	576.50(50.68)	196.00(17.23)	1137.50(100.00)
Overall	263.52(34.63)	393.85(51.76)	103.57(13.61)	760.94(100.00)
Marginal farmers				
I	156.50(40.37)	160.70(41.46)	70.44(18.17)	387.64(100.00)
II	225.00(30.18)	445.00(59.70)	75.40(10.12)	745.40(100.00)
III	336.50(28.41)	618.50(52.22)	229.44(19.37)	1184.44(100.00)
Overall	222.05(31.99)	360.44(51.92)	111.68(16.09)	694.17(100.00)
Landless labourers				
I	132.00(31.32)	232.50(55.16)	57.00(13.52)	421.50(100.00)
II	222.00(28.94)	494.00(64.41)	51.00(06.65)	767.00(100.00)
III	314.00(24.47)	621.50(48.44)	347.50(27.09)	1283.00(100.00)
overall	209.00(27.58)	421.27(55.59)	127.52(16.83)	757.79(100.00)

(Figures in parenthesis indicate percentage)

Ist, IInd and IIIrd herd size groups respectively. The result presented in table further indicates that on landless labourers, the overall average value of farm assets came to Rs. 105950.47 per family. The buffalo, young stock, cattle shed, chaff cutter and other equipments value came to Rs. 56588.57 (53.41%), Rs. 1014.75 (0.96%), Rs. 46152.37 (43.56 per cent) and Rs. 2194.48 (2.07%) respectively. The group-wise analysis indicates that the value of farm assets came to Rs. 73108.43, Rs. 108633.56 and Rs. 154741.40 in Ist, IInd and IIIrd herd size groups respectively. It can be concluded from the table that cattle shed and animal value were the major items of assets found on the farms under different herd size groups, the proportion of milch animal value increases with increase in herd size groups. The value of milch animals was more on small farms as compared to marginal farmers and landless labourers.

The Table 4 reveals that the overall average per family labour hours employed in upkeep of milch

Table 5: Family labour use per family in different herd size groups (converted men days) on small, Marginal farmers and Landless labourers (Converted man days)

Herd Size	Small farmers			
	Male	Female	Children	Total
I	20.50(50.93)	18.25(45.34)	01.50(03.73)	40.25(100.00)
II	30.06(39.50)	39.75(52.23)	06.9(08.27)	76.10(100.00)
III	45.62(38.14)	57.65(48.20)	16.33(13.65)	119.60(100.00)
Overall	32.94(40.69)	39.38(48.65)	08.63(10.6)	80.95(100.00)
Marginal farmers				
I	19.56(47.13)	16.07(38.72)	05.87(14.15)	41.50(100.00)
II	28.12(35.64)	44.50(56.40)	06.28(07.96)	78.90(100.00)
III	42.06(34.19)	61.85(50.27)	19.12(15.54)	123.03(100.00)
Overall	27.76(37.98)	36.04(49.30)	9.30(12.72)	73.10(100.00)
Landless labourers				
I	16.50(37.08)	23.25(52.25)	04.75(10.67)	44.50(100.00)
II	27.75(34.09)	49.40(60.69)	04.25(05.22)	81.40(100.00)
III	39.25(30.11)	62.15(47.68)	28.96(22.21)	130.36(100.00)
Overall	26.12(33.12)	42.13(53.42)	10.62(13.46)	78.87(100.00)

(Figures in parenthesis indicate percentage)
F.N.- Woman 10 Hours = 1 Man day, Children = 12 Hours = 1 Man day, Adult male = 8 Hours = 1 Man day

animals in case of small farmers came to 760.94 hrs. The overall average per family worked by male labour came to 263.52 hrs. (34.63%). While the female labour came to 393.85 hrs (51.76%) and children hours came to 103.57 hrs (13.61%). The herd size group wise analysis indicates that the per family hours used came to 364.50, 713.50 and 1137.50 in I ,II and III herd size groups respectively .The table further reveals that in case of marginal farmers, the per family overall average hours came to 694.17 . The overall average per family of male labour hours came to 222.05 hrs. (31.99 per cent). While the female labour hours came to 360.44 hrs. (51.92%) and children hours came to 111.68 hrs (16.09%). The herd size group wise analysis indicates that the per family total hours came to 387.64, 745.40 and 1184.44 in I ,II and III herd size groups respectively . In case of landless labourers, per family overall average labour hours came to 757.79. The overall average per family male hours came to 209.00 hrs. (27.58%). While the female labour hours came to 421.27 hrs. (55.59 per cent) and children hours came to 127.52 (16.83 per cent). The different herd size group wise analysis indicates that per family labour hours came to 421.50, 767.00 and 1283.00 in I, II and III herd size groups respectively. It can be concluded that women labour hours used came highest in all categories farms ascent area for male hours use.

The Table 5 Shows that the overall average per family labour (converted in men days) employed in upkeep of milch animals in case of small farmers came to 80.95 male days. The overall average per family worked by male labour came to 32.94days (40.69%). While the female labour use came to 33.38 men days (48.65 per cent) and children men days use came to 8.66 (10.66%). The herd size group wise analysis indicates that the per family men days came to 40.25, 76.10 and 119.60 in I ,II and III herd size groups respectively. In case of marginal farmers, the per family overall average men days came to 73.10. The overall average per family of male labour men days came to 27.76 (37.98 per cent). While the female labour men days came to 36.04 (49.30%) and children men days came to 09.30(12.72%). The herd size group wise analysis indicates that the per family total men days came to 41.50, 78.90 and 123.03 in I, II and III herd size groups respectively. In case of landless labourers, per family overall average labour men days came to 78.87. The overall average per family men days came to 26.12.(33.12%). While the female labour men days use came to 42.13. (53.42%) and children men days came to 10.62 (13.46 per cent). The different herd size groups wise analysis indicates that the per family labour men days came to 44.50, 81.40 and 130.36 in I, II and III herd size groups respectively.

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Food Security through Processing and Preservation

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Abstract

Women play an important role in sustaining and improving food security at global, national, community and household levels in various ways. The study was conducted in Kanpur district of Uttar Pradesh to evaluate the nutritional value of selected preserved food. The study revealed that maximum of small land holder 12.0 per cent women used semi liquid and liquid preservative. Only 7.3% large land holder women respondents used dry method for preservative vegetables. 14.0% women respondents belonging to Rs. 6001 to Rs. 9000 income category used semi liquid method for preserving. Dry method was used by women respondents in all educational categories whereas liquid and semi liquid preservative method was used by women respondents of primary and above education level. Majority of respondents, 65.0 per cent respondents used sun dry preservation out of 20 dry and only 35.0 per cent women respondents used solar dryer for preserving in commercial system in the dry preservation by women. Various liquid preservations used by women respondents like sugar and salt and chemicals. Semi liquid preservation like jam, pickles and vinegar preserved vegetables, 56.7% women respondents preserved semi-liquid for preservation of pickles followed by 21.3% respondents who preserved jam of different fruits.

Key Words: Food security, Liquid, Preservation, Pickles, Respondents

Introduction

Women play an important role in sustaining and improving food security at global, national, community and household levels in various ways. Women are the majority of agricultural producers and in many places in the world women are responsible for providing the food for their families, if not by producing it then by earning the income for its purchase. Finally women are nearly responsible for food preparation for their families. Women play a pivotal role in household. They work not less than fourteen hours per day to expedite domestic chores. Their role in food production cannot be ignored. On global scale, they produce more than half of all the food, which is grown. This role in food security must be emphasized in order to create an environment required for eradication of hunger and poverty. So keeping in mind the use of food security in the process of social change, the present study was undertaken to analyze and understand the evaluate the nutritional value of selected preserved food.

Research Methodology

The study was conducted in Kanpur district of U.P. state. The district Kanpur was purposively selected for the present study as investigator is well acquainted with the district. Kalyanpur and Sarsaul block was randomly selected for the data collection of 150 families from the selected 10 villages. Interview method was adopted for collection of information. The investigator personally took interview of selected women with the help of structured schedule consisting statements on nutritional aspects of food and grain storage technique. Adoption magnitude of new storage technique was evaluated and constraints faced in adoption of storage technique was also evaluated and enquired. Impact of various cooking methods on nutritional value of food was further evaluated. The collected data were processed, tabulated, classified and analyzed with the help of parametric and non-parametric statistical tests.

Results and Discussion

Table 1 shows that in the preservative method used by women respondents according to land holding, 12.0% small land holder women used semi liquid and liquid preservative whereas 11.3% marginal and large land holder women respondents used semi liquid method for preservation. Only 7.3% large land holder women respondents used dry method for preservative vegetables. Very meager percentage i.e. 5.3% landless women respondents have used semi liquid method for preservation.

Table 1: Preservative method used by women respondents according to land holding

Preservative method	Land holding			
	Landless	Marginal	Small	Large
Liquid	10 (6.7)	16 (10.7)	18 (12.0)	8 (5.3)
Semi liquid	8 (5.3)	17 (11.3)	18 (12.0)	17 (11.3)
Dry method	-	4 (2.7)	5 (3.3)	11 (7.3)

(Figures in parentheses denote per cent value)

Table 2 shows that in the monthly income wise women respondents using preservative methods, 14.0 per cent women respondents belonging to Rs. 6001 to

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Rs. 9000 income category used semi liquid method for preserving whereas 8.7% women respondents belong to Rs. 3001 to Rs. 6000 income category used liquid method. 8.0% women respondents earned Rs. 9001 and above monthly income have used dry method for preserving method. Semi-liquid preservation was mostly adopted by the women belonging to Rs. 6001 to Rs. 9000 and Rs. 9001 and above income group.

Table 2: Monthly income wise preservative methods used by women

Preservative methods	Monthly income Up to Rs.3000	Rs.3001-Rs.6000	Rs.6000-Rs.9000	Rs.9001& above
Liquid	12 (8.0)	13 (8.7)	16 (10.7)	11 (7.3)
Semi liquid	7 (4.7)	12 (8.0)	21 (14.0)	20 (13.3)
Dry method	-	2 (1.3)	6 (4.0)	12 (8.0)

(Figures in parentheses denote per cent value)

Table 3 shows that in the education wise use by women respondents of different preservative methods, dry method was used by women respondents in all educational categories whereas liquid and semi liquid preservative method was used by women respondents of primary and above education level. Education wise, intermediate qualified women use semi liquid method of preservation. The liquid may fall and be destroyed and in dry method fungus attract, dry method also requires care like sun drying etc. Therefore they prefer semi liquid preservation.

Table 4 shows that in the dry preservation by women respondents, 65.0% respondents used sun dry preservation like (cabbage, methi leaves, bitter guard, mint, jack fruit, potato papad and badeyan) and only 35.0% women respondents used solar dryer for preserving in commercial system. In sun dry nutritive value was same for vegetables after preservation. 65.0% women used sun drying because it is a natural resource and easily available. Solar dryer is costly equipment so the women of all category can't purchase it and illiterate women cannot use it. Education plays important role in this.

Table 4: Distribution of respondents according to dry preservation

Dry preservation	Frequency	Per cent
Sun dry	13	65.0
Solar dryer	7	35.0
Total	20	100.0

Table 5: Distribution of respondents according to use of liquid preservation

Liquid preservation	Frequency	Per cent
Orange	22	42.3
Lemon	17	32.7
Others	13	25.0
Total	52	100.0

Table 6: Distribution of respondents according to semi liquid preservation

Semi liquid preservation	Frequency	Per cent
Jam	16	26.7
Pickles	34	56.7
Vinegar preserved vegetables	10	16.6
Total	60	100.0

Table 3: Education wise various preservative methods used by women respondents

Preservative methods	Level of education Illiterate	Can read only	Primary	Secondary	High school	Intermediate & above
Liquid	-	3 (2.0)	11 (7.3)	10 (6.7)	13 (8.7)	15 (10.0)
Semi liquid	-	4 (2.7)	12 (8.0)	9 (6.0)	16 (10.7)	19 (12.7)
Dry method	4 (2.7)	2 (1.3)	1 (0.7)	3 (2.0)	3 (2.0)	7 (4.7)

(Figures in parentheses denote per cent value)

Table 5 shows various liquid preservations used by women respondents. They used different preservatives and chemicals. Main preservative in squash was sugar, sugar is very harmful for health. It causes different diseases like diabetes etc. salt was the other liquid preservation which causes blood pressure and other heart diseases. Chemicals used for preservation effect the blood pressure. Chemicals were reduced the nutritive value of liquid (squash).

Table 6 shows that semi liquid preservation like jam (apple, guava, carrot, bale, awala and mixed fruit jam), pickles (mango, lemon, red chilli etc.) and vinegar preserved vegetables 56.7% women respondents preserved semi-liquid for preservation of pickles followed by 21.3% respondents who preserved jam of different fruits. Out of 60 respondents who applied semi liquid preservatives, 16.6% women respondents preserved vegetables like (garlic, onion) in vinegar.

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Comparative Study of Beekeeping in Haldwani and Bhimtal block of Uttarakhand

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Abstract

Beekeeping may be one of the important subsidiary enterprises for raising income of small and marginal farmers. Thus, in view of low level of farm income and employment in hill agriculture of Nainital district, beekeeping may serve as an important source of generating additional income and utilize surplus family labour. Therefore, the study was conducted to investigate economic aspect of beekeeping. The study revealed that cost of raising per hive in Bhimtal block (Rs.1510) was relatively higher compared to Haldwani block (Rs.1268). However, the yield of honey per hive was higher in Bhimtal block (20 kg) compared to Haldwani block (18 kg). The average price received per kg of honey by the producers of Haldwani and Bhimtal blocks were Rs.72 and Rs.67 per kg, rescpectively. Net return from honey was higher in Haldwani block (Rs.15) than Bhimtal block (Rs.4).

Key words: Beekeeping, subsidiary enterprise, variable cost

Introduction

In India beekeeping has been mainly forest based. Several natural plant species provide nectar and pollens to honey bees. Thus, the raw material for production of honey is available free from nature. Bee hives neither demand additional land space nor do they compete with agriculture or animal husbandry for any input. The beekeeping is, therefore, ideally suited as a part time occupation. Beekeeping constitutes a source of sustainable income generation to the rural and tribal farmers. It provides them valuable nutrition in the form of honey, protein rich pollen and brood.

In Uttarakhand farmers' income is low due to small, fragmented and undulated land holdings, inadequate agricultural and marketing facilities and high degree of risk and uncertainty in crop cultivation due to rainfed conditions. As a result, farmers in hills are required to adopt diversified farming system. Beekeeping may be one of the important subsidiary enterprises for raising income of the farmers. Beekeeping with *Apis* Mellifera is now being advocated as a supplementary occupation to support the income of rural people. Honey bee increases yield of cross pollinated crops, thus help in increasing farm output and provide employment to landless labourers, marginal and small farmers. Thus, in view of low level of farm income and employment in hill agriculture of the state, beekeeping may serve as an important source for generating additional income and utilize surplus family labour during lean period. Consequently the present study was taken up to study the comparative economics of beekeeping in Haldwani and Bhimtal blocks of Nainital district.

Material and Methods

The study pertained to Nainital district of Uttarakhand purposively taking into account the factors i.e. (1) the climate of the area (suitable for beekeeping), (2) availability of sufficient bee flora, (3) sufficient number of beekeepers and (4) near to the proximity. In this district beekeeping is practiced as a subsidiary enterprise.

Haldwani and Bhimtal blocks were selected purposively in view of the availability of sufficient number of beekeepers. A list of all the beekeepers having more than one bee hive was obtained for Haldwani and Bhimtal blocks from Regional Office of KVIC, Haldwani and Government Beekeeping Research Station, Jeolikot, respectively. From the prepared lists, 25 beekeepers from each of the two blocks were selected randomly for the study purpose. Thus, study was based on 50 beekeepers.

Primary data regarding capital investment in beekeeping including expenses on equipments, sugar feeding, migration of beehives, foundation sheet, human labour, etc. and returns from sale of honey, wax and bee colonies were collected from beekeepers through pre-structured survey schedule by personal interview. The secondary data regarding land utilization, land distribution pattern and demographic feature were collected from annual reports of District Statistical Office (Sankhyiki Patrika, District Nainital 2001). Information about status of beekeeping in Uttarakhand

*The Research Paper is the part of PhD thesis

and Nainital district, KVIC Regional Office (Khadi Village Industries Commission), Haldwani and Beekeeping Research Station, Jeolikot, were procured.

Analytical tool

Computation of costs incurred in beekeeping

The cost incurred in beekeeping pertained to costs on fixed assets and on variable resources. Items of costs related to fixed assets were costs of hive boxes, honey extractor, bee veil, frames, and smoker, gloves, feeder, and storage bin and nucleus boxes. In order to calculate the annual fixed costs due to investment in fixed assets, constituted two components i) depreciation on fixed assets and ii) interest on the value of investment in fixed assets. The depreciation on fixed assets was calculated through straight line method. The junk value of all the fixed assets used in beekeeping was taken as zero as these assets were not having any resale value as reported by beekeepers. Thus depreciation on fixed assets was computed by using the following formula:

$$\text{Annual depreciation} = \frac{\text{Initial purchase price of the asset}}{\text{Estimated useful life of the asset (year)}}$$

The interest on the value of the investment in fixed assets was computed at the rate of 10 percent interest.

Under the category of operational or variable costs following items were taken into account Sugar feeding, Migration of bee hives, Human labour cost, Foundation Sheet, Maintenance expenses and Interest on working capitals

The cost of sugar feeding and foundation sheet was calculated on their actual purchase price. The cost of migration of beehives included the cost of transportation, boarding and lodging of beehives. In beekeeping, all the selected beekeepers used only family labours and hiring of labour was not used. However, the imputed value of family labour was computed at wage rates prevailing for hired labour in the locality and considered in the computation of the cost of beekeeping. The interest on working capital was calculated at the rate of 10 percent for a period of six months.

Returns from Beekeeping

The total return obtained from beekeeping was calculated by taking into account the returns from following items.

(1) Returns from honey:

The prices of honey varied in accordance with the production season and type of flora from which it was produced. Therefore, for computing the returns from honey, the actual sale price received by beekeepers was taken into consideration.

(2) Returns from sale of colonies:

The new colony was produced by beekeepers by portioning old colony either to expand their own units or to sale to others. The sale value of the colonies produced by the producers was evaluated at the prices prevailing in the locality.

(3) Returns from wax:

Wax production was generally very small in quantity in most of the selected beekeeping units. However, the produced quantity was evaluated at prevailing market prices. For achieving first objective, simple descriptive statistics like average and percentage were employed.

Results and Discussion

Comparative Economics of Beekeeping in Haldwani and Bhimtal Blocks

A perusal of cost structure of beekeeping in Bhimtal block (Table 1) and the comparison of the same with cost structure in Haldwani block (Table 1) reflected that cost of raising per hive in Bhimtal block (Rs.1510.00) was relatively higher compared to

Table 1: Costs and returns per hive in beekeeping in Haldwani block (2005)

Variables	Cost (Rs.)	% of total cost
A. Fixed cost		
i. Depreciation on the value of assets @ 20%	303.0	23.90
ii. Interest on the value of investment in fixed assets @ 10%	151.0	11.91
iii. Total fixed cost (i + ii)	454.0	35.81
B. Variable cost		
i. Cost of foundation sheet	192.0	15.14
ii. Cost of sugar	165.0	13.01
iii. Cost of migration of bee hives	42.0	3.31
iv. Cost of human labour	367.0	28.94
v. Miscellaneous expenses	9.0	0.71
vi. Interest on working capital @ 10%	39.0	3.08
vii. Total variable cost (i to vi)	814.0	64.19
C. Total cost (A+B)	1268.0	100.0
D. Cost of production of honey (Rs./kg) excluding wax and bee colonies	57.0	
Returns		**% of gross return**
Yield of honey (kg/hive)	18.0	
Average price of honey (Rs./kg)	72.0	
E. Total return from honey Rs./hive)	1296.0	81.06
Return from wax (Rs./hive)	33.0	2.06
Return from colony (Rs./hive)	270.0	16.43
F. Gross return from beekeeping (Rs./hive)	1599.0	
G. Net return from honey (Rs./kg)	15.00	
H. Net return from beekeeping {Rs./hive) over total cost	331.00	
I. Net return from beekeeping over variable cost (Rs./hive)	785.00	
J. Family labour income (Rs./hive)	698.00	
Input-output ratio	1:1.26	

Note: Figures with respect to costs and return were rounded off to nearest rupee.

Table 2: Costs and returns per hive in beekeeping in Bhimtal block (2005)

Variables	Cost (Rs.)	% of total cost
A. Fixed cost		
i. Depreciation on the value of assets @ 20% 25.30	383.00	
ii. Interest on the value of investment in fixed assets @ 10%	192.00	12.68
iii. Total fixed cost (i + ii)	575.00	37.98
B. Variable cost		
i. Cost of foundation sheet	120.00	7.93
ii) Cost of sugar	205.00	13.54
iii) Cost of migration of bee hives	50.00	3.30
iv) Cost of human labour	507.00	33.49
v. Miscellaneous expenses	12.00	0.79
vi. Interest on working capital @ 10%	45.00	2.97
vii. Total variable cost (i to vi)	939.00	62.02
C. Total cost (A+B)	1514.00	100.00
D. Cost of production of honey (Rs./kg) excluding wax and bee colonies	63.00	
Returns		**%of gross return**
Yield of honey (kg/hive)	20	
Average price of honey (Rs./kg)	67	
E. Total return from honey Rs./hive)	1340	82.77
Return from wax (Rs./hive)	13.00	0.80
Return from colony (Rs./hive)	266	16.93
F. Gross return from beekeeping (Rs./hive)	1619	
G. Net return from honey (Rs./kg)	4.00	
H. Net return from beekeeping {Rs./hive) over total cost	105.00	
I. Net return from beekeeping over variable cost (Rs./ hive)	680.00	
J. Family labour income (Rs./hive)	612.00	
Input-output ratio	1:1.07	

Note: Figures with respect to costs and return were rounded off to nearest rupee.

Haldwani block (Rs.1268.00). However, the yield of honey per hive was higher in Bhimtal block (20 kg) compared to Haldwani block (18 kg). The picture with regard to average price received (Rs.67/kg) by beekeepers of Bhimtal was dismal compared to Haldwani block (Rs.72/kg). In view of low average price received and higher cos t of production, beekeepers of Bhimtal block were at a disadvantage compared to beekeepers of Haldwani block. Moreover, there was vast difference in net returns/hive over total cost in Haldwani block (Rs.331.00) and Bhimtal block (Rs.105.00). The prime reasons for this difference was observed due to difference in cost, yield and average price received. The beekeepers of Haldwani block were in advantage with regard to above three mentioned variables. The productivity of honey per hive was found higher in Bhimtal block solely due to better availability of flora and intensive use of human labour in managing bee hive.

On the basis of the results obtained for both the blocks, it was evident that beekeeping appeared profitable in both the blocks particularly to utilize surplus family labour whose opportunity cost in the study area was nearly zero. However, it can be made more remunerative by way of offering higher product price and suitable arrangement of sale of product.

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Effect of integrated Nutrients (NPK) management on wheat (Triticum aestivum L.) on yield and economics in 'pearlmillet – wheat' cropping system in semi arid areas

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Abstracts

In a field experiment on a sandy laom soil, the effect of integrated nutrient management in pearl millet – wheat crop rotation in wheat were studied in Rabi *season 2006 -2007 and 2007 – 08. The results reveled that application of 50% recommended NPK dose through fertilizers (40:20:20) +50% N substitution through FYM @8 t ha^{-1} (Pearl millet), 100% recommended NPK dose through fertilizers (120:60:40) in wheat, improved the grain yield significantly of wheat over other treatments. Similarly application of 100% recommended NPK dose through fertilizer (80:40:40) pearl millet and 100% recommended NPK dose through fertilizer (120:60:40) in wheat was at par in {100% recommended NPK dose through fertilizer (120:60:40)}. The all yield attributing characters of wheat crop i.e. spike length (cm), No. of grains spike^{-1}, spike lets spike $^{-1}$, grain yield spike $^{-1}$ and test weight of 1000 grain were significantly higher in this treatments. The maximum net return (Rs.42,437.00) and B:C ratio (2.83) were recorded with (50% recommended NPK dose through fertilizer 40:20:20 +50% N substitution through FYM @8t ha^{-1} in pearl millet and 100% recommended NPK dose through fertilizer (120:60:40) in wheat crop in pearl millet –wheat crop rotation.*

Key words: Yield attributing characters, test weight, net return, B:C ratio

Introduction

Amongst agricultural inputs, fertilizers have played a vital role in achieving the goal of food security in India. But having attained food security, the accentuate in recent times has shifted from productivity enhancement – based agricultural research to nutritional security and sustainability issues because the deterioration in soil health associated with global circumstance of energy crises and isolation in prices of chemical fertilizers have forced us to supplement them with low priced organic and bio sources of plant nutrients (Kumar and Dhar, 2010). The use of readily available parochial farmyard manure and suitable of Azotobactor in a crop like wheat (Triticum aestivum L.) in conjugation with chemical fertilizer can help in achieving the productivity and sustainability of production. Apart from integration of nutrient sources application of mineral nutrients in a proper balance also has a role to play in improving quality of wheat. Keeping the above facts under consideration , an experiment was carried out to study the effect of integrated nutrient (NPK) management on wheat (Triticum aestivum L) in yield and economics in 'pearl millet –wheat' cropping system in semi arid areas.

Methods and Materials

A field experiment was carried out during *Rabi* season 2006-07 and 2007-08 at Cropping Systems Research Project (ICAR) R.B.S. College Bichpuri, Agra on sandy loam soils analysis normal in pH (7.9), low organic carbon (0.32%) and available N (182 kg ha^{-1}) and medium in available P (12.5) kg ha^{-1}) and K (282 kg ha^{-1}). The fixed plot experiment was laid out in four times replicated Randomized block design. The experiments composed twelve treatments (in listed). The wheat variety UP 2338 sown under the experiment in two years. Other management practices were adopted as per recommendation and need of the crop. Seed yield of component crop and important. Yield attributing characteristics were work out based on the net plot and randomly selected four plants sample. Soil sample were taken from 0-22.5 cm soil layer at the beginning and end of experiment to find out initial status of experimental site soil and changes in available N, P and K in the soil after the experimental period. Soil samples drawn at the beginning of the experiments were analyzed for organic carbon, pH and available N, P and K by following standard procedure. The rainfall receiving the crop period time nil mm in 2006 – 07 and 3.8 mm in 2007 – 08. The wheat seed was sown @ 120 kg ha^{-1} treated with agroson GN @2g per kg seed before sowing. The seed was sown in furrows in the 5cm deep. Phorate -10(G) @10kg ha^{-1} was mixed in the soil at the time of last ploughing of the field to control termites and other insects.

Results and Discussion

The yield attributing characters of wheat i.e. spike length (cm), spike lets of spike $^{-1}$, no. of grain spike $^{-1}$, grain weight (g) spike $^{-1}$ and 1000 grain weight

Treatments: 12 – as listed below

Treatment	Kharif (Pearlmillet)	Rabi (Wheat)
T_1	No fertilizer, no organic (Control)	No fertilizer, no organic (Control)
T_2	50% recommended NPK dose through fertilizer (40-20-20)	50% recommended NPK dose through fertilizer (60-30-20)
T_3	50% recommended NPK dose through fertilizer (40-20-20)	100% recommended NPK dose through fertilizer (120-60-40)
T_4	75% recommended NPK dose through fertilizer (60-30-30)	75% recommended NPK dose through fertilizer (90-45-30)
T_5	100% recommended NPK dose through fertilizer (80-40-40)	100% recommended NPK dose through fertilizer (120-60-40)
T_6	50% recommended NPK dose through fertilizer (40-20-20)+ 50% N through FYM @8 t/ha	100% recommended NPK dose through fertilizer (120-60-40)
T_7	75% recommended NPK dose through fertilizer (60-30-30)+25% N substitution through FYM @ 4 t./ha	75% recommended NPK dose through fertilizer (90-45-30)
T_8	50% recommended NPK dose through fertilizer (40-20-20)+ 50% N substitution through waste residue of crop (WRC) @6.6 t/ha	100% recommended NPK dose through fertilizer (120-60-40)
T_9	75% recommended NPK dose through fertilizer (60-30-30)+25% N substitution through waste residue of crop (WRC) @3.3 t/ha	75% recommended NPK dose through fertilizer (90-45-30)
T_{10}	50% recommended NPK dose through fertilizer (40-20-20)+ 50% N substitution through green manure (dhaincha) @ 5.5 t/ha	100% recommended NPK dose through fertilizer (120-60-40)
T_{11}	75% recommended NPK dose through fertilizer (60-30-30)+ 25% N substitution through green manure (dhaincha) @ 2.75 t/ha	75% recommended NPK dose through fertilizer (90-45-30)
T_{12}	Farmer's practices (conventional method) (40-0-0)	Farmer's practices (conventional method)of the area (40-0-0)

(test weight) g (Table 1) clearly indicated that the levels of fertility maintained through fertilizers affected the spike length (cm) significantly, the maximum spike length (cm) was recorded with T_5 (100% recommended NPK dose through fertilizer) and remained at par with T_9, T_2, T_6, T_3, T_7, T_8 and T_{11} and treatment T_5 was significantly superior over T_1, T_{12}, T_4, and T_{10}. The spikelets spike $^{-1}$ maximum in T_5 treatment and minimum with T_1 treatment. The treatment T_5 was at par with T_4, T_6 and T_8. The lowest number of spikelets spike^{-1} in the wheat was found in control treatment. Further Table 1 clearly indicated that the no. of grain spike $^{-1}$ was significantly maximum in T_6 closely followed by T_{10} treatment. The weight of grain spite $^{-1}$ in wheat crop higher in T_6 treatment closely followed by T_5. Treatment T_6 was significantly

Table 1: Yield contributing characters of wheat as affected by various treatments (Average of two years)

Treat-ments	Spike length (cm)	Spikelets spike^{-1}	Grains spike^{-1}	Grain weight (g) spike^{-1}	1000 grain weight (g)
T_1	7.60	12.60	36.90	1.58	39.10
T_2	8.50	16.10	40.60	2.00	42.20
T_3	8.40	18.80	42.10	2.10	41.70
T_4	7.90	19.20	41.50	2.18	40.80
T_5	8.90	21.10	41.60	2.55	45.60
T_6	8.80	20.90	43.20	2.60	47.50
T_7	8.80	17.10	42.00	2.05	45.40
T_8	8.30	19.65	41.70	2.10	44.70
T_9	8.80	17.30	39.60	1.80	43.30
T_{10}	8.10	18.40	43.15	2.20	43.70
T_{11}	8.50	18.15	40.60	2.00	43.30
T_{12}	7.80	16.35	38.85	1.60	40.80
LSD 0.05%	0.69	2.15	1.15	0.30	1.50

superior over T_1, T_2, T_3, T_4, T_7, T_8, T_9, T_{10}, T_{11} and T_{12}. The lowest grain weight spike $^{-1}$ were noted in T_1 (control) treatment. The 1000 grain weight (test weight) of wheat crop T_6 treatment (100% NPK through fertilizer) produced the maximum test weight of 1000 grain (g) maintaining its statistical superiority over T_1, T_3,T_4, and T_{12} treatments but remained at par with T_2, T_5, T_7, T_8, T_9, T_{10} and T_{11} treatment. The lowest test weight was recoded in control (T_1) treatment. The combined application of NPK in balanced form have also been recorded by several workers Singh and Verma, (1990) and Patra (1990).

Productivity of wheat:

The data obtained on biomass (total dry matter production / biological yield) of wheat in q ha^{-1} during two consecutive season 2006-07 and 2007-08 and pooled data are presented in Table 2. It is reveled from table 2 that the treatment T6 (100% NPK through fertilizer in wheat, when grown after perlmillet under 50% NPK through fertilizer +50% N – through FYM @ 8 t ha^{-1}) produced maximum biomass q ha^{-1} and treatment T6 produced biomass significantly more over T_1, T_2, T_3, T_4, T_7, T_8, T_9, T_{11} and T_{12} but the former treatment (T_6) remained particularly at par with T_5 and T_{10} respectively in individual years as well as pooled analysis. The table 2 further clearly indicated that the treatment T6 superadded the treatment T_1, T_2, T_3, T_4, T_5, T_8, T_9 and T_{12}. However, reaming treatments i.e. T_9, T_{10} and T_{11} stood at par with T_6. The lowest grain yield of wheat was recorded with absolute control (No P_0K_0) on the other treatments, T_6 appeared better to produce maximum grain yield of wheat , when applied 100% NPK through fertilizer in what crop (growth affected pearlmillet 50% FYM investigation). The second best treatment was T_{10} where in 50% N

Table 2: Biological, grain, straw yield (q ha^{-1}) and harvest index of wheat crop as affected by various treatments (Average of two years)

Treatments	Grain yield			Straw yield			Biological yield			Harvest index		
	06-07	07-08	Mean	06-07	07-08	Mean	06-07	07-08	Mean	06-07	07-08	Mean
T_1	13.2	12.7	12.9	22.0	21.8	21.9	35.2	34.5	34.9	37.5	36.8	37.2
T_2	26.7	27.6	27.2	46.4	47.2	46.8	73.1	74.8	73.9	36.5	36.9	36.7
T_3	40.4	40.5	40.5	60.2	61.3	60.8	100.6	101.8	101.2	40.2	39.8	40.0
T_4	39.6	38.0	38.8	62.4	63.7	63.1	102.0	101.7	101.9	38.8	37.4	38.1
T_5	43.3	43.6	43.5	67.5	68.2	67.9	110.8	111.8	111.3	39.1	38.9	39.0
T_6	45.6	50.2	47.9	69.1	71.2	70.2	114.7	121.4	118.1	39.7	41.4	40.6
T_7	43.9	43.6	43.8	63.6	64.2	63.9	107.5	107.8	107.7	40.8	40.4	40.6
T_8	41.6	45.8	43.7	59.4	63.8	61.6	101.0	109.6	105.3	41.2	41.8	41.5
T_9	40.6	40.9	40.8	60.1	61.7	60.9	100.7	102.6	101.7	40.3	39.9	40.1
T_{10}	44.6	47.8	46.2	65.3	68.5	66.9	109.9	116.3	113.1	40.6	41.1	40.9
T_{11}	43.4	43.0	43.2	61.6	62.3	61.9	105.0	105.3	105.2	41.3	40.8	41.1
T_{12}	25.2	27.7	26.5	47.3	50.1	48.7	72.5	77.8	75.0	34.7	35.6	35.2
LSD 0.05%	2.2	2.3	-	5.9	6.2	-	6.9	8.2	-	2.1	3.1	-

substitution had made from green manuring and 100% NPK (120:60:40) fertilizer in wheat with fertilizer. Thus farmers made of 50% N substitution through FYM in pearlmillet and 100% recorded NPK through pearlmillet in what growth in sequence depending upon its availability for sustained production Rajput (2006) reported that there was no scope for reducing the fertilizer dose from recommended level (120:60:40) to either 25,50,75 per cent recommended NPK in wheat. The same trend and results obtained with straw yield of what in individual year as well as pooled analysis. The harvest index in individual year as well as pooled basis significantly in some treatments. The maximum harvest in day was recorded in T_8 treatment and lowest in T_{12} treatment in pooled analysis.

Economics

The maximum B:C ratio of 2.83 was obtained with (50% recommended NPK dose through fertilizer 40:20:20) + 50% N substitution through FYM @8t ha^{-1}) in pearlmillet crop and 100% recommended NPK dose through fertilizer 120:60:40) in wheat crop treatment (T_6). The maximum net profit of Rs.42,437 was recorded with T6 treatment followed by T_{11} (75% recommended NPK dose through fertilizer 60:20:30) + 25% N substitution through green manuring (dhaincha) @2t ha^{-1} (pearlmillet) and 75% recommended NPK dose through fertilizer 90:45:30) Rs.40,300 from wheat crop in pearlmillet – wheat crop rotation. It is due to more net return (Rs ha^{-1}) than cost of cultivation involved with these treatments (Table 3).

Table 3: Net profit (Rs ha^{-1}) and Benefit Cost ratio of wheat crop as affected by different treatments.

Treat-ments	Net Profit (Rs ha^{-1}) 2006-07	07-08	Mean	B:C ratio 2006-07	07-08	Mean
T_1	3956	3436	3696	0.32	0.27	0.30
T_2	19385	20387	19886	1.41	1.48	1.45
T_3	33612	33912	33763	2.24	2.26	2.25
T_4	33796	32423	33110	2.35	2.26	2.31
T_5	37563	37956	37760	2.50	2.53	2.52
T_6	40000	44874	42437	2.66	2.99	2.83
T_7	38190	37986	38088	2.65	2.64	2.65
T_8	34676	39452	37064	2.31	2.63	2.47
T_9	34431	34965	34698	2.39	2.43	2.41
T_{10}	38483	42117	40300	2.56	2.80	2.68
T_{11}	37393	37113	37253	2.60	2.58	2.59
T_{12}	18954	21868	20411	1.47	1.70	1.58

It can be concluded that the productivity of the crop can be sustained by supplying the nutritional requirement of crop through FYM and fertilizer in different combinations. Singh 1991, also reported that high B:C ratio (2.03) with Soybean –wheat sequence than rice based crop sequence.

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Direct effect of sources, levels of phosphorus and lime on dry matter yield, nodule number, dry weight of nodules and yield of greengram in greengram-sesamum sequence

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Abstract

A field experiment was conducted at instructional cum Research farm of Assam Agricultural University, Jorhat to study the effect of sources and levels of phosphorus on greengram - sesamum sequence. The experiment was conducted in randomized block design with three replications. The treatment consisted of three phosphorus sources, three levels of phosphorus and two lime levels. Results revealed that dry matter yield, nodule number, dry weight of nodules and grain yield of greengram were significantly influenced by the application of 52.5 kg P_2O_5/ha. The sources of phosphorus had no significant influence on dry matter yield, number of nodules, dry weight of nodules and grain yield of greengram. Application of 50% lime recorded higher grain yield over no lime but dry matter yield, nodule number was found to be non-significant by liming.

Keywords: Phosphorus, lime, Green gram, dry matter, nodules, sesamum

Introduction

Pulses occupy an important place and constitute a major component of an average Indian diet. Green gram is an energy rich crop, which requires higher amount of phosphorus that helps in root development and nodulation. Phosphorus deficiency is most important single factor responsible for poor yields of pulses in acid soils of Assam. Among the sources, DAP and SSP play a prominent role for correction of phosphorus deficiency in crops. Therefore present study was conducted to know the response of phosphorus and lime on dry matter yield, nodule number, dry weight of nodule and grain yield of Green gram.

Materials and Methods

A field experiment was conducted at instructional cum Research farm of AAU, Jorhat. The soil was sandy loam with pH 5.4, Organic carbon 0.86 %, Available Nitrogen 247.7 kg/ha, Phosphorus and Potassium 25.2 kg/ha and 100.2 kg/ha respectively. The experiment was conducted in randomized block design (factorial) with 3 replications. The treatment combination consisted of 3 phosphorus sources (SSP, DAP & MRP), 3 levels of phosphorus (control, 35 kg P_2O_5, 52.5 kg P_2O_5) and 2 lime levels (No lime and 50% of lime requirement). Well decomposed FYM @ 5t/ha was uniformly broadcasted over the experimental area at the time of land preparation, samples were collected for both the crops for analysis of various parameters. The results were analysed statistically following standard statistical procedures.

Results and Discussion

Dry matter yield, No. of nodules and dry weight of nodules

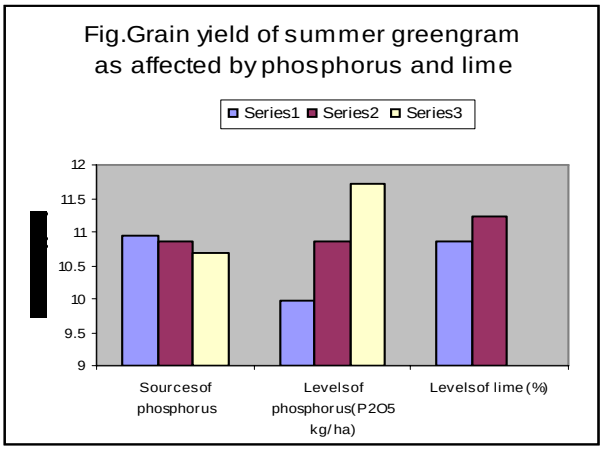
Significant differences were not observed at different levels of Phosphorus for dry matter yield, nodule number and dry weight of Green gram. However, application of SSP recorded highest dry matter yield, nodule number and dry weight of nodules as compared to DAP and MRP. The superiority of SSP might be due to easy access of water soluble phosphate to the crop during the early part of its crop growth. The superiority of SSP over other sources was also reported by Goswami (1990) and Hazarika (1991).

The highest dry matter yield at 25 at 50 DAS was found to be significant at 52.5 kg P_2O_5 /ha level. This may be due to higher plant height, number of branches and number of leaves. This finding is in conformity with the findings of Ram and Dixit (2000). Significantly highest nodule number and weight were recorded with 52.5 kg P_2O_5 /ha which was superior over 35 kg and 0 kg P_2O_5/ha.The phosphorus application at higher level might have helped in healthy root growth and improve the nodulation process. This confirm the findings of Basumatary (1999), Ram and Dixit (2000).

The dry matter yield was significantly influenced at 50 DAS due to application of 50% lime level over control treatment. This might be due to higher plant height, number of leaves and number of branches (Singh and Singh, 1983). The findings revealed that nodule number and dry weight of nodules were significantly affected by 50% lime level over control. This might be due to the fact that liming in acid soil might have increased the pH of the root rhizosphere

Table 1: Effect of phosphorus and lime on dry matter yield, nodule number, dry weight of nodules and grain yield of greengram

Treatment	Dry matter Yield(q/ha) 25DAS	50DAS	No. of nodules at flowering	Dry weight of nodules per plant(mg)	Grain yield (q/ha)
Sources of phosphorus					
SSP	18.01	25.64	40.32	169.10	10.95
DAP	17.71	25.61	40.10	169.08	10.86
MRP	17.35	25.40	39.72	168.94	10.70
S.Ed ±	0.47	0.11	0.35	0.19	0.19
C.D.(0.05)	NS	NS	NS	NS	NS
Levels of phosphorus(P_2O_5kg/ha)					
0	17.21	25.14	38.93	168.56	9.96
35	17.49	25.50	40.17	168.87	10.85
52.5	18.37	26.01	41.05	169.70	11.71
S.Ed ±	0.47	0.11	0.35	0.19	0.19
C.D.(0.05)	0.96	0.24	NS	0.39	0.39
Levels of lime (%)					
0	17.51	25.42	39.72	168.86	10.87
50	17.87	25.68	40.37	169.21	11.22
S.Ed ±	0.38	0.09	0.28	0.15	0.15
C.D.(0.05)	NS	0.19	0.58	0.32	0.32



which is essential for more availability of phosphorus, better colonization and activities of rhizobium. This might have encouraged the infection of root hairs by the rhizobiums which ultimately lead to increase in number and dry weight of nodules. This result is also in conformity with the findings of Basumatary (1999) in Green gram.

Grain Yield of Green gram

The grain yield was not significantly influenced due to various sources of phosphorus used. However application of SSP showed an increasing trend over DAP and MRP. Application of 52.5 kg P_2O_5/ha significantly increased the grain yield of Green gram over 35 kg P_2O_5/ha and control. The increase in grain yield was 17.58 percent and 7.92 percent respectively over 0 kg and 35 kg P_2O_5/ha and control. The increase in grain yield might be due to cumulative effect of higher number of pods/plant, more length of pods, more number of grains per pod and increase in 1000 grain weight. Highest grain yield of black gram with highest level of phosphorus was also reported by Kalita, 1990.

Grain yield was affected by application of lime and the highest grain yield was recorded with 50% of lime level. The higher yield under 50 percent lime level was due to more number of pods per plant and more number of seeds per pod which directly contributes to yield (Mutanal and Kumar,1998). Basumatary (1999) also reported significant effect due to application of lime on grain yield of Greengram.

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Effect of Different Systems of Land preparation on Grain Yield of Rice, Wheat and Maize in Chatra District of Jharkhand

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Abstract

Different land establishment techniques were tested in two cultivars of Rice followed by wheat and maize in Hunterganj village of Chatra district of Jharkhand in the kharif and rabi of 2006 & 2007 respectively. Grain yield differences were significant under varieties and methods of stand establishment. Hybrid PA 6201 recorded significantly higher grain yield (3.72 t/ha) over the mean grain yield of locally popular cultivar Naveen (2.69 t/ha). Among methods of stand establishments, mean maximum grain yield (3.14 t/ha) was recorded by SRI method of planting which was significantly superior over all other methods of establishment. The lowest grain yield was recorded by furrow irrigation raised bed.

Key words: Land preparation, Grain Yield, Rice, Chatra and Jharkhand

Introduction

The management of natural resources through adoption of resource conservation technologies (Different bed planting, System of Rice Intensification, AWD, Direct seeding) and diversification/ intensification of rice based cropping play important role for enhancing productivity and profitability to the farmers (Singh and Pillai, 1996). Tillage is defined as the mechanical manipulation of soil to provide conditions favorable for crop production. It is an energy intensive operation (Bouman and Tuong, 2001). Increasing water scarcity is becoming a real threat for rice cultivation. Rice is the major cereal crop but stagnating yields at levels for below the potential productivity and even yields declines are accruing in some area in rice-rice and rice-wheat system. About 80 percent of fresh water is being used for agriculture and cost of this more than 50 percent is consumed by the rice crop alone. Puddling not only consumes a large quantity of total water in rice but also requires large amount of fossils fuels. Due to non availability of sufficient labour in time and their higher wages during peak period of farm operations generally leading to delayed planting and ultimately resulting in yield reduction and increased cultivation cost. Direct seeding requires less labours, crop matures early (about 6-10 days) and lesser cost of cultivation (De Dutta 1986). Under these situations, conservation agriculture based rice crop establishment via direct seeding is a viable alternative as it ensures 25% saving in water. Considering the above facts the field experiment was conducted to find out effect of establishment methods in rice and rice based cropping system in Chatra District of Jharkhand.

Materials and Methods

Field experiments were conducted during Kharif season of 2006 and Rabi of 2007 in a preselected village of Hunterganj, district Chatra. The soil was sandy loam type having pH 5.8, available nitrogen, P_2O_5 and K_2O was of 200, 15.5 and 250 kg/ha respectively. The experiment was laid out in randomized black design with four replications and two rice varieties one hybrid PA6201 and one locally popular Naveen were tested. The seed rate adopted was 40 kg/ha under direct seeded condition. Initially land was ploughed 2-3 times in dry condition and pulverized. After that, the field was levelled it to bring the soil to a fine tilth and suitable for sowing of seeds and to provide favorable condition for germination. Irrigation was provided to field immediately after sowing and 3 days after sowing. Thinning and gap filling was done 15 days after sowing. Recommended dose of fertilizers i.e., 80: 60: 40: 25 kg N: P_2O_5: K_2O and $ZnSO_4$ kg ha^{-1} were applied during crop period. Half the dose of nitrogen, full dose of phosphorus and 75% of potash and full dose of zinc were applied basally and remaining dose of N in two splits (25% N at active tillering and 25% N along with 25% potash at panicle initiation stage) were applied in main field. During *rabi* 2006-07, wheat and maize were sown under each method of stand establishment without changing the layout of *kharif* season.

Results and Discussions

Grain yield differences were significant under varieties and methods of stand establishment. PA 6201

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Table 1: Effect of ressource conservation technologies on grain yield (t/ha)

Treatment	Grain yield (t/ha)
Varieties	
Naveen	2.69
PA 6201	3.72
C.D. (0.05)	0.02
Resource conservation technologies	
SRI	3.14
Direct seeded (Puddled)	2.27
FIRB	2.08
DC at 5%	0.09

Table 2: Grain yield (t/ha) of *rabi* crops under different methods of stand establishment.

Methods	Wheat	Maize	Mean
SRI	0.85	3.38	2.11
DS	1.01	2.59	1.80
FIRB	0.95	2.10	1.51
Mean	0.93	2.69	1.80
C.D. (0.05%)			
Rabi crop		0.04	
Systems		0.04	
S x C		0.08	

Table 3: Rice equivalent yield (t/ha) under different rice system

S. No.	Method of stand establishment	Wheat	Maize	Mean
1	SRI	3.01	5.08	4.05
2	Direct seeding	2.34	3.42	2.88
3	Furrow irrigation raised bed	2.17	5.23	3.7

recorded significantly higher grain yield (3.72 t/ha) over the mean grain yield of Naveen (2.69 t/ha). Among methods of stand establishments, mean maximum grain yield (3.14 t/ha) was recorded by SRI method of planting which was significantly superior over all other methods of establishment (Table 1). Grain yield differences were recorded among methods of stand establishment, *rabi* crops and their interactions (Table 2). Mean maximum grain yield 2.87 t/ha was recorded by maize which was significantly superior over all other crops. Among, methods of stand establishment, system of rice intensification recorded maximum grain yield which was significantly superior over other methods of stand establishment. The lowest grain yield was recorded by furrow irrigation raised bed. Rice equivalent grain yield differed significantly. Among methods of stand establishment, mean maximum grain yield of 4.045 t/ha was recorded by SRI and was significantly superior over all other methods of stand establishment (Table 3).

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Performance of MTU-1081 of paddy variety in System of Rice Intensification (SRI) through front line demonstrations in Umaria district of Madhya Mradesh

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Abstract

The front line demonstrations were conducted on farmers field at Umaria district during kharif *seasons of 2010 and 2011 at three different locations under real farm situations prevailing farmers practices were treated as control for the comparison with recommended practice i.e. System of Rice Intensification (SRI). The result of front line demonstration shown a greater impact on farmers face due to significant increase in crop yield higher than FP, the economics and benefit cost ratio of both FP and RP plots were worked out. The average of Rs. 34349/ha was recorded net profit under RP while it was Rs. 17571/ha under FP. Benefit cost ratio was 2.81 under RP, while it was 2.01 under FP. By conducting FLD of proven technologies, yield potential and net income from SRI system of paddy cultivation can be enhanced to a great extent with increase in the income level of the farming community of the district.*

Key words: System of Rice Intensification, Benefit cost ratio, Cultivation

Introduction

Rice (*Oryza sativa*) occupies a position of overwhelming importance in Indian agriculture and it constitutes the bulk of the Indian diet. For many people in the India, rice is the main source of energy, and it plays an important role in providing livelihood to the Indian population. It is largely grown in India under diverse conditions of soil, climate, hydrology and topography. Rice farming is the most important source of employment and income for the majority of rural people in this region.

The productivity of rice in the district can be increase by following the appropriate agronomic practices along with high yielding rice varieties. The basic principles of SRI are; planting young seedlings (<14 days), singly in a square pattern (Stoop *et al*, 2002), the soil is just kept saturated with water and flooding is not allowed till reproductive stage, after which a thin layer of water (1-2 cm) is kept in the field. Weeds are primarily controlled by mechanical weeding (*Cono weeder*) which also helps in incorporation of weed biomass and maintains proper aeration in soil (Satyanarayana *et al;* 2007). Various planting densities have been evaluated for SRI with the general recommendation being 25 cmx25 cm.

Rice is the staple food crop of the Umaria district of Madhya Pradesh; occupies 43.35 % of total cropped area of *kharif* season (44000 ha of total 92910 ha cultivated area). The productivity of rice in the district is only 1.5 t/ha, which is much below the national productivity (3.37 t/ha). The reason of low productivity may be attributed to non adoption of improved production technology which includes the agronomic practices and socioeconomic conditions of the tribal people. An effort made by the KVK scientists by introducing the SRI system of paddy production through front line demonstration on farmers field during *kharif* seasons of 2010 and 2011.

Materials and Methods

The present study is a part of the mandatory programme of Krishi Vigyan Kendra, Umaria, Madhya Pradesh. Participatory rural appraisal (PRA), group discussion and transect walk were followed to explore the detail information of study area. In between the technology intervention HRD components (Trainings/ Kisan sangosthi/ Kisan mela/ field day etc.) were also included to excel the farmers understanding and skill about the demonstrated technology on SRI. Field demonstrations were conducted in Umaria district of Madhya Pradesh under close supervision of krishi vigyan Kendra. Total 14 front line demonstrations under real farming situations were conducted during *kharif* seasons of 2010 and 2011 at three different villages namely; Lorha, Dogargawa and Kohka, respectively under krishi vigyan Kendra operational area. The area under each demonstration was 0.4 ha. The soil was sandy clay-loam in texture with moderate water holding capacity, low in organic carbon (0.2-0.41%), low in available nitrogen (97.3-142.3 kg/ha), low to medium in available phosphorus (8.2-12.9 kg/ha), low in available potassium (169.7-229.6 kg/ha) and soil pH was slightly acidic to neutral in reaction (6.8-7.2). The treatment comprised of recommended practice (SRI)

vs farmers practice. The rice nursery was grown on *puddled* raised beds of 10mx1.5m with half meter wide irrigation cum drainage channel around the beds. Sprouted seeds of high yielding paddy variety MTU-1081 sown using 5 kg/ha seed rate. The demonstration fields were well prepared by the suitable implements; fields were puddle twice and leveled properly. 12-14 days old seedlings were transplanted singly (one seedling per hill) with the 25cmx25cm spacing using SRI line marker in muddy field. Balance dose of fertilizers (100:60:40 kg NPK/ha was supplied; 25% through organic sources i.e. FYM and remaining 75% through chemical fertilizers i.e. Urea, DAP and MOP) supplied. The demonstration plots were kept moist throughout the vegetative growth by applying light and frequent irrigations, when required. During flowering to milking stage about 2-3 cm standing water was maintained continuously. Pyrazosulfuron @ 25 g a.i./ha as pre emergence was applied at 3-4 days after transplanting (DAT). *Cono weeder* operated at 30, 40 and 50 DAT for the mechanical weed control and increase the soil aeration.

Farmer's practice constituted the application of high seed rate (30 kg/ha), planting of old seedling (30-45 DAS), closer planting, not adopting the line sowing, imbalance and insufficient supply of nutrients (50:30:0 kg NPK/ha), submerged the paddy field throughout the crop season, one hand weeding between 30-40 days after transplanting (DAT) etc. Harvesting and threshing operation done manually; 5mx3m plot harvested in 3 locations in each demonstration and average grain weight taken at 14% moisture. Similar procedure adopted on FP plots under each demonstration then grain weight converted into quintal per hectare (q/ha).

Before conduct the demonstration training to farmers of respective villages was imparted with respect to envisaged technological interventions. All other steps like site selection, farmers selection, layout of demonstration, farmers participation etc were followed as suggested by Choudhary (1999). Visits of farmers and extension functionaries were organized at demonstration plots to disseminate the technology at large scale. Yield data was collected from farmers practice and demonstration plots; cost of cultivation, net income and benefit cost ratio were computed and analyzed.

Results and Discussion

The yield performance and economic indicators are presented in Table 1. The data revealed that under demonstration plot, the performance of paddy yield was found to be higher than that under FP during both the years (2010 and 2011). The yield of paddy under demonstration recorded was 43 and 57.2 q/ha during 2010 and 2011, respectively. The yield enhancement due to technological intervention was to the tune of 77 % and 40% over FP. The cumulative effect of the technological intervention over two years, revealed on average yield of 50.1 q/ha, 53.5% higher over FP. The year to year fluctuations in yield and cost of cultivation can be explained on the basis of variations in prevailing social, economical and prevailing microclimatic condition of that particular village. Mukhargee (2003) has also reported that depending on identification and use of farming situation, specific intervention may have greater implications in enhancing systems productivity. Yield enhancement in different crops in front line demonstration has amply been documented by Haque (2000), Sharma (2003), Gurumukhi and Mishra (2003), Tiwari *et al* (2003) and Tomar *et al* (2003).

Economic indicators i.e. gross expenditure, gross returns, net returns and B:C ratio of front line demonstration are presented in Table 1. The data clearly revealed that the net return from the recommended practice were substantially higher than FP plot during both the years of demonstration. Average net returns from recommended practice were observed to be Rs. 34349/ha in comparison to FP plot i.e. Rs 17571/ha. On an average Rs. 16778/ha as additional income is attributed to the technological intervention provided in demonstration plots i.e. SRI system.

Economic analysis of the yield performance revealed that benefit cost ratio of demonstration plots were observed significantly higher than FP plots. The benefit cost ratio of demonstration and FP plots were 2.67, 2.96 and 1.81, 2.21 during 2010 and 2011,

Table 1: Yield performance and economic indicators of Front Line Demonstration of paddy variety MTU-1081 in SRI system Vs farmers practice

Year	No. of demon-stration	Yield (q/ha)		% increase over FP	Gross expenditure (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		B:C ratio	
		RP	FP		RP	FP	RP	FP	RP	FP	RP	FP
2010	6	43.0	24.28	77	16890	14080	45150	25494	28260	11414	2.67	1.81
2011	8	57.2	41.0	40	20562	19547	61000	43275	40438	23728	2.96	2.21
Average		50.1	32.64	53.5	18726	16813	53075	34385	34349	17571	2.81	2.01

Table 2. HRD component: Cumulative data of 2010 and 2011.

S.No.	HRD components	Frequency	Beneficiries
1.	Trainings		
a	SRI method	7	233
b	INM	2	102
c	IPM	5	193
d	IWM	2	88
2.	Radio talk	2	Mass
3.	CD shows	6	Mass
4.	Kisan mela	4	1578
5.	Kisan sangosthi	10	170
6.	News paper coverage	8	Mass
7.	Folders	1	Mass

respectively. Hence favorable benefit cost ratios proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. The data clearly revealed that the maximum increase in yield and benefit cost ratio was observed during 2011. The variation in benefit cost ratio during both the years may mainly on account of yield performance and input output cost in that particular years.

The result of front line demonstration convincingly brought out that the yield of paddy could be increased higher with the intervention on varietal replacement i.e. MTU-1081 in paddy and SRI system of production in the Umaria district. To safeguard and sustain the food security in India, it is quite important to increase the productivity of rice under limited resources, especially water. Favorable benefit cost ratio is self explanatory of economic viability of the demonstration and convinced the farmers for adoption of SRI system of paddy production. The technology suitable for enhancing the productivity of paddy and calls for conduct of such demonstration under the transfer of technology programme by KVKs.

HRD components

During the study period, Human Resources Development Components i.e. training, radio talk, field day, CD shows, popular articles, training handout, Kisan Mela and Kisan Sangosthi were also taken to increase the farmers understanding and skill about the recommended practice on SRI system of paddy production (Table 2).

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Correlation analysis for seed quality traits in Rice bean (*Vigna umbellata*)

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Abstract

Rice bean is a multipurpose crop with a good potential to be used as food, fodder, green manure and a cover crop under diverse cropping system. Over years several varieties based on their superior agronomic traits have been developed at hill campus, however, no information is yet available on the storability and seed health of each of these varieties. Present study was there fore conducted to generate information on the correlation between the different seed testing methods viz. seed viability, germination and seed vigour.

Key words: Rice bean, viability, germination and vigour.

Introduction

Rice bean is an important multipurpose crop. Its nutritional qualities and diverse adaptation signifies adopting intensive research efforts for improved and sustained crop production. In the recent years Plant breeders at the campus have selected many promising lines of rice bean based on their superior agronomic characteristics and other acceptable traits. Several of these lines are in the advanced varietal testing stage while some have been identified as varieties. No information has however been generated on the seed health and storability of this promising underutilized crop. The present studies were therefore conducted to determine the planting value and seed health of various rice bean varieties developed at hill campus.

Materials and Methods

The present investigation was carried out at the Plant Pathology laboratory and research blocks, G.B. Pant University of Agriculture and Technology, Hill campus, Ranichauri. Seeds of two varieties namely, PRR 8801 and PRR8901 (seeds of five years) were taken from the Plant Pathology department of the university.

The following observations were recorded:

Field studies: For the evaluation of seed germination and seed vigour index, seeds were sown in field for seedling establishment (SET). Percentage was determined after 30 days of sowing and their seedling length were measured in cm.

Laboratory tests: Standard germination test was performed according to Anonymous (3). Using field soils in 9cm diameter plastic pots performed green house germination test. Observations with respect to per cent germination and seedling length were recorded after 30 days of sowing. Using field soil in 9 cm diameter plastic pots performed green house germination test. Observation with respect per cent germination and seedling length were recorded after 30 days of sowing. Accelerated ageing test was used for determination of seed vigour. For that purpose the seed were subjected to 100 per cent relative humidity and 45^0C for 48 hours. Seeds were then removed and germinated by towel paper method as in standard germination and a set of seed samples were placed in soil. The germination was evaluated after 8 days and the values were reported as mean per cent germination of four replication. Using topographical tetrazolium viability test assessed the seed viability. Seed vigour index was calculated by multiplying seed germination per cent x Seedling length (shoot length + root length in cm). The normal seedling from germination test was further clarified as strong and week seedlings by visual observation and seedlings were expressed as percentage. The observation recorded in both the field and laboratory were use to statistical analysis. Simple correlation coefficient for different character was done.

Results and Discussion

Correlation among vigour, viability and germination parameters in varieties PRR 8801 was studied and the coefficients thus obtained are presented in (Table 1 and 2). The results suggested that germination in laboratory (rolled paper towel method) and field germination were not having relationship. A similar result has been reported in Chickpea (6). In variety PRR 8801 green house germination showed positive correlation with seed viability, accelerated ageing (germination on paper towel), germination in field, vigour index, strong seedlings and seedling length. In variety PRR 8901, green house germination showed positive correlation with accelerated ageing

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Table 1: Correlation coefficients (r) for viability, vigour and germination parameters for variety PRR 8801

S.No. Character	2	3	4	5	6	7	8	9	10
1. Paper towel germination (%)	-0.488	0.173	0.005	-0.391	-0.423	-0.468	0.323 *	-0.284	-0.449
2. Green house germination (%)		-0.107	0.282**	0.262	0.546*	0.558*	-0.439	0.468*	0.0461
3. Accelerated ageing (% germination in soil)			-0.094	0.245	0.367*	0.446*	-0.110	0.063	0.484*
4. Accelerated ageing (%Germination on paper towel)				-0.122	-0.024	-0.011	-0.340	0.395*	0.033
5. Tetrazolium test (%)					0.419*	0.513*	-0.358	0.241	0.597*
6. Germination in field (%)						0.969*	-0.048	0.038	0.696*
7. Vigour index							-0.154	0.128	0.850*
8. Weak seedling (%)								-0.982	-0.306
9. Strong seedling (%)									0.255
10. Seedling length (cm)									

Table 2: Correlation coefficients (r) for viability, vigor and germination parameters for variety PRR 8901

S.No. Character	2	3	4	5	6	7	8	9	10
1. Paper towel germination (%)	0.626*	0.040	0.347*	-0.533	-0.200	-0.219	0.508*	-0.508	-0.213
2. Green house germination (%)		0.296*	0.360*	-0.358	-0.071	-0.058	0.185	-0.185	0.024
3. Accelerated ageing (% germination in soil)			0.319*	-0.093	0.139	0.139	-0.154	0.154	0.097
4. Accelerated ageing (%Germination on paper towel)				-0.296	0.132	0.025	0.081	-0.080	-0.169
5. Tetrazolium test (%)					0.344*	0.489*	-0.307	0.308*	0.605*
6. Germination in field (%)						0.962*	-0.142	0.112	0.646*
7. Vigour index							-0.103	0.103	0.816*
8. Weak seedling (%)								-1.00	-0.220
9. Strong seedling (%)									0.221
10. Seedling length (cm)									

(germination in soil as well as germination in paper towel), tetrazolium (TZ) test showed positive correlation with germination in field, vigour index and seedling length in variety PRR 8801 and PRR 8901. In variety PRR 8901, TZ test also showed positive correlation with strong seedlings. Studies in maize, wheat (1) paddy (2) and cotton (7) showed positive correlation between standard germination and TZ test. Vigour index was positively correlated with seedling length in both the varieties, i.e. PRR 8801 and PRR 8901. Seed germination in towel paper indicated only viability of seed but apparently failed to differentiate deterioration levels as was done by use of accelerated ageing. Therefore, the planting value of seed should be evaluated by standard germination test and supplemented by vigour tests. A similar result has been reported among cotton cultivars (5, 8) in red field bean and in mungbean (4).

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