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Effect of green manuring on sustainable productivity and soil fertility

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Abstract

Farmer's Field condition experiments were conducted on an application of green manures deals with increasing the yield with green manure frequency and also increase the status of soil organic carbon, Phosphorus, Potash, and sulphur with decreasing weed incidence and pH towards neutral. The performance of an entire system is evaluated on a researcher- controlled experimental farm under realistic condition at farmer's field. These pilot farmers, who then test and evaluate the system in on- farm testing and then communicate their experiences to other farmers. It shows that effective involvement of farmers can help to determine appropriate criteria for cropping system evaluation, farmer needs, and preferences, improved methods of dissemination, extension and feedback. Such participatory elements can provide improved linkage and overlap between the planning, research, dissemination and adoption- adaptation phases. It was observed that participatory research may be best suited to farmers that have resource limitations restrict the number of whole systems that can be compared with each other and management of such systems often changes continuously, some times conducted within whole-systems studies are important to provide an understanding of specific processes governing GM benefits, farmers make decisions based on multiple criteria that generally change with time and differ between individuals. It appears that the green manuring manage the soil resources not only to meet the goal of stabilized yield but also to protect the land resource base.

Key words: Organic carbon, GM benefits, dissemination, adoption- adaptation

Introduction

In the last few years there have been several meeting and publication dealing with the broad perspectives of sustainable agriculture (Edwards et.al.1998; Singh et al 1990). The basic trust of sustainable agriculture is to improve the quality of life in the contest of environmentally sound approach so that the resource base is maintained or enhanced for future generations. There are frequently additional focuses on sustainability as FAO(1989); define that the "Sustainable agriculture should involve successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources". Similarly, it has been suggested by Agriculture Canada, Baier(1990) that the "Sustainable agriculture system are those that are economically viable to meet society's needs for safe and nutritious food, while conserving the quality of the environment for future generations".

Since the Green Revolution of the 1960's, substantial increases in cereal production have allowed an ongoing rise in world population, which now exceeds 6.5 billion (United Nations,2006).The gain in agricultural productivity has been accomplished with the introduction of modern crop production practices that rely on high- yielding varieties and heavy inputs of fertilizers and pesticides. This approach is solely directed towards maximizing grain yield, without regard to long- term impacts on the soil resource that is crucial for sustainable cereal production. Consequently, a dramatic escalation has occurred in global consumption of synthetic N, from 11.6 Tg in 1961 to 104 Tg in 2006 (FAO, 2009). In many parts of the world, N fertilizer recommendations continue to follow a prescriptive approach using generic models of economic response, often without regard to site-specific variation in crop N requirement (Meisinger et al., 2008). Given the fundamental coupling of microbial C and N cycling, the dominant occurrence of both elements in soil organic forms, and the close correlation between soil C and N mineralization (Dou et al.,2008),the loss of soil organic carbon has serious implications for the storage of soil N. There is good reason for concern about sustaining world food production and to maintain sustainability in soil productivity the present experiment were conducted.

Materials and Methods

Field experiments were conducted at farmer's field for enhancement of productivity in backward productivity adopted village Rajadhani, C.D. Block

potential production help precise the formulation of strategies. The technologies which will be directed to achieve the ends have not only to be physically and environmentally feasible but also economically viable. These will only be adopted if they add positively to the households margin. A suitable indicator showing their economic soundness has to be devised, estimated, quantified and rightly interpreted for the effective adoption of these technologies and their contribution in achieving the goals.

After making available the technologies, socio-economic angles play a crucial role. The scientific operation of technologies and their proper handling depends largely upon socio-economic factors specially awareness level of the farmers. Proper analysis of socio-economic aspect of yield gap will help in disseminating the improved technologies and achieving the desired goals. The study was attempted meeting the broad following objectives :

1. To workout yield gaps over different zones and segregate them into technical and socio-economic components.
2. To point out potential wheat production level.
3. To study economic feasibility of latest wheat production technologies.

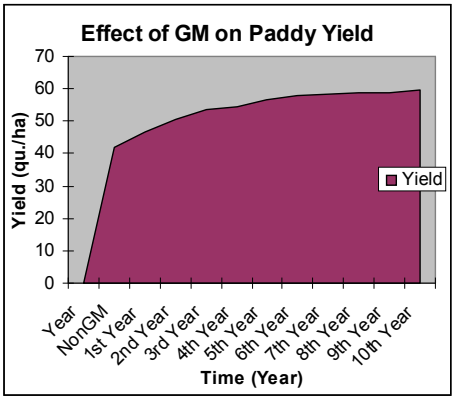
Methodology

The data on yield levels, input use levels, farmers socio-economic profile, details of technology demonstrated, package of practices adopted and prices and costing aspects were collected from coordinating centers conducting frontline demonstrations through mailed questionnaires. Parameters were pooled and averaged for arriving at yield gap and to study its components. For the purpose, the results of on-farm experiments in the form of Frontline Demonstrations (FLDs) conducted during 2000-01 to 2008-09 at 75 coordinating centers were compiled and analyzed. In all 2383 demonstrations were sampled from different agro-ecological wheat producing zones i.e. Northern Hills Zone (NHZ), North Eastern Plains Zone (NEPZ), North Western Plains Zone (NWPZ), Central Zone (CZ), Peninsular Zone (PZ) and Southern Hills Zone (SHZ). For studying comparative economics and their economic feasibility, data were synthesized for the period from 2000-2001 to 2008-09 with respect to 1123 experiments.

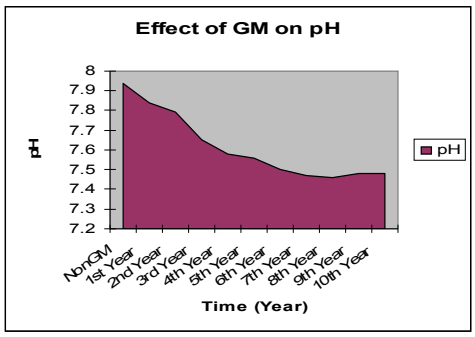
Yield gap is defined as the difference between potential yield and actual yield. The yield gap between experiment station and on-farm experiments can not be managed in farmers' field because it arises from differences in environment. Yield gap between on-farm experiments and actual farm yields is the primary concern of the present study. Which is caused due to biotic, abiotic and socio-economic constraints. On-farm experimentation in the form of Front Line Demonstrations (FLDs) conducted for the purpose of popularizing latest technologies were managed by Brahmpur district Gorakhpur. The experimental soil was sandy loam in texture and contained 142.8 kg/ha available N, 11.6 kg/ha available P and 321.6 kg/ha available K and was slightly alkaline in reaction (pH 7.94). The experiment was laid out in factorial randomized block design with ten (farmer's field) replications . Green manure crop Dhaincha (Sesbania aculeate) were raised during summer season (April to June) for six to eight weeks and ploughed into soil a day before transplanting of paddy in each year from 1994 to 2003 with the treatments consisted of Ten levels of GM i.e. To=Control without GM, T1= one Year GM, T2= Two year GM, T3= Three Year GM, T4= Four Year GM, T5= Five Year GM, T6= Six Year GM, T7= Seven Year GM, T8= Eight Year GM, T9= Nine Year GM and T10= Ten Year GM along with recommended dose of fertilizer (N:P:K 120:60:60 RDF). During 2nd onwards up to ten years, the experiments were repeated with raising of GM crops and paddy as the test crop keeping the same experiments and treatments as followed during first year at same site. Soil samples were collected after green manuring from each treatments and analyzed with conventional method (Jaction, 1967). Half of N, full P and K was applied at the time of sowing and remaining N was top dressed at till ring and flowering stage with a uniform. Paddy crop was harvested in first and second week of October in each year. For dry matter accumulation and partitioning, plant were harvested from 01m row length from three places in second row on either side in each plot. Plant parts were sun dried separately, till a constant weight was obtained. Spike weight before its emergence was added to the shoot dry weight and peduncle was considered as shoot and was added to the shoot dry weight (Bauer et al., 1987)

Result and Discussion

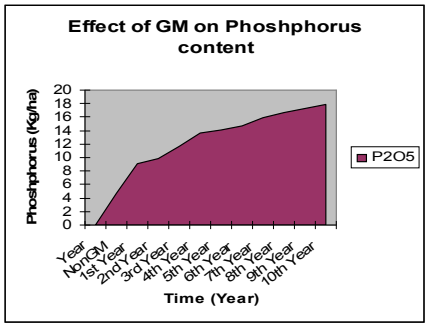
Irrespective, application of Green Manure in combination with RDF (T-10) recorded significantly more dry matter accumulation in different plant parts then rest of the treatments over control followed by T.9. Dry matter in panicle increased rapidly from 120 DAS to harvest. After ear emergence, near all the photosynthesis appear to translocation at head. The



contribution of panicle to total 60%, where as the contribution of stem and leaf are 32% and 8%, respectively. The dry matter accumulation increased progressively with advancement of crop age and frequency of GM. The result showed significant response of GM on growth and productivity of Paddy (Table-1). Frequency of GM caused considerable increase in plant height over all the treatments. Till ring enhanced significantly due to application of GM, when the crop received high frequency continuous 10th year GM (T10) than other treatments. Similar trend of results also observed in case of yield components of paddy i.e. Penicle/m2, grain/ Panicle and 1000 grain weight (g) increase significantly when the crop received. Accordingly, the highest grain yield were recorded when the crop received high frequency continuous 10th year GM (T10). From the above results it may be stated that the use of GM is beneficial in improving the growth and productivity of Paddy along with reducing the weed incidence in paddy field.



It considered as the solution for sustainability in productivity. The question arises whether green manuring can sustain the crop yield. It appears from the data presented in Table-1 and experience of several persons in Maharastra and elsewhere that natural farming and organic fertilization can sustain soil properties and favorable conditions for sustained crop production.



Several parameters are involved in sustainable productivity presented in Table-2 reveals that the pH of the soils are decreasing towards neutral from 7.94 to 7.48. These result also corroborate the earlier observation (Deve et al.,1970; Fabry, 1963 and Hesse,1992).The application of green manuring frequency also seems to be in increasing order of SOC, Phosphorus, Potash and S. The use of GM eliminated a major constant with respect to enriching the soil stock of organic carbon & N and was therefore assumed to contribute to the maintenance of soil fertility for sustained agriculture productivity. During residue decomposition, mineral N is immobilized for the synthesis of biomass, producing a labile pool of organic N and other nutrients that exists in equilibrium with a larger and more stable pool associated with humus (Jonsson, 1958; Mc Gill et al.,1981 and Sarawad et al.,2001). This equilibrium is shifted towards immobilization (assimilation) by increasing the input of C relative to N and towards mineralization (decomposition) by increasing the input of N (RDF) relative to C. The ultimate effect in the latter case is a net loss of organic N through profile transport of dissolved organic N (Murphy et al.,2000 and Van

Table 1: Effect of GM on growth and productivity of Paddy Variety Sarju-52

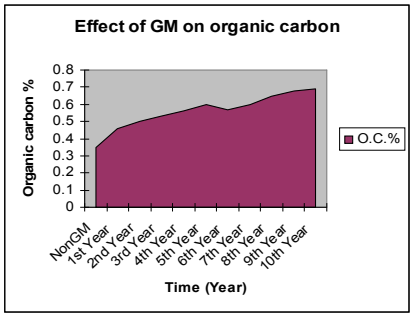
Treatment	Weed/ M^2	Plant height (cm)	Effective Tiller/m^2	Panicle length (cm)	Grain/Panicle (No.)	1000- Grain weight (g)	Yield (Tones/ha)
To	68	75.60	167	18.9	76	19.8	4.19
T1	65	77.46	204	19.4	81	20.1	4.68
T2	63	85.50	283	20.8	87	20.4	5.04
T3	60	86.53	260	20.9	89	20.7	5.36
T4	53	087.56	259	21.3	91	21.2	5.44
T5	46	88.60	305	21.3	93	21.1	5.67
T6	34	88.57	373	21.4	91	21.6	5.81
T7	24	89.60	385	21.7	95	21.9	5.83
T8	17	88.65	371	21.6	97	22.3	5.86
T9	13	89.68	432	21.9	99	22.7	5.89
T10	12	90.69	491	23.1	99	22.9	5.95
STDEV_+	22.04	5.02	98.59	1.15	7.27	1.05	0.58

Table 2: Effect of with and without GM on Physico-chemical properties of soil

Treatment	pH	O.C. (%)	P_2O_5 Kg/ha)	K_2O (Kg/ha)	Sulphur (Kg/ha)
To-Without GM	7.94	0.35	4.67	84.54	8.89
T1-1st Year GM	7.84	0.46	9.04	91.85	9.33
T2-2nd Year GM	7.79	0.50	9.83	99.39	11.84
T3-3rd Year GM	7.65	0.53	11.60	102.25	12.68
T4-4th Year GM	7.58	0.56	13.59	115.40	13.98
T5-5th Year GM	7.56	0.60	14.05	122.33	14.63
T6-6th Year GM	7.50	0.57	14.73	125.40	14.97
T7-7th Year GM	7.47	0.60	15.85	135.33	16.45
T8-8th Year GM	7.46	0.65	16.71	141.21	18.67
T9-9th Year GM	7.48	0.68	17.32	146.04	22.07
T10-10th Year GM	7.48	0.69	17.91	151.76	39.25
STDEV-+	0.170	0.101	4.071	22.839	8.432

Kessel et al., 2009) or through crop uptake, or denitrification of NO_3.

It is also questionable that organic carbon in tropics soil reverts back to its original status even after addition of huge amount of organic matter needs continuous application. Because during decomposition of these organic matter number of changes, that occur, appear to improve soil structure, several physical parameters coupled with improved nutrient status and increase soil fertility (Varade,1992). Although use of GM is routinely created for its ability to increase soil organic matter (SOM) and microbial biomass pools, the actual extent of such changes depends on management and environment as well as GM biomass accumulation. Additionally, the annual contribution of GM residues may be relatively small compared with preexisting SOM pools, especially after residue losses following decomposition. The practical effects of such SOM increases may be relatively small; however, larger increases in SOM may be limited by the short-term nature of these studies (2 to 5 years) or from the use of management approaches that do not obtain high biomass accumulation from GM. In present investigation the soil organic carbon was increases from 0.35 to 0.65% after 10 years in sandy loam soil. Organic matter and microbial biomass in fine –textured soils may, therefore, show grater and more rapid response potential to GM approaches. Similar experiments was conducted by Goyal et.al.(1992, 1999) after roughly 10 years on a low organic matter (>0.40-0.50% organic carbon), sandy loam (65-69% sand) found combinations of inorganic fertilizer and organic amendments (wheat straw, animal manure, or sesbania (GM) generally increased soil organic carbon, total N, microbial biomass C and enzyme activity more than inorganic fertilizer alone in the top 15 cm of soil. Especially in hot, humid, sandy environments, may require greater or more consistent addition of residue under conventional tillage.



Nitrogen release from plant residues on a large number of interactive factors including chemical composition, N concentration, temperature and water availability (Andren et. al., 1992 and Schomberg et. al., 1994). Some researchers have found N- substitution values for GM in excess of actual GM N accumulation, suggesting that GM N is some times taken up more efficiently than chemical fertilizer N or that GM modifies the soil environment, crop growth, or both such that greater crop N uptake is possible (Prasad et. al., 2002). The quality of residue through proper selection of GM or GM mixtures, plant population, tillage, biomass quantity and timing may better synchronize leguminous GM- N release with subsequent crop demand. If GM does not supply adequate N to meet the requirement of subsequent crops, then supplementary inorganic N may be required to prevent yield reductions.

Present investigation was planed with suitable pilot farmer participation as well as whole system evaluation with 10 farmers initially. The performance of an entire system is evaluated on a researcher-controlled experimental farm under realistic condition at farmer's field. These pilot farmers, who then test

and evaluate the system in on- farm testing and then communicate their experiences to other farmers and adoption was move to whole village and presently they don't grow paddy without GM. It shows that effective involvement of farmers can help to determine appropriate criteria for cropping system evaluation, farmer needs, and preferences, improved methods of dissemination, extension and feedback. Such participatory elements can provide improved linkage and overlap between the planning, research, dissemination and adoption- adaptation phases. It was observed that participatory research may be best suited to farmers that have resource limitations restrict the number of whole systems that can be compared with each other and management of such systems often changes continuously, sometimes conducted within whole-systems studies are important to provide an understanding of specific processes governing GM benefits, farmers make decisions based on multiple criteria that generally change with time and differ between individuals.

Green manure- based systems may provide alternatives to current approaches to crop production; however, the use of GM may not be economically justified without the provision of multiple services such as nutrient supply, weed control and improvement of soil properties for sustainable crop production. GM based systems requires critical and systematic assessment of the interactions between the GM, the environment, sustainability and management. A holistic approach for soil management in relation to productivity is necessary. These experiments will have to be converted into a package that the farmer can use without difficulty.

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Fertility & Nutrient Status of Bt Cotton Growing Soils in Kurnool District, Andhra Pradesh

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Abstract

A survey was undertaken to delineate the nutrient status in Bt cotton growing soils in Kurnool district of Andhra Pradesh. The analysis of the soils revealed that the texture of the soils varied from sandy clay loam to clay, neutral to strongly alkaline in reaction, non-saline, medium to high in organic carbon, medium in available nitrogen and high in available P and K. The available Ca, Mg, S, Fe, Mn, Zn Cu and B were found to be above their respective critical limits in all the soils. However, 53.33 per cent samples were deficient in available B in Alfisols .

Key words: Bt cotton soils, soil orders, Macronutrients, Micronutrient

Introduction

Cotton (Gossypium spp), the queen of fibres or white gold, enjoys a predominant

position amongst cash crops in India and world as well. Cotton is an important raw material for the Indian textile industry contributing about 65 per cent of its requirements. The Indian textile industry occupies a significant place in the Indian economy with over 1500 mills, 1.7 million power looms, and thousands of garments, hosiery and processing units, providing an

employment directly or indirectly to around 35 million people. Commercial cultivation of Bt cotton in India began in 2002-03 with 3 hybrids viz., MECH 12Bt, MECH 162Bt and MECH 18Bt (APCoAB, 2006).

In India, it is grown to an extent of 69.0 lakh ha^{-1} with a production of 290.0 lakh bales in the year of 2008-2009, (Narayanan and Phundan Singh, 2009) while in Andhra Pradesh, 91 per cent of area is under Bt cotton.

Soil test based fertilizer application is still a rare practice in this area. Hence, there is a wide variation in fertilizer application by farmers. This leads to either excess or deficiency of the nutrient which might result in nutrient imbalances in the soil. As a consequence, the seed cotton yield would be lower than their yield potential. To stabilise the yields of cotton and economy of cotton production, balanced nutrition is essential. Keeping the above aspects in view, the present survey was taken up to delineate the nutrient status in Bt cotton growing soils in Kurnool district of Andhra Pradesh.

Materials and Methods

The survey area in Kurnool district of Andhra Pradesh is located at the East longitude of 76°.58' and 79°.34 ,' North latitude of 14°.54' and 16°.18' on eastern side of peninsular India.

About 90 soil samples were collected from the cultivator's fields at flowering stage (60 DAS). The main aim of collecting soil samples at flowering period is with a view that the crop absorbed most of the applied nutrients by that time. Soil samples were collected at two different depths *i.e* 0-15 cm and 15-30 cm, by covering six locations in the field and mixed thoroughly and pooled as one sample (0-30 cm). The samples were air dried and pounded with a wooden hammer and passed through 2 mm sieve and used for particle size distribution. Based on the status report 1986, scarce rainfall zone, the soils were identified in to three predominant orders *viz,* Alfisols, Inceptisols and Vertisols. From each of the three orders, 30 holdings were selected from which the soil samples were collected at flowering stage (60 DAS). All the 90 soil samples were analysed for pH, EC, organic carbon, available N, available P and available K as per the standard procedures (Jackson, 1973).

Results and Discussion

The soil texture in the Bt cotton growing soils varied from sandy clay loam to clay. Further, the texture in Alfisols, Inceptisols and Vertisols varied from sandy clay loam to sandy clay, sandy clay to clay and clay loam to clay (Table 1). This variation in soil texture might be due to the variation in topographic position, nature of parent material, *in situ* weathering of clay

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Table 1: Soil test summary - soil texture, pH, E. C and organic carbon (mean values) in Bt cotton grown soils

S. No.	Soil orders	No. of samples	Soil texture	PH (1:2.5)	E.C(dSm^{-1})	Organic carbon(%)
1.	Alfisols	30	scl-sc	7.16	0.30	0.64
2.	Inceptisols	30	sc-cl	7.78	0.35	0.81
3.	Vertisols	30	cl-c	8.26	0.31	0.70
4.	Overall	30	scl-c	7.73	0.32	0.71

scl: sandy clay loam, sc: sandy clay, cl: clay loam, c: clay.

Table 2: Soil test summary - available N, P and K in Bt cotton grown soils

S. No.	Soil orders	No. of samples	Available N			Available P			Available K		
			Mean (kg ha^{-1})	Nutrient index	Fertility status	Mean (kg ha^{-1})	Nutrient Index	Fertility status	Mean (kg ha^{-1})	Nutrient Index	Fertility status
1.	Alfisols	30	399	2.00	M	39.92	3.00	H	438	2.96	H
2.	Inceptisols	30	379	1.93	M	36.24	2.96	H	516	3.00	H
3.	Vertisols	30	488	2.03	M	38.31	2.96	H	700	3.00	H

L: Low, M: Medium, H: High

and age of soils. Similar results were reported by Srinivas *et al.,*(1998) in cotton grown soils of Guntur district. The mean values of pH in Alfisols, Inceptisols and Vertisols were 7.16, 7.78 and 8.26, respectively. The variation in pH in different soil orders might be attributed to the variation in nature of parent material and degree of weathering. Similar findings were reported by Narayana *et al.,* (2009). The soils were non-saline with EC values varying between 0.31 and 0.36 dSm^{-1} in different soil orders. The organic carbon content in these soil orders ranged from 0.64 to 0.81 per cent.

Available N, P, K, Ca, Mg and S

The Bt cotton growing soils were medium in available N with overall nutrient index values ranging from 1.93 to 2.03 while available P and K were high with overall nutrient index values varying from 2.96 to 3.00 (Table2). The medium available nitrogen status in these soils might be attributed to medium to high organic carbon content. The higher values of K could be attributed to more intense weathering, release of K from organic residues, application of K fertilizers and upward translocation of potassium from lower depth along the capillary raise of ground water. These findings were in agreement with the findings of Vara Prasad *et al.,* (2008).

The mean available Ca in Alfisols, Inceptisols and Vertisols was 8.34, 8.18 and 12.94 cmol (p+) kg^{-1}, respectively. The mean available Mg content in Alfisols, was 3.81 cmol (p+) kg^{-1}, in Inceptisols it was 3.15 cmol (p+) kg^{-1} and in Vertisols it was 5.16 cmol (p+) kg^{-1}. The mean available S in Alfisols, Inceptisols and Vertisols was 26.89, 26.48 and 26.40 mg kg^{-1}, respectively.

Available Fe, Mn, Zn and Cu

The mean values of DTPA extractable Fe, Mn, Zn, Cu, and B in Bt cotton grown in Alfisols were 7.11, 6.79, 1.42, 0.78 and 0.53 mg kg^{-1}, respectively while in Inceptisols were 6.79, 5.27, 1.35,0.72 and 0.60 mg kg^{-1}, respectively and in the Vertisols were 6.98, 5.37, 1.43,0.69 and 0.92 mg kg^{-1}, respectively (Table 3). All the available micronutrients except boron were above their respective critical limits but, 53.33 percent of the samples were found to be deficient in available boron in Alfisols. These observations were in

Table 3: Soil test summary – available Ca, Mg, S, Fe, Mn, Zn, Cu and B in Bt cotton grown soils

S. No.	Soil orders	No. of samples	Available secondary nutrients			Available micronutrients (mg kg^{-1})				
			Ca (cmol (p+) kg^{-1})	Mg (cmol (p+) kg^{-1})	S (mg kg^{-1})	Fe	Mn	Zn	Cu	B
1.	Alfisols	30	8.34	3.81	26.89	7.11	5.42	1.42	0.78	0.53
2.	Inceptisols	30	8.18	3.15	26.48	6.79	5.27	1.35	0.72	0.60
3.	Vertisols	30	12.94	5.16	26.40	6.98	5.37	1.43	0.69	0.92

agreement with findings of Giridhar *et al.,* (1998) in Alfisols, Inceptisols and Vertisols of Komarole region of Andhra Pradesh.

Conclusion

In general the nutrients concentration does not differe much among the orders. Further all the nutrients are medium to high in all the three orders. The organic carbon is low in Alfisols as compared to other orders. Hence, judicious application of organic manures along with recommended doses of nutrients not only sustains the productivity of Bt cottons growing soils but also increases the Bt cotton yields.

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Transgenics: Challenges and Achievements

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Abstract

Global strategy is to blend and amalgamate the approaches of conventional crop improvement and modern biotechnology to capitalize on full potential to address the problems of poverty, malnutrition and hunger mainly by increasing productivity and cutting cost of production besides other benefits, mainly in developing countries. The government has given due importance to transgenics but with strict care after having comparative assessment of risks and benefits. All stakeholders of the technology have to work in unison to harness true potential of transgenics to meet social and commercial interests of the country.

Key words:- Transgenics and challenges

Introduction

The world population touched an important milestone of seven billion living persons in 2011. To feed the population growing at this pace, we need at least seventy percent more food by 2050. In next 50 years mankind will consume twice as much food as mankind has consumed since the beginning of agriculture 10,000 years ago. Economists believe that ingenuity could be embedded into technology in overcoming the challenges of food deficits. Biologists have empirically shown that technology can be embedded in seed. After Green Revolution, introduction of transgenic hybrid cotton in India is the landmark in the annals of agricultural research and developmental strides the country has treated (Ramasundaram *et.al*. 2012).

Poverty and hunger are inseparably linked and today afflict approximately one billion people in the world, mainly in the developing countries. Nearly half of the world's poor are small resource-poor farmers, whilst another one fifth are the rural landless whose livelihoods are completely dependent on agriculture. So nearly seventy percent of the world's poor are dependent on agriculture. Adoption of transgenic cotton has made significant contribution to the income of million small resource-poor farmers in developing countries such as China, India, Pakistan, Myanmar, Bolivia, Burkina Faso and South Africa (Gao and Feng, 2010; Laibuni *et al*, 2012).

Conventional agriculture is one of the major contributors of green house gases. Transgenics can be used to reduce the environmental footprint of agriculture. Growing Transgenics has lead to significant reduction in pesticides application, fossil fuel usage, decreased CO2 emissions through no/ less ploughing. This has also led to conservation of moisture and soil by optimizing the practice of no till through application of herbicide tolerance. Increasing efficiency of water usage will have a major impact on conservation and availability of water in near future. Seventy percent of fresh water is currently used by agriculture and this resource will become scarce in times to come (The Economists, 2008; FAO, 2007; GoI, 2011). Transgenics with improved tolerance to drought will prove beneficial in giving good yield even under water limiting conditions.

Agriculture and human well-being will be negatively affected by climate change, particularly in the developing countries as has been highlighted by IFPRI study. Droughts, floods and temperature changes are predicted to become more prevalent and more severe as we face the new challenges associated with climate change. So there is a need for dedicated crop improvement programs to develop varieties and hybrids that are well adapted to rapid changes in climatic conditions. IFPRI estimated that almost forty percent of the world population rely on agriculture for their livelihood and are likely be the most severely affected (IFPRI, 2009). Indeed, the effect of climate change on world agriculture will depend not only on altered climate conditions, but on ability and resilience of the agricultural sector and the speed with which it can adapt and develop new and improved crops to deal with opportunities and threats posed by changed climatic conditions. Several molecular biology tools, including molecular marker-assisted selection (MAS), tissue culture, genomics, and transgenic crops are used collectively for 'speeding the breeding' and help mitigate the effects of climate change on crop productivity. Transgenic crops are capable of increasing productivity and income and can serve as an engine of rural economic growth. The

environmentalists in general have opposed transgenic crops. The climate change specialists, who agree that cutting CO_2 levels is the only remedy to avoid a future catastrophe, have been supportive of biotech crops. In this backdrop, it becomes essential to analyse (i) the extent of commercialization of transgenic crops; and (ii) to estimate the pace of penetration of technology in the landscape of Indian cotton scenario.

Materials and Methods

Meta- analysis technique was used to discern the pattern and extent of commercialization of cotton, Compound growth rate (CGR) was used to compute the pace of penetration of technology in the landscape of cotton production scenario. The formula for CGR is:-

$Y=a.b^t$

Where, Y = area /production/productivity; t = time variable in years; a = Intercept indicating Y in the base period (t=0), b = Regression coefficient

as log Y= log a + log b

The CGR has been calculated as: CGR (%)=(Anti log b-1) x 100

Coefficient of variation (C.V.) was used to ascertain the extent of reduction in variation (risk) in yield of transgenic cotton. The formula for C.V. = Standard deviation/Mean

Results and Discussion

Commercialization of transgenic crops

China was the first country to commercialize transgenic crops in the early 1990s. The first approval for commercial sale of a genetically modified product for food use was in the United States in 1994 when Calgene marketed its delayed ripening tomato Flavr-Savr. Since then, the number of countries growing transgenic crops has increased from one to twenty nine. Global acreage of transgenic crops increased from 1.7 million ha in 1996 to 160 million hectare in 2011 (James, 2011). A 94-fold increase in acreage makes transgenic crops the fastest adopted crop technology in the history of modern agriculture. Farmers across the world elected/decided to adopt transgenics due to the benefits they offer. The only reason that explains the trust and confidence of risk-averse farmers in transgenics is because they deliver substantial, sustainable and socio-economical benefits.

Realising their potential in alleviating poverty and hunger and ensuring sustainable benefits even to small farmers a number of countries have adopted/ decided to grow/ import transgenics. Biotech cotton was first transgenic plant to be commercialized. Insect resistant cotton, featuring Bt genes and herbicide tolerant cotton were amongst the first products to be commercialized. Their impact has been substantial in all the countries where they have been commercialized, growing from less than one million hectares globally in 1996 to ~25 million hectares in 2011 (James, 2011).

Insect resistant Bt cotton has been grown on a larger area, compared with the stacked product and herbicide tolerant cotton. Bt cotton has been the major contributor to adoption and growth of transgenics, however, it is the stacked traits of insect resistance (Bt) and herbicide tolerance traits that are coming up now. Bt cotton has changed the pattern of cotton production in India. We completed a decade of successful cultivation of Bt cotton in 2011. Phenomenal success has been achieved in transforming the cotton crop into the most productive and profitable crop in the country. India's Bt cottons are unique in that they are hybrids and not varieties, as used by all other countries. Bt cotton in India surpassed the historical milestone of ten million hectares. The principal beneficiaries were seven million farmers growing, on an average, 1.5 hectares of cotton. There has been nearly 200 fold increase in acreage of Bt cotton in last ten years (Guillame and Sun, 2012). Thus, Bt cotton has transformed cotton production in India by increasing yield substantially, decreasing insecticide applications by half. This has led to alleviation of poverty of a number of small resource-poor farmers. This technology has cut cost of production and increased farm income substantially which results in significant net increase in gross margins. (Table 1).

Table 1: Gains from adoption of Bt cotton in India, 2002-2010

Year	Cost change (US$/ha)	Net increase in gross margins (US$/ha)	Increase in farm income (US$ million)
2002	-12.4	82.7	3.7
2003	-16.2	209.9	21.0
2004	-13.6	193.4	96.7
2005	-22.3	256.0	332.7
2006	3.5	221.0	839.9
2007	26.4	356.9	2094.0
2008	24.3	256.7	1790.2
2009	22.2	211.2	1755.0
2010	23.1	265.8	2498.5

Source: Brookes and Barfoot (2012)

Area, Production and Yield of Cotton in India

Figure 1 shows that India has achieved significant progress in cotton cultivation on all the three fronts– area, production and yield. The average yield of cotton in India, which used to have one of the lowest yields in the world, increased from 308 kg per hectare in 2001-02, to 521 kg per hectare in 2006-07 with 50% or more of the increase in yield, attributed to Bt cotton. This sustained high cotton yield of around 500 kg per hectare was achieved despite significant increases in cotton hectarage. Thus, at a national level, Bt cotton is a major factor contributing to higher cotton production which

increased from 15.8 million bales in 2001-02, to 28 million bales in 2005-06, to 34.51 million bales in 2011-12, which was a record cotton crop for India (Cotton Advisory Board, 2012).

Compound Growth Rate:

A comparison of the all India compound growth rates data of the Department of Economics and Statistics, Ministry of Agriculture - for area, production and yield of cotton during 1991-2000 with those for the period 2001-2010 (Figure 2) is indicative of the fact that during past decade, the improvement in production and productivity seems to be the result of dissemination and adoption of improved technologies as there was practically very little increase in the cotton area.

One of the main objectives of agricultural policies and technologies in low-income countries is to improve the well-being of the poor households which is possible only when there is stable agricultural incomes through new crop varieties that enhance productivity and reduce yield variability under different conditions. While past research has focused almost exclusively on benefits generated by expected mean yield increases, the present study also estimates the benefits of yield variance reductions as measured by risk reduction to producers and consumers. Such variance reductions are often the main goal of agricultural research. In case of cotton, a state wise analysis of data shows that apart from Madhya Pradesh and Tamil Nadu yield growth is accelerating. Our results (Table 2 and Figure 3) also show a consistently falling trend in yield variability across all the states which is an encouraging outcome.

Adoption of Bt cotton in India

The Government of India through Genetic Engineering Approval Committee (GEAC), Ministry of Environment and Forests considered the proposal for the commercial release of Bt cotton in its meeting held on 26th March, 2002 and after careful and in-depth consideration, accorded approval for release. Initially it was approved only for the Central (Gujarat,Maharashtra & Madhya Pradesh and South zone states (Tamil Nadu, Andhra Pradesh & Karnataka). GEAC has approved the commercial cultivation of Bt cotton in North Zone from the year 2005-06.

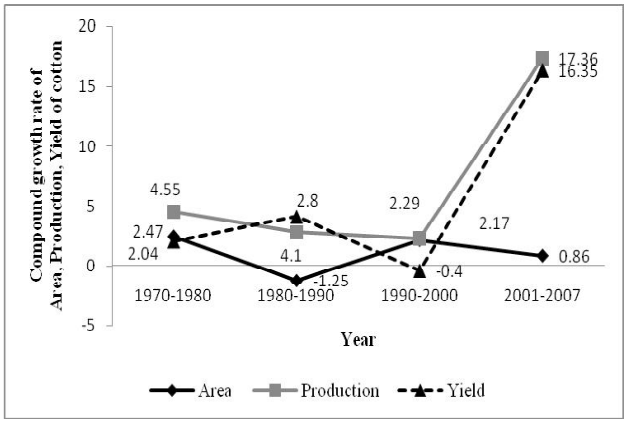


Figure 2: All India compound growth rates for area, production and yield of cotton

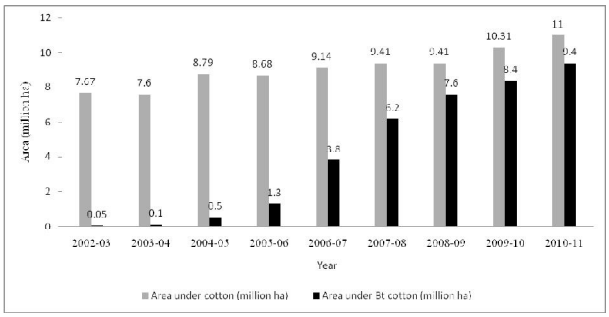
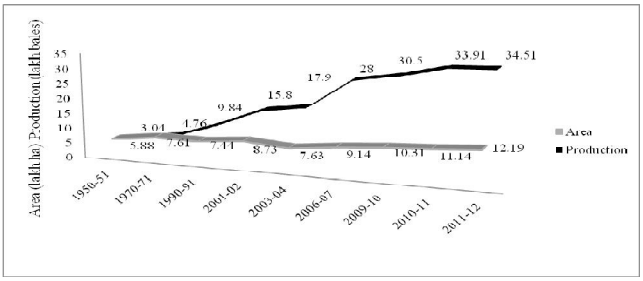


Figure 3: Adoption of Bt cotton in India

The area occupied by Bt cotton hybrids in 2002-03, the first year of commercialization, was 50,000 hectares. It increased significantly every single year and reached 9.4 million hectares in 2010-11, an impressive 188-fold increase in eight years, occupying 86% of 11 million hectares under cotton cultivation in 2010-11 (Figure 3). Bt cotton area coverage is 91% in A.P., 64% in Tamil Nadu and 10% in Karnataka contributing 69% of the total Bt area by South Zone. Similarly in Central zone 71% in M.P. 81% in Maharashtra and 52% in Gujarat are under Bt hybrids and occupying 69% of total Bt area. North zone contributes 59% of total Bt area having highest in Punjab 85%, Haryana 53% and Rajasthan 10%. The Bt adoption was very less in Karnataka & Rajasthan i.e 10% only. Similarly, the number of farmers who



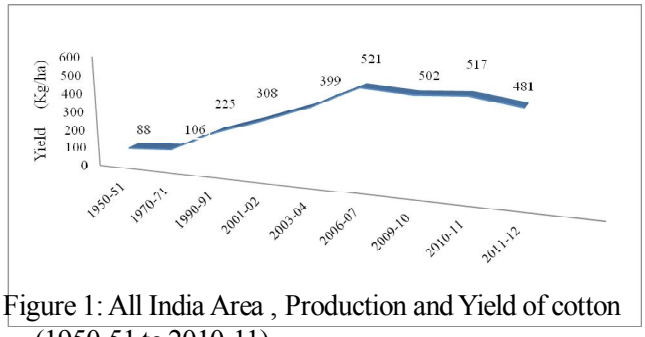


Figure 1: All India Area , Production and Yield of cotton (1950-51 to 2010-11)

Table 2: Growth and variability in cotton yield in different cotton growing states of India

States	Annual growth rate in yield (%)		Coefficient of Variation in yield (%)			Probability of Yield falling>10% below the trend yield (%)	
	1980-2003	2003-2011	1980-2003	2003-2011 (Composite data)	2003-2011 (Bt cotton only)	1980-2003	2003-2011
Andhra Pradesh	3.96	8.5	23.40	11.29	7.58	33.36	18.67
Gujarat	4.74	22.75	21.82	12.69	14.34	32.28	21.48
Haryana	-3.70	14.88	16.72	8.99	12.06	27.43	13.35
Karnataka	4.78	12.38	19.87	14.56	14.23	30.85	24.51
Madhya Pradesh	20.04	-4	21.56	6.25	4.74	32.28	5.48
Maharashtra	2.35	19.38	22.02	11.82	15.80	32.64	19.77
Punjab	-2.09	15.5	21.75	17.47	18.80	32.28	28.43
Rajasthan	0.52	8.63	17.13	3.92	6.78	28.10	0.54
Tamil Nadu	16.3	9.38	12.84	6.67	8.64	21.77	6.68

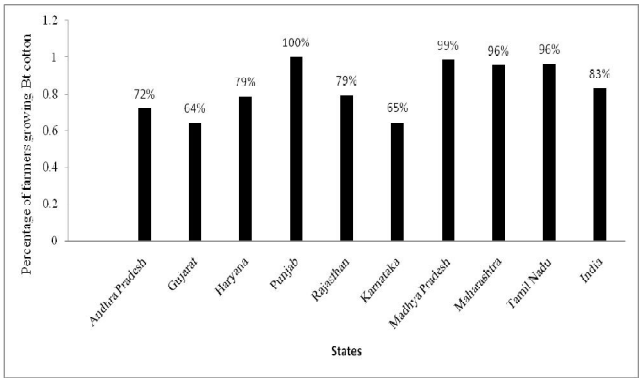


Figure 4: Percentage of farmers growing Bt cotton in different states of India in 2010-11.

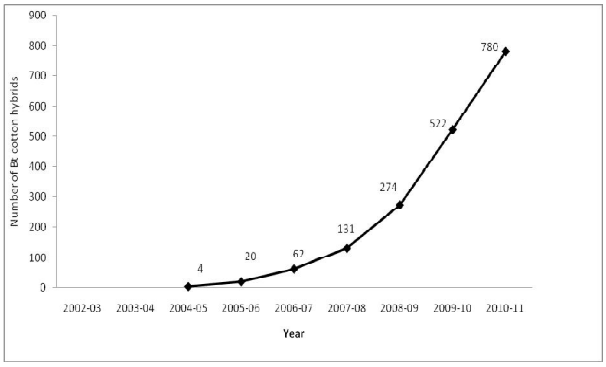


Figure 5: Number of Bt cotton hybrids

planted Bt cotton also consistently increased from a few thousands in 2002 to a record of 6. 3 million farmers – a significant percentage of whom are small and resource-poor farmers. The figure below (Figure 4) shows the percentage of cotton farmers growing Bt and non Bt cotton in different states of India.

Approval of Events and Bt Cotton Hybrids in India

By 2009, 34 private sector seed companies were engaged in the production of Bt cotton, involving 522 Bt cotton hybrids (including one variety). The number of events, as well as the number of Bt cotton hybrids and companies marketing approved hybrids have all increased significantly from 2002, the first year of commercialization of Bt cotton in India. As seen in Figure 5, by 2010, the number of Bt cotton hybrids has increased substantially to 780 introductions (779 hybrids and one variety).

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Biomass recycling and integrated nutrient manangement in banana-a farmer participatory research in Kollam, Kerala

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Abstract

The need for reducing chemical usage in banana necessitated an on farm testing programme on integrated nutrient management in Nendran banana during 2009-10 in farmers' field in Kollam district. The trial to assess the effectiveness of organic wastes composted using earthworms, enriched with chemical fertilizers at 50% substitution and using biofertilisers on the growth and performance of Nendran in farmers' fields revealed highest yields and returns in the fields where chemical source of N was used for enrichment (20.2 t/ha) and significantly superior to biofertilisers (13.2 t/ha). The results of the trial projects the need for integration of nutrient sources for higher yields in banana and the responses of the farmers reveal their acceptance of the technology of vermicomposting as an ideal method of disposal and recycling of organic wastes.

Key words : Recycling, enrichment, vermicompost, integration

Introduction

Banana is one of the most remunerative crops preferred by farmers for cultivation both in the uplands and lowlands. Nendran banana is an integral component in the banana fields on account of its market preference. It is the assumption among the farmers that due to the long duration of the crop, large quantity of fertilizers are to be applied during the different growth phases. The farmers' practice is to apply complex fertilizers six to seven times in soil at the expense of organic manures and this is followed by application of ammonium sulphate in sachets to the tip of the bunches to increase bunch size. Heavy use of pesticides is also common. However, the increasing awareness among the consumers about the chemical hazards has urged the farmers to adopt use of safer and ecofriendly alternatives to these inputs. The enormous of organic wastes available after harvest in the form of pseudostems, leaves, bunch peduncle and rhizomes (20-30 kg/ plant) offers scope for recycling and use in the subsequent crop. Keeping this in view an attempt on the evaluation of recycled banana wastes as a source of manure for the successive crop was initiated as a field testing programme in Kollam district.

Materials and methods

The on farm testing programme was conducted in farmers' fields during 2009-10. Vermicompost units were set up and weighed quantities of the biomass available after the harvest of the bunches were composted using *Eisenia foetida* earthworms. Biowastes were mixed with FYM in the ratio 8:1 in the cemented rings and the final compost was enriched with different nutrient sources which were then evaluated for its nutrient value and applied for the succeeding crop of banana. The treatments were T1: Vermicompost enriched with urea, (10 kg/ plant) T2: Vermicompost enriched with N and P biofertilisers and rock phosphate (10 kg/ plant), T3: farmer's practice of applying pseudostems in basins and complex fertilisers. Phosphorus and potassium were applied as chemicals supplementing that were made available through the organic manures

The prepared enriched compost were applied as per the treatments fixed and the response was evaluated in the trial modifying the nitrogen recommendations according to the nitrogen contents in the organic source. Planting and other management practices were followed as per the package of practices recommendations. The crop was ready for harvest during October 2010. The data were analysed using statistical procedures with the farmers fields' serving as replications.

The trial also explored the feed back of the participating farmers to the technology of organic recycling in banana and recorded the response of a sample of 32 farmers visiting the trial fields during the different stages of growth and field days.

Results and Discussion

The observations recorded showed that the growth performance and yields were highest for the treatments in which chemical organic integration was

Table 1: Growth and yield parameters of Nendran banana

Treatments	Height at harvest (cm)	No. of hands/ bunch	No.of fingers/ hand	Bunch weight/ plt (kg)	Yield t/ha	BC
T1	305	5.0	49.7	8.7	20.2	2.17
T2	275	4.5	41.0	5.6	13.2	1.06
T3 (Farmer's practice)	290	5.0	46.3	8.0	18.8	2.06
CD	ns	ns	13.030	0.522	2.680	0.023

adopted (T1) compared to enrichment with rock phosphate and N and P biofertilisers. Significantly superior values are recorded with respect to the number of fingers and bunch weight which contributed to the significantly higher yields in the combined application. This could be attributed to the better availability of nutrients from both sources, especially in the early stages of growth, while in plants fertilized with the biofertiliser enriched compost, an initial stress would have occurred on account of the lower contents in the compost. Banana is a heavy feeder of nutrients and a steady supply of nutrients right from planting to bunch maturity is essential to produce large and good quality bunches (Shehana and Abraham, 2002). Integrated nutrient management is beneficial for nutrient supply to an optimum level for sustained crop productivity. Bhalerao etal.(2009) reported that in Grand Naine TC banana application of 100 % recommended dose of NPK with 10 kg FYM per plant and biofertiIizers *(Azosprillum* and PSB @ 25 g per plant each) were found beneficial in terms of banana yield and monetory returns, which was followed by application of 50 % NPK through organic (FYM + Green manure) and 50 % NPK through inorganic and biofertiIizers. In his study Ziauddin (2009) recorded that integration of organic and inorganic fertilizer was more effective than the inorganic fertilizers alone. Field trials on compost enrichment and application in bhindi revealed results of chemical fertilizer enrichment of vermicompost to be the best (Isaac et al.,2006) The farmers' practice which included application of pseudostems as such in basins followed by complex fertilizers gave on par yields to enrichment of vermicompost with chemicals but significantly lower benefit cost ratio (Table 1). The yield benefit is attributed to the better nutrient availability from vermicompost compared the fresh pseudostems.

The farmer participatory study also brings to focus that recycling and enrichment technology in banana is good especially in terms of reduction of pest innoculm. The field survey and response of farmers to the technology revealed that the recycling of banana biomass could significantly reduce the pest innoculm (Fig.1) The conventional method of applying the pseudostems in basins cannot be considered as good in commercial banana cultivation. The concept of integrated nutrient management in banana, organic recycling of the bulk biowastes have been rated very good by 56-68 per cent of the farmers. Biofertilisers for compost enrichment has not been acceptable.

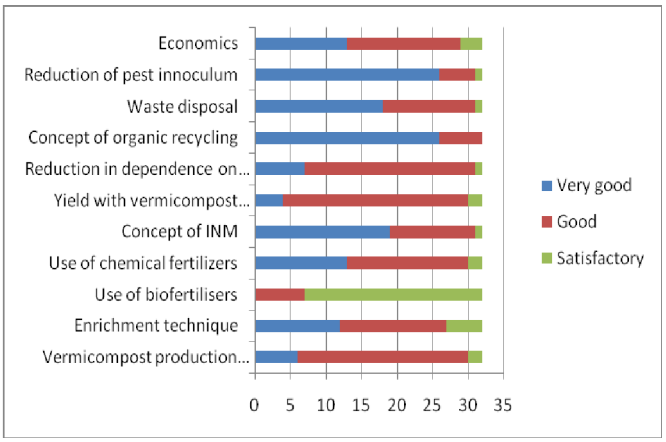

Fig. 1: Response of farmers to biomass recycling in banana (n=32)

The limitations put forth by the farmers in adopting the recycling technology and organic nutrition in banana are presented in Table 2

Table 2: Constraints ranked by the participating farmers in organic nutrition in banana

Constraints	Rank
Labour shortage- transportation of the pseudostems from fields to the compost pits normally taken in homesteads	1
Availability of biofertilisers locally	4
Separation of worms from compost is laborious	2
Low nutrient contents in organic manures	3
Long duration necessitates chemical fertilisers	2

It is very much evident that the farmers uphold chemical fertilizers as the source of nutrients in banana. The study shows that the conventional practice of

applying the biowastes in basins adds to chances of pests and disease incidence in the succeeding crop and application of complex fertliser in indiscriminate quantities hikes the cost of cultivation with no significant increase in yields as revealed in the economic analyses. As chemicals are ready sources of nutrients and taking into account the need for organic nutrition it is economical to integrate vermicompost and fertilisers thus partly substituting the nutrient requirement with chemical sources of fertilisers. Biofertilisers alone cannot satisfy the nutrient needs of banana in compost enrichment. Vermicompost units need to be established near farmers' fields and the ideal recommendation would be recycling banana pseudostem as vermicompost + chemical fertilizers (50% N substitution). Pseudostems composted with earthworms on an average need to be applied @ 10 kg per Nendran plant in two splits, urea 220g and potash 500g (six splits), rajphos, 550g (two splits) at monthly intervals. Enriching compost with green leaf manures or biofertilisers can further reduce the chemical dosage in the integrated schedule based on the nutrient content of the final compost, but based on the results of the trial and farmers' feed back, chemical fertilisers cannot be avoided. Awareness programmes have to strengthened among the farmers on the need for integration of nutrient sources rather than overdependence on chemicals

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Genetic and phenotypic correlations between first lactation milk yield and some performance traits in Sahiwal cattle

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Abstract

Data on 506 pedigree, breeding and performance records of a purebred herd of Sahiwal cattle maintained at State Livestock cum Agriculture Farm Chak-Ganjaria, Lucknow, during the period 1986 to 2009 were analysed. The genetic and phenotypic correlations between first lactation 90 days milk yield and some performance traits were estimated, using the least squares analysis model-2 of LSMLMW (Harvey,1990). Phenotypic and genetic correlations between first lactation 90 days milk yield and age at first calving were 0.002 ± 0.045 and -0.109 ± 0.211; between first lactation90 days milk yield and first lactation length were 0.263 ± 0.043 and 0.466±0.183; between first lactation90 days milk yield and first calving interval were 0.006 ± 0.045 and 0.343 ± 0.276; between first lactation 90 days milk yield and first lactation 300 days milk yield were 0.983 ± 0.008and 0.985±0.007. On the basis of these estimates, it revealed that age at first calving had low and negative genetic association with first lactation 300 days milk yield. It could be concluded that age at first calving and first lactations 300 days MY should be incorporated in selection indices for the selection of genetically superior Sahiwal cows. Calving interval could be minimized by improving the managemental aspects of the farm regarding breeding services,so that it is in prescribed range for Sahiwal cows(10-14 months).

Key words: First lactation; milk yield; genetic and phenotypic correlations; Sahiwal cattle

Introduction

The genetic composition of a population can be studied by considering the relative importance of heredity and environmental factors affecting the performance of individuals in that population (Falconer and Mackay, 1997). The estimates of genetic parameter are helpful in determining the method of selection to predict direct and correlated response to selection, choosing a breeding system to be adopted for future improvement as well as in the estimation of genetic gains. If genetic correlation between the two traits is high, the selection for one trait would result in an improvement/deterioration for the other trait as a correlated response. The phenotypic correlation is an expression of observed relationship between the phenotypic performance of different traits while the degree of association between genes responsible for the additive variance of different traits is measured through genetic correlation. The genetic correlations give the information that genes affecting one trait also affect the other traits. The effectiveness of selection and net genetic progress can be measured when selection is made for more than one trait. The present investigation was made to explore the phenotypic and genetic correlations between first lactation milk yield and some other first lactation and lifetime traits in Sahiwal cattle. It is envisaged that this information will be useful for the formulation of future breeding strategy for the genetic improvement of Sahiwal cattle in India and elsewhere.

Materials and Methods

Data on 506 pedigree, breeding and performance records of a purebred Sahiwal herd maintained at State Livestock cum Agriculture Farm Chak-Ganjaria, Lucknow. during the period 1986 to 2009 were utilised for the present study. The data on first lactation traits (age at first calving, milk yield, lactation length and calving interval) and lifetime milk yield were analysed to estimate the genetic and phenotypic correlations between first lactation milk yield and age at first calving; first lactation milk yield and first lactation length; first lactation milk yield and first calving interval; and first lactation milk yield and lifetime milk yield. The data were edited as far as the accuracy and reliability of records were concerned for pedigree information. The performance traits were analysed statistically for the estimation of genetic and phenotypic correlations between various performance traits. For this purpose, least squares analysis was carried out using model-2

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of LSMLMW (Harvey,1990).

Genetic correlation was calculated as follows:

$$rg_ig_j = \frac{Cov(s_is_j)}{(Vs_i\ Vs_j)^{1/2}}$$

Where,

rg_ig_j=Genetic correlation coefficients between i^{th} and j^{th} characters.

$Cov(s_is_j)$= Sire component of covariance between i^{th} and j^{th} characters.

Vs_i= Sire component of variance of i^{th} character.

Vs_j = Sire component of variance of j^{th} character.

The standard error of the genetic correlation was estimated by the formula given by Robertson (1959).

$$SE\ (rg_ig_j) = \sqrt{\frac{1-(rg_ig_j)^2}{\text{“2}} \times \frac{SE\ (h^2_i) \times SE\ (h^2_j)}{(h^2_i)\ (h^2_j)}}$$

Where,

rg_ig_j = Genetic correlation coefficient between i^{th} and j^{th} characters

$SE\ (h^2_i)$ = Standard error of heritability of i^{th} character

$SE\ (h^2_j)$ = Standard error of heritability of j^{th} character

h^2_1 & h^2_j = Heritability estimate of i^{th} and j^{th} characters

The phenotypic correlation coefficients were estimate by the formula given by Searle (1961).

$$rp_ip_j = \frac{Cov(s_is_j) + Cov\ (e_ie_j)}{[(Vs_i + Ve_i)\ (Vs_j + Ve_j)]^{1/2}}$$

Where,

$Cov(s_is_j)$= Sire component of covariance between i^{th} and j^{th} characters.

$Cov\ (e_ie_j)$= Error component of covariance between i^{th} and j^{th} characters.

Vs_i = Sire component of variance of i^{th} character.

Vs_j = Sire component of variance of j^{th} character.

Ve_i = Error component of variance of i^{th} character

Ve_j = Error component of variance of j^{th} character

The standard errors of the phenotypic correlation coefficient were obtained by the formula given by Panse and Sukhatme (1967).

$$SE\ (rp_ip_j) = \sqrt{\frac{1-(rp_ip_j)^2}{N-2}}$$

Where,

rp_ip_j = Phenotypic correlation between i^{th} and j^{th} characters

N = Total number of animals.

Results and Discussion

Genetic and Phenotypic correlations among different production traits and heritability estimates are presented in Table1.

The genetic & phenotypic correlations of MY 90, MY 120, MY 150, MY 180 days with MY 300 days were 0.985±0.007, 0.989 ± 0.005, 0.994±0.003, 0.995±0.002 and 0.983 ± 0.008, 0.989 ± 0.007,0.993 ± 0.005 & 0.995 ± 0.004 respectively in Sahiwal cattle.

The genetic & phenotypic correlations of MY 90, MY 120, MY 150, MY 180 days, MY300 days with First Lactation Period were 0.466 ± 0.183, 0.471 ± 0.184, 0.491 ± 0.181, 0.499 ± 0.180, 0.513 ± 0.179 and 0.263 ± 0.043, 0.265 ± 0.043, 0.268 ± 0.043, 0.266 ± 0.043, 0.265 ± 0.043 respectively in Sahiwal cattle.

The genetic and phenotypic correlations between cumulative part yields and first lactation yield were positive and highly significant. Other workers have also reported positive and highly significant genetic and phenotypic correlations between cumulative part yields and first lactation yield (Saigaonkar *et al.,* 1981; Sharma *et al.,* 1982;; Parmar *et al.,* 1984; Shrivastava and Khan, 1987; Jain *et al.,* 1991; Yadav *et al.,* 2003 and Singh and Gurnani,2006).

The genetic and phenotypic correlations between cumulative part & complete lactation milk yields and first lactation period were positive and non-significant. Similar findings were also reported by Dahlin et al. (1998), Javed (1999), Choudhary et al. (2003) and Banik and Gandhi (2010).

The genetic and phenotypic correlations of MY 90, MY 120, MY 150, MY 180 days, MY 300 days with age at first calving were -0.109 ± 0.211, -0.096 ± 0.213, -0.083 ± 0.214, -0.068 ± 0.214, -0.027 ± 0.215 & 0.002 ± 0.045, 0.007 ± 0.045, 0.007 ± 0.045 , 0.010 ± 0.045, 0.019 ± 0.045, respectively in Sahiwal cattle.

The genetic and phenotypic correlation of MY 90, MY 120, MY 150, MY 180 days, MY 300 days with first calving interval were 0.343 ± 0.276, 0.327 ± 0.279, 0.322 ± 0.280, 0.322 ± 0.280, 0.300 ± 0.282 & 0.006 ± 0.045, 0.005 ± 0.045, 0.004 ± 0.045, 0.003 ± 0.045, 0.003 ± 0.045, respectively in Sahiwal cattle.

On the basis of these estimates, it is revealed that age at first calving had low and negative genetic association with first lactation 300 days milk yield. Banik and Gandhi (2010) reported similar findings in

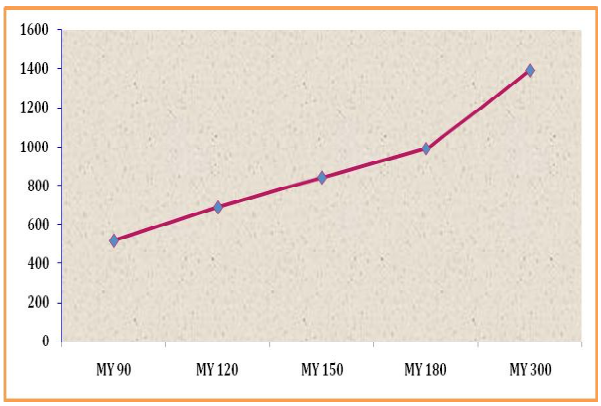

Figure No. 1: showing Trend of Milk Yield in First lactation at MY 90, 120, 150, 180 & 300 days.

Table 1: Estimates & S.E. of heritability (diagonal), genetic (above diagonal) and phenotypic correlations (below diagonal) among different economic traits in Sahiwal cattle.

Traits	MY 90	MY 120	MY 150	MY 180	MY 300	FLP	AFC	FCI
MY 90	0.698 ± 0.183	0.998 ± 0.001	0.996 ± 0.002	0.993 ± 0.003	0.985 ± 0.007	0.466 ± 0.183	-0.109± 0.211	0.343 ± 0.276
MY 120	0.997 ± 0.003	0.663 ± 0.179	0.999 ± 0.001	0.998 ± 0.001	0.989 ± 0.005	0.471 ± 0.184	-0.096± 0.213	0.327 ± 0.279
MY 150	0.994 ± 0.005	0.998 ± 0.003	0.661 ± 0.179	0.999 ± 0.000	0.994 ± 0.003	0.491 ± 0.181	-0.083± 0.214	0.322 ± 0.280
MY 180	0.992 ± 0.006	0.997 ± 0.003	0.999 ± 0.002	0.663 ± 0.179	0.995 ± 0.002	0.499 ± 0.180	-0.068± 0.214	0.322 ± 0.280
MY 300	0.983 ± 0.008	0.989 ± 0.007	0.993 ± 0.005	0.995 ± 0.004	0.654 ± 0.178	0.513 ± 0.179	-0.027± 0.215	0.300 ± 0.282
FLP	0.263 ± 0.043	0.265 ± 0.043	0.268 ± 0.043	0.266 ± 0.043	0.265 ± 0.043	0.599 ± 0.171	0.018 ± 0.219	0.582 ± 0.230
AFC	0.002 ± 0.045	0.007 ± 0.045	0.007 ± 0.045	0.010 ± 0.045	0.019 ± 0.045	0.037 ± 0.045	0.769 ± 0.191	0.119 ± 0.278
FCI	0.006 ± 0.045	0.005 ± 0.045	0.004 ± 0.045	0.003 ± 0.045	0.003 ± 0.045	0.293 ± 0.043	0.050 ± 0.044	0.227 ± 0.118

Significant rp estimates are 0.081 at $P < 0.01$ & 0.062 at $P < 0.05$.
MY=Milk yield, FLP=First lactation period, AFC=Age at first calving, FCI=First calving interval

Sahiwal Cattle. Present estimates were not in agreement with the results of Ramalu and Siddhu (1995).

Non significant and very low phenotypic correlations of age at first calving with first calving interval, first lactation 300 days milk yield, first lactation length were observed in the present study. Our finding was similar with Banik and Gandhi (2010).

Positive and low genetic association of first calving interval with first lactation 300 days milk yield, first lactation total milk yield is desirable. This is almost important to control larger period of calving interval for genetic improvement of economic traits for the benefit of rural farmers. Similar findings were obtained by Banik and Gandhi (2010). Our findings were also in agreement with Singh et al. (2001) and Khan et al. (1999).

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Economic analysis of agricultural sustainability in eastern Uttar Pradesh, India

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Abstract

Sustainable agriculture is the successful management of resources for agriculture to satisfy changing human needs while maintaining/enhancing the quality of environment and conserving natural resources. Sustainable agriculture integrates three main goals viz., environmental health, economic profitability and social and economic equity. The objective of the present study was to generate Sustainable Livelihood Security Index (SLSI) for agricultural sustainability and evaluate the existing status of different districts of Eastern Uttar Pradesh. SLSI reflects the overall performance of a district. Its component indices indicate how the district performs in the three dimensions of sustainability. The districts with the better SLSI* ranks are described as advanced districts using other ecological, economic and social indicators whereas districts with the lower SLSI* ranks are generally known as backward districts. The SLSI ranged from 0.54 to 0.29 whereas SLSI* ranged from 0.55 to 0.32. Sultanpur district of Eastern Uttar Pradesh ranked first position, whereas Sonbhadra was the bottom district having the least desirable conditions for sustainable development of agriculture. Out of 27 districts of Eastern Uttar Pradesh, only five and eight districts performed better in term of their SLSI and SLSI*, respectively.*

Keyword: Sustainable Livelihood Security Index, Ecological Security, Economic Efficiency, Social Equity.

Introduction

Agriculture is the largest private enterprise in India and it contributes nearly 17 per cent to the Gross Domestic Product (GDP) and sustains livelihood of about two-third of the India's population (GOI, 2009). Agricultural growth during the last 50 years was 2.7 per cent per annum and it was triggered by augmentation of crop productivity (GOI, 2009). During the same period, government, scientists and policymakers advocated intensive use of inputs for crop production to obtain productivity led agricultural growth to feed the growing population and make the country self sufficient in the food front.

The consequences of excessive and unbalanced use of inputs of crop production resulted in decline in soil productivity, decrease in micro-organism population in soil, increase in contamination of surface and ground water and adversely affect human and animal health. In response to negative consequences, presently more emphasis is given on sustainable agriculture. Sustainable farming system is an eco-friendly and ecological based low input cost and economically sustainable. The most popular definition of sustainable development adopted by the World Commission on Environment and Development (WCED) is "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Uttar Pradesh is endowed with richest natural resources in India. Since the development of agriculture in the state has lagged behind due to several constraints viz., uneconomical size of land holdings, traditional methods of cultivation, low productivity, inadequate capital formation and low investment, inadequate irrigation facilities, widespread illiteracy among farmers, helpless victim of natural calamities, inefficient management of resources, poor performance of extension services and inadequate agricultural marketing facilities.

In view of the aforesaid facts, the objective of the present study is to evaluate the relative agricultural sustainability in different districts of Eastern Uttar Pradesh and suggests the policy implications for agricultural sustainability in Eastern Uttar Pradesh.

Methodology

Data collection

Eastern Uttar Pradesh is purposively selected for the present study which consists of 27 districts. The study is based on the secondary data and it was collected from the different government publications such as district-wise development indicators, Human Development Index of Uttar Pradesh etc.

The variables used for ecological security are: population density (per km^2), percentage forest area to geographical area, cropping intensity (per cent), livestock population density (per km^2), percentage share of barren land to reporting area, percentage area under

commercial crops to gross sown area and stage of groundwater development (per cent). The parameters used for explaining economic efficiency are: paddy yield (quintal/ha.), fertilizer consumption (kg/ha.), per capita food grain production (kg/annum), per capita gross value of agricultural produce (Rs) at current prices, gross value of agricultural produce (Rs) per hectare of net area sown at current prices, credit deposit ratio and per capita district plan expenditure (Rs) at current prices.

The explanatory variables were used for explaining social equity are: total literacy rate (per cent), female literacy (per cent), number of primary health centre per lakh population, length of total pucca roads per lakh population, length of total pucca roads per thousand km^2, per capita electricity consumption (K.W.H.), percentage electrified villages to total inhabited villages, number of regulated *mandis* per hectare of net area sown, number of primary agricultural cooperative society per lakh of rural population and number of agricultural marketing centres per lakh hectare of net area sown.

Analytical Procedure

Methodology for integrating different types of information into a composite index was first developed by Morris (1979) for constructing the Physical Quality of Life Index (PQLI). This approach has been also used by the United Nations Development Programme (UNDP) for constructing the Human Development Index (HDI) that ranked and grouped countries in terms of their relative status in human development (UNDP, 1992).

The Sustainable Livelihood Security Index (SLSI) methodology is actually a generalization of the relative approach underlying the HDI developed by the United Nations Development Programme (UNDP, 1990). It is a cross sectional measure in evaluating the relative sustainability status of a given set of entities. The SLSI methodology originally explained by Saleth and Swaminathan (1993) is given below:

Let X_{ijk} and $SLSI_{ijk}$ denotes the value of the i^{th} variable, j^{th} component of k^{th} district and index for the i^{th} variable representing j^{th} component of the SLSI of k^{th} district respectively. Then,

$$SLSI_{ijk} = \frac{X_{ijk} - \min_k X_{ijk}}{\max_k X_{ijk} - \min_k X_{ijk}} \quad \ldots\ldots (1)$$

$$SLSI_{ijk} = \frac{\max_k X_{ijk} - X_{ijk}}{\max_k X_{ijk} - \min_k X_{ijk}} \quad \ldots\ldots (2)$$

Where,

i = 1, 2, 3, …, I) variables

j = 1, 2, 3, …, J) components

k = 1, 2, 3, … , K) districts

Equation (1) is applicable to variables having positive implications for Sustainable Livelihood Security (SLS) and equation (2) is applicable for variables with negative implications for SLS. The numerators in equation (1) determine the extent by which the k^{th} district did better in the i^{th} variable representing the j^{th} component of its Sustainable Livelihood Security Index (SLSI) as compared to the district showing the worst performance. The denominator used in the equation is the range i.e. the difference between the maximum and minimum values of a given variable across the district. The denominator serves as a scale by which the performance of district is appraised in a given variable. We note that such a scale can also be identified exogenously utilizing scientific standards, social norms or even policy targets.

Having calculated the $SLSI_{ijk}$ for all variables, the indices for various components of *SLSI* were calculated as a simple means of the indices of their respective variable. That is,

$$SLSI_{jk} = \frac{\sum_{i=0}^{I} SLSI_{ijk}}{I} \quad \ldots\ldots (3)$$

Where:

j = 1, 2, 3, … , J

k = 1, 2, 3, … , K

The composite indicator for each district is calculated as a weighted mean of the component indices obtained from equation (3). That is:

$$SLSI_{jk} = \frac{\sum_{j=1}^{j} W_{jk}\ SLSI_{ijk}}{j} \quad \ldots\ldots (4)$$

Where:

k = 1, 2, 3, …, K

The W_{jk} in equation (4) indicates the weight assigned to the j^{th} component of SLSI of k^{th} district, and has the property that: $W_{ik} + \ldots + W_{jk} = 1$. If the weights are identical and sum up to unity, then SLSI is calculated as a simple mean. But, when the weights are different across all *js* and *ks*, then SLSI is calculated as a weighted mean. For distinction, the former is denoted simply as SLSI and the latter as SLSI*. All the indices and hence, both SLSI and SLSI* will be bounded by 0 and 1.

The approach used to derive the weighting scheme with the above two properties can be described in a more generalized form as follows:

$$Max \sum_{j=1}^{j} \alpha_{jk}\ \gamma_{ij} \quad \ldots\ldots (5)$$

Subjected to

$$\sum_{j=1}^{j} \alpha_{jk} = 1 \quad \ldots\ldots (6)$$

Where,

α_{jk}= Coefficient associated with the jth

component of SLSI of district k, and

α_{ik} = Value of the j^{th} components of SLSI of the district k.

Results and Discussion

Table 1 presents district-wise relative agricultural sustainable status. The maximum and minimum value of ecological security index (ESI) was 0.55 and 0.28 respectively whereas in case of economic efficiency index (EEI) it was maximum with 0.62 and minimum with 0.18. The social equity index (SEI) was ranging from 0.65 to 0.13 respectively. This implies that the agricultural systems of all the districts of eastern Uttar Pradesh display wide variations in their economic and social equity aspects relative to their ecological aspects. While the SLSI indicates range from 0.54 to 0.29 and the SLSI* reflects a range from 0.55 to 0.32.

Based on findings of the present study and indices provided in Table 1, the better performing districts on the basis of Sustainable Livelihood Security Index (SLSI) were Sultanpur followed by Ambedkar Nagar, Mau, Varanasi, Deoria, Chandauli, Faizabad, Allahabad, Maharajganj and Azamgarh, whereas, worst performing districts was Sant Ravidas Nagar followed by Balrampur, Mirzapur, Sonbhadra and Shrawasti. The rest of districts of Eastern Uttar Pradesh were average performing according to SLSI. The SLSI* reflects the overall performance of the district, its component indices indicated that how the district fared in the three dimensions (ESI, EEI and SEI) of sustainability. The best performing districts of Eastern Uttar Pradesh on the basis of relative sustainable livelihood security index (SLSI*) was Sultanpur followed by Ambedkar Nagar, Deoria, Mau, Varanasi, Chandauli, Allahabad and Faizabad, whereas, less performing districts were Sonbhadra followed by Shrawasti, Mirzapur, Sant Ravidas Nagar, Balrampur, Bahraich, Sant Kabir Nagar, Siddhartha Nagar, and Gonda. Rest of the districts was average performing districts on the front of SLSI*.

The inter-district comparison of component indices (ESI, EEI and SEI), Varanasi district dominated in ecological security in the Eastern Uttar Pradesh followed by Mau and Faizabad while most of the districts of Eastern Uttar Pradesh had poor performance in ecological security front. The worst performing districts in ecological security point of view was Shrawasti followed by Siddhartha Nagar and Sonbhadra. In case of economic efficiency point of view, best performed district was Sultanpur followed by Ambedkar Nagar and Faizabad, whereas, the bottom line districts in term of economic efficiency were Sonbhadra followed by Mirzapur and Allahabad. In case of social equity point of view, the districts which perform better were Deoria followed by Allahabad and Mau. Similarly, the bottom line districts in social equity were Shrawasti followed by Balrampur and Kushinager.

Conclusion and policy implication

The SLSI* approach has received increasing attention from the fact that it helps not only to establish inter-district priority for the allocation of the agricultural investment and programmes relevant to each districts for sustainable agricultural development. The districts with SLSI* of less than 0.4 have poor conditions for Sustainable Development Agriculture (SDA) and they should receive the prime importance in agricultural investment, policy making and successful implementation. In view of the inter-districts investment allocation, the SLSI* approach could also infusing recognition and policy guidance on specific activities and programmes to improve the overall agricultural sustainability of each district successfully. District specific prioritization over programmes and projects can be identified by the relative values of the Ecological Security Index (ESI), Economic Efficiency Index (EEI) and Social Equity Index (SEI). The district-wise possible priority areas for intervention required for agricultural sustainability in Eastern Uttar Pradesh is presented in Table 2. These are:

i. Relatively better-off districts require some interventions like ecological security (more area under forest, more are under commercial crops and groundwater development), economic efficiency (credit deposit ratio, per capita food grains output and per capita district plan expenditure) and social equity (Increase in number of PHC, PACS and regulated *mandi*);
ii. Relatively average performing districts require interventions in the areas of ecological security (Increase in forest cover, groundwater development, area under commercial crops, cropping intensity and livestock), economic efficiency (increase in fertilizer consumption, credit deposit ratio, district plan expenditure and per capita gross value of agricultural output) and social equity (female literacy); and
iii. Relatively poor performing districts require intervention in the areas of ecological security (increase in cropping intensity, livestock, groundwater development and area under commercial crops), economic efficiency (increase in per capita gross value of agricultural output and per capita food-grains) and social equity (agricultural produce market, PACS, regulated *mandi*, literacy, female literacy and *pacca* road).

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Table 1: District-wise Relative Agricultural Sustainable Status for Eastern Uttar Pradesh

Districts	Ecological Security Ecology Security Index (ESI)	Status Ranks	Economic Efficiency Economic Efficiency Index (EEI)	Status Ranks	Social Equity Social Equity Index (SEI)	Status Ranks	Sustainable Livelihood Security Status Sustainable livelihood Security Index (SLSI)	Ranks	Relative Sustainable Livelihood Security Index (SLSI*)	Ranks
1. Pratapgarh	0.34	23	0.36	23	0.61	6	0.44	15	0.47	11
2. Kaushambi	0.43	11	0.46	13	0.46	15	0.45	13	0.45	16
3. Allahabad	0.47	6	0.34	25	0.64	2	0.48	8	0.51	7
4. Faizabad	0.49	3	0.59	3	0.38	21	0.49	7	0.50	8
5. Ambedkar Nagar	0.44	9	0.61	2	0.50	13	0.52	2	0.53	2
6. Sultanpur	0.49	4	0.62	1	0.51	12	0.54	1	0.55	1
7. Bahraich	0.40	16	0.51	8	0.36	23	0.42	21	0.43	22
8. Shrawasti	0.28	27	0.45	14	0.13	27	0.29	27	0.35	26
9. Balrampur	0.40	15	0.50	9	0.15	26	0.35	24	0.41	23
10. Gonda	0.45	8	0.49	12	0.36	24	0.43	18	0.44	19
11. Siddhartha Nagar	0.29	26	0.55	5	0.39	20	0.41	22	0.44	20
12. Basti	0.39	17	0.55	6	0.38	22	0.44	16	0.45	17
13. Sant Kabir Nagar	0.39	18	0.50	10	0.40	17	0.43	19	0.44	21
14. Maharajganj	0.37	21	0.57	4	0.50	14	0.48	9	0.49	9
15. Gorakhpur	0.35	22	0.39	19	0.59	7	0.44	17	0.47	12
16. Kushinager	0.39	19	0.55	7	0.36	25	0.43	20	0.45	18
17. Deoria	0.41	12	0.45	15	0.65	1	0.50	5	0.53	3
18. Azamgarh	0.48	5	0.43	17	0.51	11	0.47	10	0.48	10
19. Mau	0.49	2	0.43	18	0.63	3	0.52	3	0.53	4
20. Ballia	0.41	13	0.39	20	0.54	8	0.45	14	0.46	14
21. Jaunpur	0.46	7	0.38	21	0.53	9	0.46	11	0.46	15
22. Ghazipur	0.41	14	0.44	16	0.53	10	0.46	12	0.47	13
23. Chandauli	0.37	20	0.50	11	0.62	4	0.50	6	0.52	6
24. Varanasi	0.55	1	0.38	22	0.61	5	0.51	4	0.53	5
25. Sant Ravidas Nagar	0.44	10	0.35	24	0.39	19	0.39	23	0.40	24
26. Mirzapur	0.32	24	0.29	26	0.45	16	0.35	25	0.37	25
27. Sonbhadra	0.31	25	0.18	27	0.40	18	0.30	26	0.32	27

Source: Authors' own estimate based on data provided in GoUP, (2009)

Table 2: District-wise Priority Areas for Intervention Required for Agricultural Sustainability, Eastern Uttar Pradesh

Name of the district	Intervention Required		
	Ecology Security	Economic Efficiency	Social Equity
Relatively Best Performing District			
1. Sultanpur	Forest cover	-	-
2. Ambedkar Nagar	Forest cover	-	-
3. Deoria	Forest cover	-	-
4. Mau	-	Credit deposit ratio, District plan expenditure	-
5. Varanasi	-	Per capita food grains, District plan expenditure	-
6. Chandauli	Area under commercial crop & Groundwater development	-	-
7. Allahabad	-	District plan expenditure	-
8. Faizabad	-	-	PHC, PACS, Regulated Mandi
Relatively Average Performing District			
1. Maharajganj	Groundwater development	-	-
2. Azamgarh	Forest cover	Fertilizer consumption, credit deposit ratio	-
3. Pratapgarh	Forest cover & Area under commercial crop	Credit deposit ratio	-
4. Gorakhpur	Forest cover & Area under commercial crop	Credit deposit ratio	-
5. Ghazipur	Forest cover	Credit deposit ratio	-
6. Ballia	Forest cover & Area under commercial crop	Credit deposit ratio	Female literacy
7. Jaunpur	Forest cover & Area under commercial crop	Credit deposit ratio	Female literacy
8. Kaushambi	Forest cover &Cropping intensity	Credit deposit ratio	Female literacy
9. Basti	Forest Cover	Credit deposit ratio	-
10. Kushinager	Forest cover & Groundwater development	District plan expenditure, Female literacy	-
11. Gonda	Forest cover	District plan expenditure	Female literacy
12. Siddhartha Nagar	Forest cover & Area under commercial crop	Female literacy	-
13. Sant Kabir Nagar	Forest cover	Credit deposit ratio	Female literacy
14. Bahraich	Area under commercial crop	-	Female literacy
15. Balrampur	Livestock	-	Female literacy
16. Sant Ravidas Nagar	Forest cover & Area under commercial crop	Per capita food grains, per capita gross value of agricultural Output	-
Relatively Poor Performing District			
1. Mirzapur	Cropping intensity, livestock, Groundwater development, Area under commercial crop	Per capita gross value of agricultural Output	Agricultural Mar, ket, PACS, Regu - lated *Mandi* Female literacy
2. Shrawasti	Area under commercial crop	Per capita gross value of agricultural Output	Literacy, Female literacy, Electricity, PACS
3. Sonbhadra	Cropping intensity, livestock, Groundwater development, Area under commercial crop	Per capita output of food grains, paddy yield	*Pacca* Road, agri cultural Market, Female literacy

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Efficiency of resources used in wheat cultivation

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Abstract

This study was conducted in Bashrehar block of district Etawah Uttar Pradesh Following purposing random sampling technique, 100 sample farmers were selected and interviewed for collection of data. Sample farmers were categorized as marginal, small, medium and large size of farms. Cobb-Douglas function was applied to analyse the data and interpretation of the result. Production of wheat was characterized by decreasing return to scale. Coefficient of multiple determinations of all four independent variables indicated 89.81 per cent, 93.91 per cent, 94.37 per cent and 93.97 per cent of variation, in dependent variable respectively. Resources like seed, manure & fertilizer, human labour and irrigation were significantly related with the production. MVP to factor cost was found positive indicating future scope for increasing the investment on resources used.

Key words- Resource, Efficiency, Cultivation and Elasticity

Introduction

Wheat is the world's most widely cultivated food crop. It has been grown since pre historic time and being consumed in various forms by more than one thousands million people in the world. Wheat is a staple food of our country and plays an important role in Indian economy. Globally wheat is grown in 122 countries over an area of 215 million hectare and produced nearly 676 million tones during 2011-12.

Wheat played an important role in shaping agriculture and food security policy. India has been second largest producer of wheat after china. It covers an area of 27 .8 million hectare having a production of 90.23 million tones with a productivity of 32.45 quintal per hectare. It contributes about 34% of the total food grain production of the country. (Pratiyogita Darpan 2012).

Wheat is processed in different forms like flour, suzi, maida and being eaten by number of consumers in different ways as porridge (Halwa), chapatti bread and biscuits etc. Besides, wheat straw and wheat bran are good source of feed & fodder for animals.

In India Uttar Pradesh is the highest wheat producing state followed by Punjab and Haryana. It contributes which 34.42% of national production (37.85 million tonnes) having the area 9.25 million hectare, but the productivity is much lower as compared to Punjab and Haryana (anonymous -2012)

In district Etawah wheat was grown in 94709 hectares and per hectare production was 35.81 quintal however total production was 339172 metric tones in 2009- 10. Wheat productivity of Etawah district was higher than the national productivity.

In Etawah district block Bashrehar rank IInd in wheat cultivation. The area covered by wheat was 15154 hectare and total production was 542662 quintal with productivity of 35.8 quintal per hectare (statistical bulletin directorate of statistics U.P. 2009)

During the post green revolution period, the large scale adoption of new technology particularly in wheat raised the production of food grain remarkably. Wheat compares well with other important cereals in its nutritive value. It contains more protein than other cereals. Wheat has relatively high content of Niacin and Thiamine. Gluten as an essential component for bakers available in wheat provides the structural framework for the familiar spongy, cellular texture of bread and other baked product. Wheat provides more than 50 per cent of the calories to the people, who mainly depends on it and will continue to be the major player in the Indian food sector. Keeping the importance of the crop in view the study on "Efficiency of resources used in wheat cultivation" was conducted in Bashrehar block of Etawah district with following objectives:-

1- To study the production elasticity of resources in wheat cultivation.
2- To find out the MVP of included factors in wheat cultivation.

Methodology

Hundred farmers were selected through purposive cum random sampling, from Bashrehar block of Etawah district. Primary data were collected through personal interview with the use of pre-structured and pre-tested schedule. The data pertained to the agriculture year 2010-11. Simple tabular and functional analysis was used to analyse the data and presentation of the result.

Results and Discussion

Resources use efficiency

The production function analysis was carried out to determine the efficiency of various resources (seed,

Table 1: Production Elasticity of Wheat crop on different size group of farmer

Size group of sample farms (hectares)	Production elasticity				Sum of elasticities return to scale	R^2
	X_1	X_2	X_3	X_4		
Marginal (below 1)	0.04995053*(0.04459295)	0.69965472**(0.07662413)	0.16037529*(0.07309627)	0.01879796*(0.00769054)	.92877849	.8981
Small (1-2)	0.0657589(0.0707864)	0.71925836**(0.07702141)	0.12218944*(0.06280414)	0.00330995(0.0060881)	.91053365	.9391
Medium (2-4)	0.5481016**(0.12408535)	0.15987856(0.14092432)	0.19990734(0.20905975)	0.0460047(0.04872853)	.9538922	.9437
Large (4 and above)	0.37211704**(0.0823034)	0.53703685**(0.11953364)	0.04974905**(0.06650221)	0.0096881(0.0127406)	.96859105	.9397

(Figures in parenthesis denoted standard error of respective variables) (** Statistically significant at 1 percent probability level)
(* Statistically significant at 5 percent probability level) X_1 = Human lobour X_2 = Seed X_3 = Manure & fertilize X_4 = Irrigation

manure & fertilizer, human labour and irrigation) used in the production of process. Cobb-Douglas production function was applied to find out the efficiency of various resources used in the production of wheat.

The value of elasticity of production, standard error, co – efficient of multiple determination and returns to scale for wheat production on different size group of farms are presented in table-1. The high value of R^2 of the fitted function indicated that sufficient and large proportion of the total variation in the dependent variable is explained by the inputs included in the function. The table further indicated that four variables viz. manure & fertilizer, human labour, seed and irrigation jointly explained 89.81, 93.91, 94.37 and 93.97 per cent variation of the dependent variable in marginal, small, medium and large categories of the farms respectively. It is also revealed from the table that in case of marginal size of farms the resources like human labour, manure & fertilizer and irrigation were significantly associated with the yield at 5% probability level where as seed was found significantly associated at 1% level of probability.

In case of small size group of farms seed was associated at 1% level of probability and significant level of manure and fertilizer with yield was 5%. Where as in case of medium size of farms only human labour was found statistically and significantly associated with independent variable at 1 per cent level of probability.

As for as large category of farm were concerned, the independent variables like human labour, seed, manure & fertilizer were found significantly associated with yield at 1% level of probability.

Returns to scale on marginal, small, medium and large farms were found 0.9287, 0.9105, 0.9538 and 0.9685 respectively. It is therefore concluded that cultivation of wheat is characterized by decreasing return to scale on each farm situation viz. marginal, small, medium and large farms. It is therefore inferred that increasing all the factors by one per cent simultaneously results in increase of the returns by less than one per cent on each farm situation.

Table 2: Marginal Value Productivity (MVP) of included factors in production process of wheat crop.

Size group of farms	Marginal value productivity of input/factors			
	X_1	X_2	X_3	X_4
Marginal	0.40760	10.57568	2.67916	1.57184
Small	0.59974	10.15962	1.85742	0.28983
Medium	4.378542	2.07376	2.77194	4.47453
Large	3.54322	8.356495	8.47041	0.94307

Marginal value productivity:

In case of all the categories of farms and all four variables the positive value of M.V.P. to factor costs indicates that there is further scope to increase the investment on all these factors to realize more return than the costs.

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Studies on impact of Weedicides and nitrogen levels on growth and Yield of maize-soybean intercropping system

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Abstract

A field experiment was conducted during the rainy seasons of 2009 and 2010 at R.B.S. College Agricultural Research Farm, Bichpuri, Agra in sandy loam soil, to study the effect of weedicides and nitrogen levels on growth and yield of maize-soybean intercropping system. The eight weed control measures were applied (W_0-Weedy check, W_1-Hand weeding at 25 DAS, W_2-Oxyfluorfen pre-em. @ 0.100 kg/ha, W_3-Oxyfluorfen pre-em. @ 0.150 kg/ha, W_4-Pendimethalin pre-em. @ 1.000 kg/ha, W_5-Pendimethalin pre-em. @ 1.500 kg/ha, W_6- Metribuzin pre-em. @ 0.500 kg/ha and W_7- Metribuzin pre-em. @ 0.750 kg/ha) and Four nitrogen levels were applied (N_0, N_{40}, N_{80} and N_{120}). The maximum plant height (cm) and dry matter per plant (g) were obtained with the application of Pendimethalin pre-em. @ 1.500 kg/ha (W_5). This treatment was significantly superior as compare to all other treatments during both the seasons. Plant height and dry matter per plant were increased significantly with every increase in the level of nitrogen up to 120 kg/ha in maize crop and in soybean crop both parameters were increased significantly with the application of 40 kg N/ha as compare to control during both the years. The highest maize equivalent yield (MEY) was obtained with W_5 (Pendimethalin pre-em. @ 1.500 kg/ha) and this was found significantly superior as compared to all other treatments and MEY increased significantly with every increase in the level of nitrogen up to 120 kg/ha during both the years.

Key Words: Seed yield, Weedicides and Nitrogen levels

Introduction

Maize (*Zea mays*) is an important Kharif cereal crop in northern and central part of India. It is the most versatile crop with wider adaptability in varied agro-ecologies. The maize is cultivated throughout the year in different parts of country for various purposes including grain, fodder, green cobs, sweet corn, baby corn, pop corn etc. The malnutrition caused due to short supply of protein calories is posing a serious threat to be the over growing population of developing countries and India is no exception to this fact. Population of India will reach the mark of one billion and sixty-two crores by 2050 (Amar Ujala, 2005). The gap between the requirement and supply of protein has to be bridged at an early date particularly through vegetable source because of the dominating religious and social consideration in the country. Soybean (*Glycine max* L. Merrill) impregnated with 40% protein and 20% oil hold great promise in meeting of the challenge of malnutrition (Sharma, 2007). The understanding by scientists of technical implementation of intercropping, in term of management of fertility and soil moisture and handling of disease and insect problems has helped in recognition of intercropping as a scientific practice which is rather superior to sole cropping (Monyo *et al*. 1976 and Willey, 1979). Weed control under such condition is necessary to take full advantage of other technological advancements in crop production. Weed free environment is now a foreseeable reality for most crops including maize planted in rows for full expression of new varieties, added fertility, irrigation etc. required for higher productivity. In Indian soils nitrogen is most important element which needs region wise standardization. Maize-soybean intercropping deserves all over where in both nitrogen and weed management have not studied simultaneously in agro climatic condition of Agra region.

Material and Methods

The field experiment was conducted during Kharif seasons of 2009 and 2010 with maize-soybean intercropping system at R.B.S. College Agricultural Research Farm, Bichpuri, Agra (U.P.). The experimental soil was sandy loam (Typic ustochrept) containing organic carbon 0.38%, available N 189.7, P_2O_5 29.40 and K_2O 313.00 kg/ha. Experiment was conducted in split plot design with three replications keeping weed control measures in main plots, level of nitrogen in sub plots. The eight weed control measures were applied (W_0-Weedy check, W_1-Hand weeding at 25 DAS, W_2-Oxyfluorfen pre-em. @ 0.100 kg/ha,

Table 1: Effect of weedicides and nitrogen levels on growth parameters and maize equivalent yield

Treatments	Growth Parameters				Grain Yield (kg/ha)						MEY (qu/ha)	
	Maize		Soybean		Maize			Soybean			2009	2010
	Plant height (cm)	Dry matter/ plant(g)	Plant height (cm)	Dry matter/ plant(g)	2009	2010	Pooled	2009	2010	Pooled		
Weed control measures												
(W_0)	134.56	341.57	49.72	67.10	2760.33	2802.50	2781.42	557.71	581.75	569.73	54.91	55.37
(W_1)	149.90	350.49	52.79	71.80	3404.17	3449.00	3426.59	776.90	817.94	797.42	69.19	69.82
(W_2)	153.24	369.82	53.12	74.03	3504.60	3552.75	3528.68	821.19	861.64	841.42	71.59	72.25
(W_3)	166.69	376.07	55.07	80.41	3752.87	3803.25	3778.06	1161.76	1205.78	1183.77	81.33	81.97
(W_4)	156.56	374.00	54.29	76.49	3657.68	3705.75	3681.72	989.40	1031.56	1010.48	76.90	77.53
(W_5)	170.21	380.69	56.14	83.20	3868.43	3921.75	3895.09	1178.15	1222.11	1200.13	83.50	84.17
(W_6)	137.31	348.45	50.96	70.58	3097.68	3141.75	3119.72	754.31	792.89	773.60	63.74	64.39
(W_7)	142.46	360.68	51.79	71.49	3209.43	3254.25	3231.84	771.56	812.38	791.97	65.88	66.53
SEm±	0.23	0.42	0.37	0.22	20.19	6.24	5.85	11.10	12.14	10.00	0.65	0.70
C.D. at 5%	0.70	1.26	1.11	0.66	61.06	18.87	17.68	33.29	36.81	30.33	1.97	2.12
Nitrogen levels												
Control (N_0)	137.81	343.26	50.20	64.89	2135.21	2169.13	2152.17	472.33	494.56	483.45	43.14	43.58
40 kg N ha^{-1} (N_1)	150.62	359.06	53.75	77.33	3333.09	3386.25	3359.67	1002.79	1047.26	1025.03	71.75	72.54
80 kg N ha^{-1} (N_2)	156.97	368.28	53.94	77.59	3930.84	3976.25	3953.55	1011.99	1057.60	1034.80	81.79	82.37
120 kg N ha^{-1} (N_3)	160.06	372.13	54.05	77.74	4228.86	4283.88	4256.37	1018.38	1083.60	1040.99	86.83	87.51
SEm±	0.23	0.23	0.13	0.17	11.94	5.72	8.83	6.48	6.85	5.80	0.46	0.56
C.D. at 5%	0.64	0.65	0.37	0.49	33.85	16.22	25.04	18.37	19.41	17.02	1.30	1.59

W_3-Oxyfluorfen pre-em. @ 0.150 kg/ha, W_4-Pendimethalin pre-em. @ 1.000 kg/ha, W_5-Pendimethalin pre-em. @ 1.500 kg/ha, W_6- Metribuzin pre-em. @ 0.500 kg/ha and W_7- Metribuzin pre-em. @ 0.750 kg/ha) and Four nitrogen levels were applied (N_0, N_{40}, N_{80} and N_{120}). The crop was fertilized with N as per treatment and Phosphorus (60 kg), Potash (40 kg) and Zinc (30 kg) ha^{-1}. Urea (46% N), Single super phosphate (16 % P_2O_5), Muriate of Potash (60% K_2O) and $ZnSO_4$ (21% Zn) were used as the source of N, P_2O_5, K_2O and Zn, respectively. Half dose of N as per treatment and full dose of P_2O_5, K_2O and Zn were applied at the time of sowing as basal blow the seed. The remaining half dose of N was top dressed at knee high stage of maize crop.

Result and Discussion

Growth parameters (Plant height and dry matter)

The maximum plant height (cm) and dry matter per plant (g) were obtained with the application of Pendimethalin pre-em. @ 1.500 kg/ha (W_5). Tuti and Das (2011) have also observed similar results. This treatment was significantly superior as compare to all other treatments during both the seasons. Plant height and dry matter per plant were increased significantly with every increase in the level of nitrogen up to 120 kg/ha in maize crop and in soybean crop both parameters were increased significantly with the application of 40 kg N/ha as compare to control during both the years.

Seed yield

The maximum grain production was obtained by treatment W_5 (Pendimethalin pre-em. @ 1.500 kg/ha). Verma *et al* (2006) have also observed similar results. The second highest yield was recorded in W_3 (Oxyfluorfen pre-em. @ 0.150 kg/ha) from base as well as intercrop. Both treatments were significantly superior over all other treatments. Grain yield increased significantly with every increase in the level of nitrogen up to 120 kg/ha in maize crop and in soybean crop grain yield was increased significantly with the application of 40 kg N/ha as compare to control during two consecutive years and on polled basis.

MEY (Maize Equivalent Yield)

The highest maize equivalent yield was obtained with W_5 (Pendimethalin pre-em. @ 1.500 kg/ha) and this was found significantly superior as compared to all other treatments and MEY increased significantly with every increase in the level of nitrogen up to 120 kg/ha during both the years.

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Effect of nitrogen and seed rate on growth, quality and seed productivity of wheat (*Triticum aestivum* L.)

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Abstract

*A field experiment was conducted during Rabi season of the year 2011-12, at Agricultural farm, Bundelkhand University, Jhansi (U.P.), to find out the effect of different levels of nitrogen, and seed rate on grain yield and other characters on 'K-8020' variety of wheat (*Triticum aestivum *L.) different levels 100, 120 and 140 kg/ha nitrogen and 100, 125 and 150 kg/ha. Seed rate significantly yielded the 100 kg/ha nitrogen and seed rate in grain yield, biological yield. Almost similar result were obtained in case of shoot length, plant height, dry matter (gm.), spike length (cm.), spike ear^{-1}, grain spike^{-1}, 1000 grain weight and harvest index. The application of 140 kg N/ha and 150 kg seed rate/ha was the best combination for getting higher grain yield with its better quality.*

Key word -: wheat, nitrogen (N.), seed rate, grain yield, biological yield.

Introduction

In, India, wheat is the second most important cereal crop after rice, covering an area 25.63 million hectare contributing 68.43 million tones to world's food grain production with the productivity of 27.25q/ha during 2011-12, it is generally cultivated on plains. Plateau as well as hill at altitudes from mean sea level to 3000 m. above sea level. Almost the various Agronomic factors known to augment crop production, the nitrogen have an important role in gating high grain yield of wheat *Kibe et al., 2003.* Keeping in view the above facts the present study was under taken to find out the effect of application of nitrogen and seed rate on grain yield, biological yield and other characters including plant height and 1000 grain weight, and its quality in a national variety 'K-8020' of wheat (*Triticum aestivum* L.) in the Agro. climatic condition of Bundelkhand region (U.P.).

Materials and Methods

The field experiment was conducted at the Agricultural research farm in Institute of Agricultural Sciences, Bundelkhand University, Jhansi during Rabi (winter) season of 2011-12. The treatment comprising of three levels of nitrogen viz- 100, 120 and 140 kg/ha and three graded levels of seed rate viz- 100, 125 and 150 kg/ha were laid-out in randomized block design with three replications each. Thus total number of treatment combination were 09, the grass plot size in the experiment was taken 5X3.6 m=18m^2, whereas the net plot size was 4mX1.80=7.2m^2, row to row spacing was 20 cm, plant to plant spacing 5 cm, no. of rows sown per plot were 8 and no. of rows harvested per plot were 4, urea was the sources of nitrogen. The observation were recorded on number of shoots length, plant height, dry matter, spike length (cm), number of spikes /ear, number of grain /spikes, grain yield, biological yield, straw yield, 1000 grain weight and harvest index. The data was subjected to statistical analysis as per method proposed by *Cochran and Cox 1959*.

Results and Discussion

For the use of proper quality of fertilizers in most essential for enhancing yield and quality important inputs for increasing productivity of this crop, therefore these fertilizer were tried to find their role in wheat crop and the results of present study are discussed character wise.

It is revealed from (Table 1) that all three doses of nitrogen and seed rate kg/ha of wheat had highly significantly effect on the number of shoots/length. The highest number of shoots/length was recorded (102.0) at in 150 kg seed rate/ha which was significantly higher than 100 and 125 kg seed rate/ha, but in case of 125 kg seed rate/ha recorded significantly highest number of shoots/length (94.2) in comparison to 100 kg seed rate/ha. However in case of nitrogen, similar trend of significant increase was observed for number of shoots/length, their number varying from 36.0 to 40.0 with highest increased was observed for number of shoots/length was increased with increasing levels of nitrogen up to 140 kg/ha and there after it was increased numerically. The number of shoots/length was influenced with the combined effect of seed rate and

Table1: Effect of nitrogen levels and seed rate on growth, seed yield and seed quality of wheat (*Triticum aestivum L.*)

Treatments	No. of shoots/ length (cm)	Plant height (cm) 60 day	At harvest	Dry matter (gm.)	Spike length (cm.)	No. of spikes/ear	No. of grains/ spike
Nitrogen (kg/ha)							
100	85.1	36.0	90.0	12.0	7.1	16.0	40.5
120	96.2	38.5	95.1	14.4	7.6	17.5	42.0
140	100.4	40.0	95.4	15.7	7.9	18.5	42.5
SE m±	2.0	1.1	1.1	1.0	0.5	0.4	0.6
CD at 5%	6.1	NS	NS	3.2	NS	1.3	1.8
Seed rate (kg/ha.)							
100	85.3	38.3	92.0	16.0	7.8	18.0	43.5
125	94.2	38.2	92.1	14.4	7.7	17.5	41.0
150	102.0	38.0	93.0	13.0	6.3	16.5	40.0
SE m±	2.0	1.1	1.1	1.0	0.5	0.4	0.6
CD at 5%	6.1	NS	NS	3.2	NS	1.3	1.8

nitrogen levels. This could be on account of various vegetative growths due to greater cell division and more meristematic activity increasing supply of nitrogen for the formation of shoots/length it is well known that nitrogen being the constituent of amino acids, proteins, chlorophyll and protoplast would directly influence the growth and attributing characteristic through better utilization of photosynthesis. These result are in agreement with those obtained by *Palfdey at el., 1999,* who has are ported that the increasing levels of nitrogen increasing plant height, number of shoot length, yield straw and functional leaves per plant, relative growth rate and assimilation retreat all the stages of crop growth.

All the three seed rate of wheat viz- (100, 125 and 150 kg/ha) Table 1 reveals on effect up to a greater extent with the increase in all three seed rate of wheat. After 60 days of sowing the plant height increased significantly up to 150 kg seed rate/ha showing the maximum plant height (38.0 cm.) and 100 and 125 seed rate /ha gave almost similar minimum plant height, where in case of nitrogen application, the plant attained the maximum plant height of (40.0 cm.) at nitrogen levels of 140 kg/ha, after 60 days of sowing. At the harvesting stage, the maximum plant height was recorded (93.0 cm.) in case of 150 kg seed rate/ha and the minimum in 100 and 125 kg seed rate/ha, thus showing clear at effect of 150 kg seed rate increasing on plant growth. These findings are consonance with the reports of *Kumar et al., 2000 and Pandey et al., 1999*. While in case of nitrogen application, the maximum plant height recorded with the application of 140 kg N/ha was (95.4 cm.), which differed significantly from the plant height recorded at 100 and 120 kg N/ha was (90.0 and 95.1 cm.) respectively. Consequently, the main effect of nitrogen plant height during the observation recorded after 60days of sowing and at harvesting stage was found significant. The combined effect of seed rate kg/ha and nitrogen levels kg/ha have showed significantly effect on plant height, the seed rate 150 kg/ha have showed significantly more plant height up to 140 kg N/ha while the plant height of 100 and 125 kg seed rate/ha was increased up to 120 kg N/ha beyond. These findings are comparable with *Pandey at el., 1999,* who stated that plant height, number of shoot length, increased significantly with the increasing levels of nitrogen fertilization.

Concerning dry weight under the studied of three levels of seed rate viz. 100, 125 and 150 kg/ha and nitrogen fertilization levels, viz. 100, 120, and 140 kg/ ha, data of (Table 1) revealed that it is clear from the table that maximum dry matter was recorded (16.0 gm.) in 100 kg seed rate/ha, it was significantly superior comparison of 125 and 150 kg seed rate/ha, and 125 and 150 kg seed rate/ha produced almost similar dry weight (gm.). However in case of application of nitrogen up to 140 kg N/ha recorded significantly higher dry weight (gm.) than 100 kg N/ha, although dry weight with the application of 120 kg N/ha remained at par with 140 kg N/ha, the high dry weight (15.7 gm.) being recorded at 140 kg N/ha level. Henceforth, improvement in the growth and yield attributes of Wheat (*Triticum aestivum* L.) due to nitrogen application was quit logical. The results are in conformity with the findings of *Samiram et al., 1993,* who also reported increased dry weight with increased fertilization of nitrogen.

It is revealed from the data given in Table-1 that different levels of seed rate had considerable effect on length of spike. The height length of spike (7.8 cm.) was recorded in 100 kg seed rate/ha which was significantly higher than the length of spike in other levels of seed rate including 150 kg seed rate/ha. This could be due to the availability of more nutrients for proper development of vegetative parts of plant including spike under higher doses of seed rate kg/ha. These results are in full agreement with those observed by *Kumar at el., 2000*. However, in case of 140 kg

Table 2: Effect of nitrogen levels and seed rate on some traits of wheat

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield(q/ha)	1000-grain weight (g)	Harvest index (%)
Nitrogen (kg/ha)					
100	37.4	66.6	104.0	40.5	35.9
120	40.1	75.1	115.2	42.5	34.8
140	40.5	85.6	126.1	43.0	32.1
SE m±	1.72	2.2	2.8	0.5	0.6
CD at 5%	NS	6.8	8.6	1.5	1.9
Seed rate (kg/ha.)					
100	36.0	69.0	105.0	43.0	34.2
125	40.5	74.7	115.2	42.5	35.1
150	41.0	83.5	124.5	41.0	32.9
SE m±	1.72	2.2	2.8	0.5	0.6
CD at 5%	5.16	6.8	8.5	1.5	1.9

levels of nitrogen, 7.9 cm. length of spike was recorded which was significantly higher than the spike length observed in 100 and 120 kg doses of nitrogen per hectare. These findings are in full agreement to those reported by *Sawires et al., 2011,* who observed that the increasing level of nitrogen not only increased the spike length but also gave higher yield of straw, more functional leaves, high growth rate and higher net assimilation rate at all the stages of crop growth.

The result presented in Table-1 indicated that all the two levels of seed rate kg/ha i.e. 100 and 125 kg/ha gave two significantly higher number of spikes/ear in comparison to 150 kg seed rate/ha. The difference in the number of spikes/ear with the doses of 100 and 125 kg nitrogen/ha were also significant. The highest number of spikes/ear was recorded in (18.0) kg N/ha followed by 100 kg N/ha. These findings are in consonance to result reported by *Singh et al., 2003* and *Smiram et al., 1993*. In case of nitrogen application, 140 kg/ha dose of nitrogen produced highest number of spike/ear followed by 120 kg of nitrogen/hectare. The differences in the number of spike/ear among all the doses of nitrogen including control 100 kg N/ha were significant. The successive increasing the number of spike/ear under varied doses of nitrogen and seed rate may due to availability of more nutrients for proper growth of plant at different stages of wheat crop. These findings are in full agreement to the results reported earlier by *Sawires et al., 2000* and *Kumar et al., 2000.*

Number of grain yield per spike recorded in wheat under three levels of nitrogen application are given in Table-1 which revealed that there were significant difference in the mean values of grain per spike (43.5) was recorded in 100 kg seed rate/ha and lowest (40.0) in case of 150 kg seed rate/ha it was observed that this doses was significantly better over control as well as other doses (125 and 150 kg/ha) of seed rate in increasing the number of grain per spike in other in producing the number of grain per spike. In case of nitrogen, the number of grain per spike recorded in wheat under three doses of nitrogenous fertilizers. The highest number of grains per spike (42.5) was recorded in 140 kg N/ha and lowest (40.5) in case of 100 kg N/ha it was evident that increase in the number of grain/spike with the application of 120 kg N/ha was successive and it amounted 119.45 percent higher over 100 kg N/ha, respectively, similar result were reported by *Lathwal et al., 1992* and *Kibe at el .,2003,* who found that use of higher doses of nitrogen in wheat crop increased the number of grain per spike.

It was observed (Table-2) that there was remarkable increase in seed yield with increase in the doses of seed rate kg/ha against control. The highest grain yield was recorded in 150 kg seed rate /ha (41.0 q/ha) followed by 125 kg seed rate/ha (40.5 q/ha) and the lowest grain yield was recorded by 100 kg seed rate/ha (36.0 q/ha). The increase in grain yield under all the two seed rate kg/ha (125 and 150 kg/ha) was significantly higher as compared to 100 kg seed rate/ha respectively. These findings are in consonance with the reports of *Pandey et al., 1999*, while in case of nitrogen maximum grain yield recorded with the application of 140 kg N/ha was (40.5 q/ha), which was significantly higher than all the three levels of nitrogen. The result are conformity with the findings of *Sawires et al., 2000*, who reported that the treatment doses of 120 kg N/ha were observe highest grain yield as compare to other treatment.

As, for the straw yield q/ha, the highest value of (83.5 q/ha) was obtained at 150 kg seed rate/ha showing a significant increase with the increasing dose of seed rate kg/ha. The various straw yields attributes like higher grain yield showed their additive effect in influencing the straw yield with increasing rate of seed rates kg/ha ultimately all these straw yield attributes had their pronounced effect in significantly increasing the straw yield of wheat at higher rates of nitrogen application up to 150 kg N/ha. These results are in accordance with the early research workers working

on wheat *Palfdey et al., 1999*, who also reported that increased straw yield with the increased straw yield with increased seed rate kg/ha. Comparing the straw yield q/ha, under the nitrogen rates, data presented in Table-2 showed that the highest straw yield q/ha (85.6 q/ha) was obtained under 140 kg N/ ha level. Thus, the straw yield q/ha increased significantly with a successive increase in levels of nitrogen fertilization, similar to seed rate. The reason being straw yield of wheat is chiefly a product of yield attributing characters like grain weight per year. Consequently, the increase in other yield attributing characters due to nitrogen fertilization resulted in increase straw yield q/ha of wheat. These results confirm the findings of *Kumar et al., 2000*.

The result presented in Table-2 showed that all the three levels of seed rate viz- 100 and 125 kg/ha gave significantly higher biological yield over 100 kg N/ha it was farther clear from the seed rate 150 kg/ha has yielded significantly higher biological yield (124.4 q/ha) in compared to 100 and 125 kg seed rate/ha respectively similarly, seed rate 125 kg/ha has also given significantly higher biological yield (115.2 q/ha) in compare to 100 kg seed rate/ha respectively. These results are in agreement with those obtained by *Samira et al., 1993*. However in case of nitrogen application the biological yield was increased with increasing doses of nitrogen up to 140 kg N/ha (126.1 q/ha). The biological yield kg/ha was significantly influenced by seed rate and nitrogen doses in which seed rate of 150 kg/ha produces significantly the maximum biological yield (115.2 q/ha) at 120 kg N/ha. The results are in conformity with the findings of *Singh et al., 2003* and *Palfdey et al., 1999*.

The seed weight of wheat under three levels of seed rate i.e. 100, 125, 150 kg/ha and three studied nitrogen fertilization rates as shown in (Table-2) showed significant increase with the increase in seed rate of 100, 125 and 150 kg/ha. The highest 1000 seed weight (43.0) was recorded with 100 kg seed rate/ha which was significantly higher than 125 and 150 kg seed rate/ha and lowest 1000 seed weight recorded (41.0) in case of 150 kg seed rate/ha, respectively where as crop fertilized with 140 kg N/ha was influenced significantly over control and produced highest 1000 grain weight of (43.0) however, 1000 grain weight recorded with the application of 100 and 120 kg N/ha remained at per. This significant influence of different levels of nitrogen fertilization over the lower levels was observed because of nitrogen formation of plant height and shoot length under higher rates of nitrogen. Those results are in full agreement with those observed by *Samiram et al., 1993*, who observed that the increasing levels of nitrogen not only increased the 1000 seed weight but also gave higher yield of straw, more functional leaves, high growth rate and higher net assimilation rate at all the stage of growth.

The data given Table-2 revealed that all the three seed rate kg/ha of wheat. The seed rate of 125 kg/ha gave significant higher harvest index (35.1 %) as compared to 100 and 150 kg seed rate/ha and the lowest harvest index was founded (32.9 %) in seed rate of 150 kg/ha respectively. The data revealed that all the three levels of nitrogen gave significantly higher harvest index as compared to 140 kg levels of nitrogen. The use of 100 kg N/ha gave significantly higher harvest index (35.9 %) over other two doses i.e. 120 and 140 kg N/ha. The difference in the harvest index between 120 kg N/ha was non-significant. The value of harvest index in 140 kg/ha of nitrogen was at per with the harvest index value of all the other two levels of nitrogen similar result were reported by *Sawires et al., 2000,* who reported that harvest index, dry weight and shoot length increased significantly with increasing levels of nitrogen fertilization.

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A study of HIV/AIDS awareness among women of agra slum

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Abstract

The HIV/AIDS epidemic is one of the most important and urgent public health challenges facing government and society around the world. Demographically the second largest country in the world, India has also the third largest number of people living with HIV/AIDS. AIDS was at first taken as a problem of homosexual men, then "became" a disease, which affected men only. Today, women and children are the center of concern. It is now estimated that almost half of all infected adults are women. A rise in the infection of women means an increase in the infection of infants born to them. This means greater impact of the disease on women and children in particular, and society as a whole. Therefore it was essential to know the level of awareness about HIV/AIDS among women of Agra slum. So to find out the level of awareness about HIV/AIDS the researcher conducted the present study among women of 18-45 year age group. It was concluded from the study that majority of the respondents have high level of awareness regarding causes of AIDS and precautions to be taken against AIDS. Maximum number of respondents is not aware about the symptoms of AIDS. Overall figures reveal that majority of the respondents have high level of awareness regarding HIV/AIDS.

Keywords: HIV/AIDS, Awareness, Slum

Introduction

Acquired Immune Deficiency Syndrome (AIDS), as it is popularly known as, is the new scourge of the last two decades of the twentieth century. The situation regarding HIV/AIDS in the world is dramatic. Since the beginning of the epidemic 34 million people are living with HIV/AIDS; 25 million of them are to be found only in Africa, South of Sahara. 18.8 million have died of AIDS and 13.2 million children have become orphans (UNAIDS 2000). At the end of 2008, there are 33 million ''people living with HIV/AIDS (PLHA)'', with 25 million AIDS-related deaths reported in the last 25 years. The situation of AIDS in Asia is as a 'ticking bomb' with scarce statistics and perspectives, considering the potential catastrophes of India and china.

India has a population of one billion, around half of whom are adults in the sexually active age group. The first AIDS case in India was detected in 1986 and since then HIV infection has been reported in all states and union territories. Demographically the second largest country in the world, India has also the third largest number of people living with HIV/AIDS. As per the provisional HIV estimate of 2008-09, there is an estimated 22.7 lakh people were living with HIV/AIDS in India. HIV has spread rapidly from urban to rural areas and from high-risk groups to the general population. Statistics reveal that it is the productive workforce between the ages of 15-44 that is most affected and comprises 87.7% of the HIV infection in India.

India's socio-economic status, traditional social ills, cultural myths on sex and sexuality and a huge population of marginalized people make it extremely vulnerable to the HIV/AIDS epidemic. In fact, low level of awareness also gave rice to the problem. Balk et al (1993) reported in their study that only 17% of married women of reproductive age had heard of AIDS. Even among those who had heard of AIDS, only about one fourth had understanding of how the disease is transmitted. Despite low level of awareness and knowledge, the findings indicated a strong positive correlation between knowledge of AIDS and condom use.

Shah (2003) in his "Technical paper on gender vulnerabilities and HIV/AIDS" found a link between literacy and awareness about HIV/AIDS notes that awareness level among women and rural women in particular. Low awareness levels have resulted in misconceptions, fears, doubts and negatively.

So it is very important for the women to be aware of the prevention method of HIV/AIDS. In the absence of a vaccine or a cure, prevention is the most effective strategy for the control of HIV/AIDS. For this purpose the present study entitled "A study of HIV/AIDS awareness among women of Agra slum" was undertaken to know the level of awareness regarding HIV/AIDS among selected women.

Research Methodology

Research design used for the present study was exploratory research design. The study was conducted in Agra district. There are 19 health posts functioning in Agra district for implementation of health programmes

in slum areas, known as D-type health center.

For investigation purpose out of these 19 D-type health centers the researcher selected 2 D-type health centres on random bases, namely Lady Lyall and shahganj-I.

Each D-type health center covers within it a number of slums. Accordingly the D-type health centers selected the following numbers of slums-Lady Lyall has 10 slums and shahgnaj-I has 20 slums.

For purpose of investigation from each selected D-type health center one slum was taken randomly. The selected slums were "Gokul pura" from Lady Lyall health center and "Ashok Nagar, sindhi colony" from shahganj-I health centre.

Sample of 60 women who belonged to the reproductive age group (18-45) years from two slums namely "Gokul pura" and "Ashok Nagar, sindhi colony" were selected randomly.

At the reproductive stage women are more vulnerable for getting HIV/AIDS because they face many problems related to health and sexual relations. During the reproductive age infection of women also means an increase in the infection of infants born to them. So it is important that the women in the reproductive age group should be made aware regarding HIV/AIDS.

The data was collected from primary as well as secondary sources. Secondary data was collected from different libraries, organization, agencies and Internet etc. Primary data was collected through a well constructed interview schedule.

After the collection of data, it was tabulated and was subjected to statistical analysis i.e. class interval and percentage.

Results and Discussion

The results obtained were thoroughly examined, interpreted and discussed with all care. After statistical analysis the results have been presented under the following heads:

1. Awareness about different aspects of HIV/AIDS

The distribution of respondents regarding their awareness about different aspects of HIV/AIDS has been furnished in the following manner:

Table 1A: Awareness regarding basic facts about HIV/AIDS N = 60

S. No.	Score	Awareness Number	Percentage
1.	(High) 13-18	10	16.67
2.	(Medium) 7-12	31	51.67
3.	(Low) 0-6	19	31.66
	Total	60	100.00

Table 1A. shows that majority of the respondents (51.67%) received medium level scores regarding general information about HIV/AIDS. Only 16.67% respondents received high level of scores.

The correct responses given by the respondents have been given in table 1B. shows the awareness of respondents regarding causes of AIDS. The various causes for which respondents were aware that AIDS can be transmitted by unprotected sexual contact (73.33%); by transfusion of infected blood and shared use of infected needles and syringes (71.67%); and by infected mother to her unborn child (70%).

There were respondents who were aware that AIDS cannot be transmitted by shaking hands with infected persons (71.67%); by shared use of utensils and clothes of infected person and by sitting and walking with infected persons 66.67%. While 68.34%, 65% and 63.34% of the respondents respectively were aware that AIDS cannot be transmitted by donating blood, by caring for HIV positive person and bites by pets. Only 48.33% respondents were aware that AIDS can not be transmitted by coughing, sneezing and by touching the tears of infected person. Thus it can be seen that majority of the respondents were aware about causes of AIDS by which it can be transmitted or not.

A person infected with AIDS usually shows the following symptoms: - continuous weight loss, fever for long duration, dry cough, diarrhoea and general itchiness. But only these symptoms may not finally lead a person to the detection of AIDS. A person really suffering from AIDS can only be confirmed by medical test.

In table 1C. the responses reveal that a few percentages of respondents were aware regarding the symptoms of AIDS, because these are not confirmed symptoms of AIDS, these are general symptoms that may lead a person to get himself tested.

Results show that 45% of the respondents were aware that fever for long duration may lead a person to detect that he/she may be suffering from AIDS along with other symptoms.

38.33% of the respondents reported that highly weight loss shows that a person may be infected with AIDS. Only 11.67%, 10% and 8.35% of the respondents receptively reported that diarrhoea, dry cough and general itchiness may also lead a person to detect that a person may be infected with AIDS.

Maximum numbers of respondents did not know about the symptoms that may lead a person to detect and go for confirm test regarding AIDS.

Table 1D. depicts the awareness of respondents about the precautions to be taken against getting infection with AIDS. Most of the respondents (73.33%) were aware that to protect themselves against HIV/AIDS a person should have sexual intercourse with only one uninfected person, avoid sex with people who have many partners; needles and syringes should be sterilized before use and blood tested before transfusion.

About 71% of the respondents were aware that to prevent themselves against HIV/AIDS never to

Table 1B: Awareness regarding causes of HIV/AIDS N = 60

S. No.	Questions	Responses Yes(%)	No(%)	Do not know(%)	Total No. of respondents	Correct Responses
1.	Transmitted by unprotected sexual contact	44(73.33)	0(0)	16(26.67)	60(100)	Yes
2.	By shaking hands with infected person	0(0)	43(71.67)	17(28.33)	60(100)	No
3.	By shared use of utensil and clothes of infected person	1(1.67)	40(66.67)	19(31.66)	60(100)	No
4.	By caring for HIV positive person	2(3.33)	39(65)	19(31.67)	60(100)	No
5.	By transfusion of infected blood	43(71.67)	0(0)	17(28.33)	60(100)	Yes
6.	By donating blood	2(3.33)	41(68.34)	17(28.33)	60(100)	No
7.	By shared use of infected needles and syringes	43(71.67)	0(0)	17(28.33)	60(100)	Yes
8.	Bites by pets	5(8.33)	38(63.34)	17(28.33)	60(100)	No
9.	By coughing, sneezing and tears of infected person	13(21.67)	29(48.33)	18(30)	60(100)	No
10.	By infected mother to her unborn baby	42(70)	1(1.67)	17(28.33)	60(100)	Yes
11.	By sitting and walking with infected person	2(3.33)	40(66.67)	18(30)	60(100)	No

Table 1C: Awareness regarding the symptoms leading to the detection of HIV/AIDS N = 60

S. No.	Questions	Responses Yes(%)	No(%)	Do not know(%)	Total No. of respondents	Correct Responses
1.	Weight loss of over 10%	23(38.33)	1(1.67)	36(60)	60(100%)	Yes
2.	Fever for longer than 1 month	27(45)	0(0)	33(55)	60(100%)	Yes
3.	Dry cough of longer than 1 month	6(10)	6(10)	48(80)	60(100%)	Yes
4.	Diarrhoea for longer than 1 month	7(11.67)	7(11.67)	46(76.66)	60(100%)	Yes
5.	General itchiness	5(8.33)	7(11.67)	48 (80)	60(100%)	Yes

Table 1D: Awareness regarding precautions to be taken against infection of HIV/AIDS N = 60

S. No.	Questions	Responses Yes(%)	No(%)	Do not know(%)	Total No. of respondents	Correct Responses
1.	Sexual intercourse with only one uninfected person	44(73.33)	0(0)	16(26.67)	60(100)	Yes
2.	Avoid sex with people who have many partners	44(73.33)	0(0)	16(26.67)	60(100)	Yes
3.	Make sure that needles and syringes are sterile before use	44(73.33)	0(0)	16(26.67)	60(100)	Yes
4.	Never share needles and syringes	43(71.67)	0(0)	17(28.33)	60(100)	Yes
5.	Make sure that blood is tested before transfusion	44(73.33)	0(0)	16(26.67)	60(100)	Yes
6.	Avoid being pregnant if infected with HIV	43(71.33)	0(0)	17(28.33)	60(100)	Yes

share needles and syringes and to avoid being pregnant if one is infected with HIV/AIDS.

Thus maximum numbers of respondents were aware about precautions to be taken against infecting from HIV/AIDS.

2. Level of awareness regarding HIV/AIDS

Table 2: Level of awareness regarding HIV/AIDS
No = 60

S. No.	Score	Awareness Number	Percentage
1.	High (43 - 64)	33	55.00
2.	Medium (22 - 42)	11	18.33
3.	Low (0 - 21)	16	26.67

Till now the researcher has discussed the awareness regarding various aspects of HIV AIDS. The following table shows the total level of awareness (all aspects included) achieved by the respondents regarding HIV/AIDS. The result has being presented in Table 2.

Table 2 shows that majority (55%) of the respondents had high level of awareness about HIV/AIDS and 26.67% had low level of awareness. while only 18.33% were found having medium level of awareness.

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Effect of levels and methods of boron application on growth and yield of cauliflower (*Brassica oleracea* L. *var. botrytis*) Cv. Snowball-16

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Abstract

*A field experiment was carried out at Shri F.H. (P.G.) College, Agricultural Research Farm, Nidhauli Kalon Etah during winter season with four levels of boron (5, 10, 15 and 20 Kg ha^{-1}) and three methods of boron application (Full through soil, Full through foliar spray and 1/2 through soil + 1/2 through foliar spray) in randomized block design having 12 treatment combinations on cauliflower (*Brassica oleracea *L.* var. botrytis*) Cv. Snowball. The results indicated that the all growth parameters (highest plant height, maximum diameter of stem, maximum spread of plant, minimum days of start of curd initiation and days to the completion of curd formation) were noted with B_3M_2 (15 kg ha^{-1} boron through foliar spray) combination. Whereas the treatment combination of B_2M_3 (10 kg ha^{-1} boron by 1/2 through soil+1/2 through foliar spray)was found as the best treatment combination in respect to maximum fresh weight of whole plant less root (742.25 q ha^{-1}) and highest yield of trimmed curd (310.83 q ha^{-1}) as compared to all other treatment combinations.*

Key Words: Boron, Growth, Yield, Cauliflower

Introduction

Cauliflower (*Brassica oleracea* L. *var. botrytis*) is the most important member of cruciferae family and also it is cole crop of vegetable which is grown under varying agro-climatic condition in India. In cauliflower the edible curd is made up of abortive flower, the stalks of which are short fleshy and closely crowded. Cauliflower is a good source of vitamin A and C. It contains minerals likes phosphorus, calcium, potassium, sodium and iron. There is a need to increase overall production to meet the inflating demand. This can be accomplished either by increase in area under cultivation or raising the productivity. Deepa *et al*. (2005).

Boron is one of the essential micro nutrients needed by the crop plants for their normal growth. It become toxic, when it exceeds a particular limit and cause several physiological disorder and disease. It is associated with meristematic activity, auxin, cell wall, protein and pectin metabolism, fruiting and phenalase inhibitors. Boron is closely related to the function performed by calcium in the plant. It has also reported that boron in necessary for the lignin polymerization process (Prasad *et al*. 2000). The deficiency of boron caused reduction in plant growth, leaf were curled, leathery and less in number, curd information was delayed which turned dirty pale to brown in colour (Mitra, 1990).

Material and Methods

A field experiment was conducted during the rabi season at the Agricultural Research Farm of Shri F.H. (P.G.) College, Nidhauli Kalan, Etah. The Research Farm is situated about 11 km. away from south west of Etah city on Nidhauli Kalan road. It lies between 27^0.10 N latitude and 77^0.5 E longitudes at an elevation of about 168.0 m above mean sea level. The average annual rainfall of this region is 700 mm, about 78% of rainfall which is received from fortnight June to September and remain occasional showers also occur during winter and summer (Oct-Mar). May and June are the hottest months of the year and maximum temp. range between 42.0-48.5^0 C, while January and December are the coldest months with minimum temperature.

The experimental soil was sandy loam (Typic ustochrept) poor in nitrogen, moderately rich in phosphorus fairy rich in potash content with slightly alkaline in reaction. The experiment was laid out in randomized block design having 12 treatment combinations i.e. 4 levels of boron viz. B_1-5, B_2-10, B_3-15 and B_4-20 kg ha^{-1}along with 3 methods of application viz. M_1-Full through soil, M_2-Full through foliar spray and M_3-1/2 through soil + 1/2 through foliar spray and also an uniform application of 200:60:60 kg ha^{-1} NPK (as a recommended dose) was supplied

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Table 1: Growth and yield parameters of cauliflower as affected by various treatment combinations.

Treatment combinations	Height of plant (cm)	Diameter of stem (cm)	Spread of plant (cm)	Days of start of the curd initiation	Days to the completion of curd formation	Fresh wt. of whole plant less root (q ha^{-1})	Yield of trimmed curd (q ha^{-1})
B_1M_1	47.85	1.90	34. 83	84.66	94.66	488.33	230.83
B_1M_2	49.38	2.11	36.78	84.33	94.33	526.67	235.83
B_1M_3	50.27	1.90	35.20	83.33	93.66	590.42	283.33
B_2M_1	45.84	2.04	35.96	82.66	91.33	646.58	235.83
B_2M_2	48.19	2.05	44.66	83.33	89.66	709.58	285.33
B_2M_3	46.50	2.30	46.46	83.33	89.00	742.25	310.83
B_3M_1	48.84	2.38	45.12	83.66	88.66	721.92	267.67
B_3M_2	50.88	2.67	46.56	83.00	87.33	595.25	310.00
B_3M_3	44.64	2.12	39.68	83.66	87.66	610.83	266.67
B_4M_1	41.84	2.57	45.25	83.33	93.33	601.42	262.92
B_4M_2	41.78	2.28	40.83	84.00	92.00	721.00	262.50
B_4M_3	50.33	2.54	33.72	84.00	91.33	547.67	252.50
SEm ±	1.52	0.09	0.97	0.84	1.73	39.88	15.05
CD at 5%	4.44	0.35	2.75	NS	NS	116.41	45.78

through urea, single super phosphate and muriate of potash, respectively. The half dose of urea and full dose of single super phosphate and muriate of potash were applied as basal dressing. The remaining quantity of urea was applied as top dressing after one month of transplanting. In case of soil application, boron was applied as basal dressing and for foliar spray it was applied at crop age of 30 days in the field.

Results and Discussion

Table 1 showed that the growth and yield parameters were affected significantly due to the different levels and methods of application of boron except days of start of curd initiation and days to completion of curd formation. Highest plant height (50.88 cm) was obtained with B_3M_2 combination and it was closely related with B_4M_3 and B_1M_3 combinations but this combination was found significantly superior only over B_2M_1, B_3M_3, B_4M_1 and B_4M_2 combinations. Whereas maximum diameter of stem (2.67 cm) was noted with B_3M_2 combination over all combinations but this was found at par with B_4M_1, B_4M_3 and B_3M_1 combinations. Although the maximum spread of plant (46.56 cm) was recorded with B_3M_2 combination and closely followed by B_2M_3 combination but this combination was found at par with B_4M_1, B_3M_1 and B_2M_2 combinations. Same report given by (Shanmugaula, 1989). The days of start of curd initiation and days to the completion of curd formation were influenced with different combinations but these were not found significant.

The data presented in Table 1 also indicated that the maximum fresh weight of whole plant less root was observed with B_2M_3 combination and this was closely followed by B_3M_1 and B_4M_2 combinations as well as this was found significantly superior only over B_1M_1 combination. Chakrabarty and Shyam (1992) have also observed similar results. However the highest yield of trimmed curd was noted with B_2M_3 combination and also closely followed by B_3M_2 combination but this was found statistically at par with B_1M_3, B_2M_2, B_3M_1 and B_3M_3 combinations. Pandey *et al*. (1974) also observed that curd yield of cauliflower significantly influenced by the levels of boron.

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Effect of type of milk, coagulants with concentration and coagulation temperature on sensory quality of paneer

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Abstract

Paneer, prepared from standardized buffalo (6% fat, 9% SNF), cow (4% fat, 8.5% SNF) and mixed milk (5% fat, 8.7% SNF) using two different coagulants, viz. citric acid and lactic acid at 1 and 2% concentrations each and coagulated at 80^0 and 85^oC , was assessed for sensory quality on a 9-point hedonic scale. The paneer samples made from buffalo milk using one per cent citric acid at 80^oC coagulation temperature elicited maximum scores for appearance, flavour, body and texture and overall acceptability, followed by paneer made from mixed milk using same processing parameters. The minimum sensory and overall acceptability scores were obtained for cow milk. However, a good quality paneer could also be prepared from cow milk using one per cent citric acid at 80^oC coagulation temperature.

Key words : Coagulants, coagulation temperature, sensory quality, paneer

Introduction

The market for value added Indian dairy products has been growing at very rapid pace. This development marks the second wave of India's White Revolution, which is transforming the face of dairy industry. The first wave made India the world's biggest milk producer and the biggest market. The second wave is boosting the organized sector and will make it a prominent segment of the industry.

During recent years, paneer, a heat-cum-acid coagulated product, has become extremely popular because of its high nutritive value, taste and excellent frying characteristics. Paneer contains almost all the proteins and fats of milk besides an adequate amount of minerals and fat soluble vitamins. It is an ideal food for expectant and nursing mothers, infants, growing children, adolescent and adults, being rich source of energy and animal proteins. It is an excellent source of all essential amino acids to the vegetarians. With its high protein and low sugar content, it could also be recommended to diabetic persons. Generally, the buffalo milk is best suited for paneer manufacture but good quality of paneer could also be made from cow or mixed milk with suitable treatments and/or modifications. The present study was undertaken to assess the influence of different types of milk alongwith different coagulants, their concentration and various coagulation temperatures on the sensory quality of paneer with a view to standardize the process.

Materials and Methods

Procurement of milk

The buffalo and cow milk were procured from established farms and standardized to 6.0 per cent fat and 9.0 per cent SNF, and 4.0 per cent fat and 8.5 per cent SNF, respectively. The mixed milk was prepared by mixing 50 per cent buffalo milk and 50 per cent cow milk and standardized to 5.0 per cent fat and 8.7 per cent SNF for preparation of paneer.

Coagulants, concentration and coagulation temperature

Two coagulants, *viz.* citric acid and lactic acid at 1 and 2% concentration each were used for coagulating milk at two different temperatures, namely, 80^o and 85^oC for preparation of paneer from each type of milk.

Preparation of paneer

The paneer was prepared as suggested by Bhattacharya *et al.* (1971) and subsequently modified by Sachdeva (1983) with further modification as per requirement.

The standardized cow, buffalo and mixed milk were heated to 100^oC for 5 minutes and then cooled to 80^oC or 85^oC. Citric acid or lactic acid (1 and 2 per cent) were added to milk at 80^o or 85^oC. The milk was agitated continuously till clear whey separated out. The curd was left for 5-10 minutes in the whey without agitation. The whey was then drained through muslin cloth and the coagulated mass was pressed in a a hoof by applying pressure at 2 kg/cm^2. It was then dipped in chilled water for one hour and packaged in LDPE sachets.

Sensory evaluation: A 9-point hedonic scale was used to evaluate the flavour, body and texture, appearance and general acceptability of paneer by a selected panel (BIS, 1971).

Results and Discussion

The paneer samples prepared from different types of milk using citric acid and lactic acid as coagulants at two coagulation temperatures were assessed for sensory quality by a panel of judges in

terms of flavour, body and texture, appearance and overall acceptability. The flavour score of paneer has been laid down in Table 1.

The results (Table 1) indicated that the maximum flavour score (8.45)

was noted for paneer made from buffalo milk (A_1), followed by paneer made from mixed milk (8.15) and the minimum (7.85) from that of cow milk. The concentration of coagulants also affected the flavour score of paneer, being maximum in paneer (8.4) prepared with citric acid at one per cent level (B_1) and minimum in paneer (7.90) prepared using 2 per cent lactic acid (B_4) coagulants. As regards the coagulation temperature, the highest flavour score of paneer (8.25) was found at 80°C (C_1) and minimum score (8.05) at 85°C coagulation temperature (C_2).

Body and texture: The paneer samples prepared from buffalo milk (A_1) elicited maximum (8.35) body and texture score, followed by mixed milk (8.05) and cow milk (7.75). The data in Table 2 further indicated that one per cent concentration of citric acid (B_1) yielded maximum score (8.30) for body and texture, while 2 per cent citric acid (B2) and one per cent latic acid (B_3) yielded almost similar scores but 2 per cent lactic acid (B_4) produced minimum score (7.90) for body and texture, which are important attributes of paneer and form basis for acceptance of the product with regards to frying characteristics.

Appearance: The results (Table 3) revealed that the maximum score for appearance of paneer (8.20) was noted in buffalo milk (A_1) and minimum (7.85) in cow milk (A_3). The paneer from mixed milk (A_2) was slightly superior to cow milk paneer (7.95 score). Different coagulants and their concentrations affected the appearance of product to some extent. One per cent citric acid (B_1) elicited the best product, two per cent citric acid (B_2) or one per cent lactic acid (B_3) produced almost comparable products but two per cent lactic acid (B4) yielded a little inferior product (7.70 score).

The coagulation temperature, 80°C (C_1) yielded better appearance score (8.05) than 85°C (C_2) temperature (7.82). The various parameters (type of milk,

Table 1: Effect of different types of milk, coagulants with concentration and temperature of coagulation on flavour score of paneer.

	B_1	B_2	B_3	B_4	C_1	C_2	Mean
A_1	8.70	8.40	8.50	8.20	8.55	8.35	8.45
A_2	8.40	8.10	8.20	7.90	8.25	8.05	8.15
A_3	8.10	7.90	7.80	7.60	7.95	7.75	7.85
B_1					8.50	8.30	8.40
B_2					8.20	8.00	8.10
B_3					8.30	8.10	8.20
B_4					8.00	7.80	7.90
Mean					8.25	8.05	

A_1 Buffalo milk, A_2 Mixed milk, A_3 Cow milk, B_1 Citric acid (1%), B_2 Citric acid (2%), B_3 Lactic acid (1%), B_4 Lactic acid (2%), C_1 Coagulation temperature (80°C), C_2 Coagulation temperature (85°C).

	A	B	C	AB	AC	BC
SE(d)	0.00204	0.00238	0.00167	0.00408	0.00289	0.00333
CD at 5%	0.00410	0.00474	0.00335	0.00820	0.00580	0.00870

Table 2: Effect of types of milk, coagulants with concentration and temperature of coagulation on body and texture score of paneer

	B_1	B_2	B_3	B_4	C_1	C_2	Mean
A_1	8.60	8.30	8.40	8.10	8.45	7.25	8.35
A_2	8.30	8.00	8.10	7.80	8.15	7.95	8.05
A_3	8.00	7.70	7.90	7.50	7.85	7.65	7.75
B_1				8.40	8.20	8.30	
B_2				8.10	7.90	8.00	
B_3				8.20	8.00	8.10	
B_4				7.90	7.70	7.90	
Mean					8.15	7.95	

A_1 Buffalo milk, A_2 Mixed milk, A_3 Cow milk, B_1 Citric acid (1%), B_2 Citric acid (2%), B_3 Lactic acid (1%), B_4 Lactic acid (2%), C_1 Coagulation temperature (80°C), C_2 Coagulation temperature (85°C).

	A	B	C	AB	AC	BC
SE(d)	0.00409	0.00473	0.00334	0.00819	0.00579	0.00888
CD at 5%	0.00823	0.00950	0.00672	0.001646	0.1164	0.01344

Table 3: Effect of different types of milk, coagulants with concentration and temperature of coagulation on appearance score of paneer

	B_1	B_2	B_3	B_4	C_1	C_2	Mean
A_1	8.33	8.20	8.30	8.00	8.35	8.06	8.20
A_2	8.20	7.90	8.00	7.70	8.05	7.85	7.95
A_3	7.80	7.60	7.70	7.40	7.75	7.55	7.85
B_1				8.30	7.98	8.14	
B_2				8.00	7.80	7.90	
B_3				8.10	7.90	8.00	
B_4				7.80	7.60	7.70	
Mean					8.05	7.82	

A_1 Buffalo milk, A_2 Mixed milk, A_3 Cow milk, B_1 Citric acid (1%), B_2 Citric acid (2%), B_3 Lactic acid (1%), B_4 Lactic acid (2%), C_1 Coagulation temperature (80°C), C_2 Coagulation temperature (85°C).

	A	B	C	AB	AC	BC
SE(d)	0.03565	0.04116	0.02911	0.07130	0.05041	0.05821
CD at 5%	0.07168	0.08276	0.05852	0.14335	0.10136	0.31705

coagulant, concentration and coagulation temperature) had significant ($p<0.01$) effect on quality of paneer.

Overall acceptability: The results on overall acceptability (Table 4) of the product, based on individual data for appearance, flavour, body and texture as compiled in Table4 suggested that maximum overall acceptability score (8.80) was obtained for paneer made from buffalo milk coagulated with one per cent citric acid at 80°C temperature ($A_1B_1C_1$), followed by mixed milk paneer (8.50) using same parameters of coagulant, concentration and coagulation temperature ($A_2B_1C_1$). The minimum overall acceptability score (7.50) was obtained for cow milk coagulated with 2 per cent lactic acid at 85°C temperature ($A_3B_4C_2$). However, a good lquality paneer could also be prepared from cow milk using one per cent citric acid as coagulant at 80°C temperature ($A_3B_1C_1$).

Table 4: ABC Mean for overall acceptability of paneer

		C_1	C_2
A_1	B_1	8.80	8.60
	B_2	8.50	8.30
	B_3	8.60	8.40
	B_4	8.30	8.10
A_2	B_1	8.50	8.30
	B_2	8.20	8.00
	B_3	8.30	8.10
	B_4	8.00	7.90
A_3	B_1	8.20	8.00
	B_2	7.90	7.70
	B_3	8.00	7.80
	B_4	7.80	7.60

The above results brought out clearly that best quality paneer was prepared from buffalo milk (6 per cent fat and 9 per cent SNF) using citric acid as coagulant at one per cent concentration and 80°C coagulation temperature. Ramasamya *et al.*(1997) also reported that best quality paneer could be obtained by using buffalo milk having 6.0% fat. Shukla *et al.* (1984) and Pal and Yadav (1991) also observed that mixture of cow and buffalo milk in 1:1 ratio with 5 per cent fat yielded superior quality paneer than cow milk alone. Such reports corroborate the results of present investigation. Further, a coagulation temperature of 80°C and one per cent concentration of citric acid have been found optimal for making good quality paneer from buffalo milk (Shukla *et al.,* 1984; Sachedeva and Singh, 1988). These reports support the present data.

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Performance of system of rice intensification (SRI) through front line demonstrations in Umaria district of Madhya Pradesh

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Abstract

The front line demonstrations were conducted on farmers field at Umaria district during kharif *season 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. SRI. The result of front line demonstration showed a greater impact on farmers due to significant increase in crop yield, higher than FP. The economics and benefit cost ratio of both farmers practice and recommended practice plots were worked out. An average of RS. 34349/ha was recorded net returns under recommended practice while it was Rs. 17571/ha under farmers practice. Benefit cost ratio was 2.81 under recommended practice, while it was 2.01 under farmers practice. By incorporating proven technologies of SRI, yield potential and net income from rice cultivation can be enhanced to a great extent with increase in the income level of the farming community of the district.*

Key Words: Front Line Demonstration, SRI, Yield, BC ratio

Introduction

System of rice intensification (SRI), an emerging water saving technology, was developed by Fr. Henri De Laulanie, a French priest with a background in agriculture in Madagascar during 1980's. This method of rice cultivation involves the set of certain management practice for plant, soil, water and nutrient, which provide better growing conditions for rice plants especially in the root zone than those for plants grown under traditional practices. SRI appears to be a viable alternative that not only saves the inputs, but also improves soil health and protects the environment sustainability. SRI technology needs less seed, water, chemical fertilizers and pesticides but yields more with large root volume, profuse and strong tillers with longer panicles, more and well-filled spikelets with high grain weight. The potential benefits of SRI are being tested now in predominately rice growing countries like India, China, Indonesia, Cambodia, Thailand, Cuba, Bangladesh and Sri Lanka.

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.

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 1.8 t/ha, which is much below the national productivity (2.1 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.

The productivity of rice in the district can be increase by following the appropriate agronomic practices along with high yielding rice varieties. Thakur *et al* (2009) suggested that the system of rice intensification (SRI) holds a great promise in increasing the rice productivity. 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. whereas farmers are using old seeds of IR-64 or local varieties, transplanting old age seedling (30-45 days old), closer spacing (3-4 seedlings/hill with higher seed rate i.e. 30-35 kg/ha), submerged the soil entirely crop season, poor weed management and insufficient supply of nutrients. Hence, an effort made by the KVK scientists by introducing the SRI system of rice

production with HYV MTU-1081 through front line demonstration on farmers field during *kharif* season of 2010 and 2011.

Material 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* season 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 recommended practice (RP) constituted growing of the rice nursery on *puddled* raised beds of 10mx1.5m with half meter wide irrigation cum drainage channel around the beds. Sprouted seeds of high yielding rice variety MTU-1081 (medium duration) 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/vermicompost and remaining 75% through chemical fertilizers i.e. Urea, DAP and MOP) supplied. The demonstration plots were kept moist throughout the vegetative growth phase 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 to increase the soil aeration.

Farmer's practice (FP) constituted the application of high seed rate (30 kg/ha), planting of old seedling (30-45 DAS), closer planting (3-4 seedlings/hill), not adopting the line sowing, imbalance and insufficient supply of nutrients (50:30:0 kg NPK/ha), submerged the rice field throughout the crop season, one hand weeding between 30-50 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 returns and benefit cost ratio were computed and finally the extension gap, technology gap and technology index were worked out. To estimate the technology gap, extension gap and technology index, following formula have been used.

$$\text{Technology Index} = \frac{(Pi-Di)}{Pi} \times 100$$

Where,

Pi- Potential yield of i^{th} crop

Di- Demonstration yield of i^{th} crop

Results and Discussion

Yield attributes and biomass yield analysis:

The yield performance and economic indicators are presented in Table-1. The yield attributing characters have direct influence on the crop productivity and for increasing the yield. In the present findings number of tillers was influenced positively due to recommended practice. Thus, the maximum number of tillers 32.5/hill was noted in case of RP as compared to farmers practices i.e.16.5 tillers/hill. Increase in quantitative parameters in rice is the reflection of adoption of SRI system. The data revealed that under demonstration plot, the performance of rice yield was found to be higher than that under FP during both the years (2010 & 2011). The yield of rice 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 an average yield of 50.1 q/ha, 53.5% higher over FP. The crop yield and biomass increased under RP may be due to the profuse tillering and sufficient supply of nutrients by extensive root development. The year to year fluctuations in yield and cost of cultivation can be

Table 1: Productivity, growth and yield parameters, Technology gap, Extension gap and Technology index of rice as affected by recommended practices as well as farmer's practices

Year	Area (ha)	No. of farmers	No. of tillers/hill RP	FP	Grain yield (q/ha) Potential	RP	FP	% increase over FP	Straw yield (q/ha) RP	FP	Harvest index(%) RP	FP	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (q/ha)
2010	2.4	6	26	12	60	43.0	24.28	77	62.0	46.0	41	34.5	17.0	18.7	28.3
2011	3.2	8	39	21	60	57.2	41.0	40	74.8	62.0	43	39.8	2.8	16.2	4.6
Total/mean	5.6	14	32.5	16.5	60	50.1	32.64	53.5	68.4	54.0	42	37.0	9.9	17.46	16.5

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). Higher grain and straw yield of rice (50.1 and 68.4 q/ha) were observed in RP over FP (32.64 and 54 q/ha), respectively. Among both the treatment harvest index was observed (Table-1) 37% and 42% in farmers practice (FP) and recommended practices (RP), respectively. This may be due to the congenial environment for root development and crop growth.

Economics:

Economic indicators i.e. gross expenditure (Rs/ha), gross returns (Rs/ha), net returns (Rs/ha) and B:C ratio of front line demonstration are presented in Table-2. 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, 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.

Extension and Technology gap:

The extension gap ranging between 16.2-18.7 q/ha during the period of study emphasized the need to educate the farmers through various human resource development means for the adoption of improved production technology of rice cultivation to reverse the trend of wide extension gap (Table-1).

The trend of technology gap ranging between 2.8-17 q/ha reflected the farmer's cooperation in carrying out such demonstration with encouraging results in both the years. The technology gap observed

Table 2: Economics of Front Line Demonstration of rice as affected by recommended practices as well as farmer's practices

Year	No of demonstration	Yield (q/ha) RP	Yield (q/ha) FP	% increase over FP	Gross expenditure (Rs/ha) RP	Gross expenditure (Rs/ha) FP	Gross returns (Rs/ha) RP	Gross returns (Rs/ha) FP	Net returns (Rs/ha) RP	Net returns (Rs/ha) FP	B:C ratio RP	B:C ratio 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
Total/ Mean		50.1	32.64	53.5	18726	16813	53075	34385	34349	17571	2.81	2.01

may be attributed to the dissimilarity in climatic and edaphic conditions.

The technology index showed the feasibility of the evolved technology at the farmer's field. The lower the value of technology index, the more is the feasibility of the technology. As such, the reduction in technology index from 28.3% during 2010 to 4.6% during 2011 exhibited the feasibility of the demonstrated technology in this region.

HRD components:

To increase the understanding and skill of the farmers about recommended technology of weed management in rice; various training programmes, radio talk, field day, kisan sangosthi, CD shows, folders (technical manual) and kisan mela were organized both at district level and village level. These human resource development components not only helped in proper understanding of the technology required by farmers for maximizing the production potential of the crop but they have also compared the actual recommended practice plots with farmers practice plots (Table 3) during field days and kisan sangosthi organized at village level.

Table 3: HRD component: Cumulative data of 2010 & 2011

S.No.	HRD components	Frequency	Beneficiaries
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

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Effect of independent variables on knowledge extent of farmers about dairy enterprise technology

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Abstract

This study was conducted in milkipur block of faizabad district on 120 respondents selected through propositionate random sampling technique. There were 61.66% respondents found in middle age group i.e. 37 to 58 years and observed to be literate (81.67 %), belonging to scheduled caste (40%), residing in joint families (50.83 %) and 84.16 percent respondents having 5 to 13 members in their families. The maximum respondents (62.50 %) were having marginal land holding, (40.83%)family annual income of Rs 40001 to 80000, reported agriculture as the main occupation (80.33%) and half of the respondents (50%) having participation in one organization. The maximum i.e. (54.16 %) respondents residing in mixed type of houses. The maximum number of respondents (78.33 %) were found having material possession satisfactory The radio (93.33 %) and mobile (81.66 %) were observed as main communication media with respondents. The maximum number of (88.33 %) respondent reported 2 to 15 litres of milk production. Maximum contact was observed with gram pradhan (0.52) under formal sources, family members (0.98) under informal sources and radio (0.97) under mass media sources of information. Maximum number of respondent's were found in medium level of economic motivation, scientific orientation and risk orientation with 50.83%, 65 per cent and 63.33 per cent, and the overall extent of knowledge for the different practices was calculated to be 73.61 per cent respectively.

Key words: Respondents, marginal land, joint families, economic motivation, scientific orientation

Introduction

The rearing of cattle and dairying go hand in had with agriculture and help in improving the socio-economic conditions of rural folk. Dairy enterprise is one of the important enterprise which provides gainful income and employment to the rural families. It also provides continues and regular employment to the rural families as the dairying requires a lot of manual labour for its various kinds of activities like maintenance of animals, feeding, milking, cleaning, cattle shed, taking care of calf, processing of milk and marketing etc. The dairy industry requires skilled and unskilled labour for its various activities. Thus, the employment potential is higher in dairy sector.

As knowledge of dairy enterprising system is an innovation which is considered as pre-requisite for its successful adoption. It is an essential requirement for occupational awareness to farmers which consequently forms the basis of action proceeding the act of adoption. Efficient returns from improved dairy technologies presupposes that desirable use of dairy innovations will depend upon relevant acquired knowledge, which is an important force of accelerated adoption. Knowledge is also affected by various personal and socio-economic characteristics of the individual.

Dairying is the main sector of livestock farming and plays a multipurpose role in India. More than 80% of milch animals are owned by small and marginal farmers and landless labourers and have their life inexorably linked with dairying for their existence.

As a matter of fact, most of the Dairy farmers in India have the capacity and talents, but they are unable to get jobs due to the problem of unemployment that India is facing. One best was for dairy farmer is to engage themselves in gainfall employment of entrepreneurial skills and becoming

independent entrepreneurs. Keeping this in view, the present investigation was carried out with the following specific objectives:

1.To study the socio-economic profile of the farmers.
2. To study the knowledge extent of farmers about dairy enterprise technology.
3.To see effect of independent variables on knowledge extent of farmers about dairy enterprise technology.

Methodology

The present study was carried out in Milkipur block of Faizabad district in Uttar Pradesh. In this block, there were 113 villages existence, out of which

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only five villages were selected randomly. A total of 120 respondents those were selected though proportionate random sampling technique on the criteria of herd size possessed by them viz., small (having one cattle), medium (having 2 to 3 cattles), and large (having 4 and above cattles) were interviewed purposely for data collection. The socio-economic characteristics of the respondents were studied on the basis of SES (Socio-economic scale) scale developed by Trivedi and Pareek (1964) with suitable modifications. The classification of the received values was done on basis of mean – S.D. (low), mean ± S.D. (medium) and mean + S.D. (high).

Results and Discussion

A. The maximum number of the respondents (61.66) was observed in the middle category of age.

B. The literacy percentage of the respondents was observed 81.67 % while 18.33% respondents were found illiterate.

C. It indicates that scheduled caste and backward caste were almost same i.e. 40.00 and 39.16% respectively, while the general were observed to be 20.83%.

D. It is projected that 50.83 per cent respondents families belonged to joint family system.

E. The 84.16 per cent of the respondents families were observed such who had 5 to 13 members.

F. The data indicates that the majority (62.50%) of the respondents was found in the land holding category of marginal farmers (below 2.5 acre).

G. It is apparent from the data that 54.16% respondents were found having their houses of mixed types.

H. In case of main occupation, it is clear from data that a overwhelming majority (80.83%) of the respondents families were reported agriculture as their main occupation. while, in case of subsidiary occupation the maximum (23.33%) of the respondents families have adopted service.

I. A cursory glance over the data depicted indicates that out of 120 respondents, 50 per cent respondent participated in one organization.

J. It is obvious that maximum (40.83%) of the respondents were from those families whose annual income was found in the categories of Rs. 40001 to 80000.

K. The data revealed that highest numbers of respondents (78.33%) were observed in the medium category (11 to 50) of materials possession.

L. The perusal of data included in shows that a maximum number of respondents (88.33%) was observed in medium category of milk production (2 to 15 liters).

M. It is evident that in case of formal sources, more contact was found with gram pradhan by the respondents which ranked I (0.52).

In case of mass media source utilization, the radio rank orders as, I, with mean score values 0.97. The average score value was found 0.35. Hence, it can be concluded that informal sources of information seemed to be most important as generally utilized by most of the respondents.

N. It is apparent that the maximum number of respondents (50.83 %) were found having medium level of economic motivation with a range of minimum 11 and maximum 26.

O. It is clear that 65 per cent of the respondents were found having medium level of scientific orientation with a range of minimum 11 and maximum 26.

P. It is apparent that 63.33 per cent of the respondents were found having medium level of risk orientation with a range of minimum 13 - 26.

The Table 2 focuses that the majority of the respondents (64.16%) was found possessing medium level of knowledge followed by 20 and 15.83% respondents who had high and low levels of knowledge, respectively. The mean of scores was found to be 68.12 with arrange of minimum 23.88 and maximum 95. On the basis of above discussion, it can be said that nearly half of the respondents had medium level of knowledge regarding dairy entrepreneurs technology.

The Table 3 that among all the main practices viz., breeds, cattle shed, insurance, balance ration, disease control, milk products, method of milking, lactation period, milk selling and record of the dairy entrepreneur. The practice like lactation period was ranked 1st (98.33%) as for as knowledge possessed by respondents was concerned followed by milk selling ranked IInd, disease control ranked IIIrd, method of milking IVth , insurance Vth, milk products VIth, cattle shed VIIth, balanced ration VIIIth, breeds IXth and records ranked X with percentage, 86.25, 82.41, 77.50, 76.38, 75.47, 68.61, 61.49, 59.58 and 50.16%, respectively.

The over all extent of knowledge for the different practices was calculated to be 73.61 per cent. It may be concluded that except few of the practices the respondents were having considerably good knowledge about dairy entrepreneurs technology.

The Table 4 analytical result of multiple linear regression analysis to find out the effect of different independent variables on the level of knowledge of dairy entrepreneur technology.

Out of 20 independent variables studied the three variables, i.e. education, social participation and milk production were found significantly and positively correlated with extent of knowledge.

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Table 1: Socio-personal, economic and psychological profile of the respondents

N=120

S.No. Variables	%tage of the respondents	Mean	Standard Deviation	Minimum	Maximum
A. Age.					
I. Young (up to 37 years)	21.67	47.5	11.00	22.00	72.00
II. Middle(38 to 58 years)	61.66				
III. Old (59and above years)	16.67				
B. Education					
a. Illiterate	18.33				
b. Literate	81.67				
I. Primary	19.17				
II. Middle	19.17				
III. High school	19.17				
IV. Intermediate	18.33				
V. Undergraduate	2.50				
VI. Postgraduate	3.33				
C. Caste composition.					
I. General caste	20.83				
II. Backward caste	39.17				
III. Scheduled caste	40.00				
D. Family type.					
I. Single family	49.17				
II. Joint family	50.83				
E. Family size.		8.79	5.22	3.00	50.00
I. Small(up to 4 members)	5.00				
II. Medium(5 to 13 members)	84.17				
III. Large(14 and above members)	10.83				
F. Housing pattern					
I. Hut	0.00				
II. Kachcha	28.33				
III. Mixed	54.17				
IV. Pucca	17.50				
G. Land holding.		2.65		0.25	17.50
I. Marginal(below 2.5 acre)	62.50				
II. Small(2.5 to 5.0 acre)	23.33				
III. Medium(5.0 to 7.5 acre)	7.50				
IV. Large(7.5 acre and above)	6.67				
H. Occupation					
I. Agriculture labour	5.00				
II. Caste based occupation	0.00				
III. Service	7.50				
IV. Agriculture	80.33				
V. Business	4.17				
VI. Dairying	2.50				
I. Social participation					
I. No participation	30.00				
II. Participation in one organization	50.00				
III. Participation in two organizations	15.83				
IV. Participation in more than two organizations or office bearer	4.17				
J. Family annual income (Rs.)		81442		25000	390000
I. Up to 40000	32.50				
II. 40001 to 80000	40.83				
III. 80001 to 120000	10.00				
IV. 120001 to 160000	5.00				
V. 160001 and above	11.67				
K. Overall material possession (scores).		31.58	22.61	3.00	97.00
I. Low (up to10)	4.17				
II. Medium(11 to 50)	78.33				
III. High (51 and above)	17.50				
L. Milk production.		8.25	7.24		50.00

I. Low (up to 1 liter)	Nil				
II. Medium (2 to 15 liters)	83.33				
III. High (16 liters and above)	10.83				
IV. Having no milk production	0.84				
M. Extent of contact with information sources					
I. Formal sources		0.242			
II. Informal sources		0.710			
III. Mass media sources		0.356			
N. Economic motivation (scores)		20.65	2.73	11.00	26.00
I. Low (up to 18)	19.17				
II. Medium (19 to 22)	50.83				
III. High (23 and above)	30.00				
O. Scientific orientation (scores)		19.08	3.02	11.00	26.00
I. Low (up to 16)	21.67				
II. Medium (17 to 22)	65.00				
III. High (23 and above)	13.33				
P. Risk orientation (scores)		19.37	2.62	13.00	26.00
I. Low (up to 16)	25.00				
II. Medium (17 to 22)	63.33				
III. High (23 and above)	11.67				

Table 2: Distribution of respondents according to extent of knowledge about dairy entrepreneurs technology. N=120

S. No.	Categories	Respondents Number	Percentage
1.	Low (up to 53)	19	15.83
2.	Medium (54 to 83)	77	64.17
3.	High (84 and above)	24	20.00
	Total	120	100-00

Table 3: Practice wise knowledge extent about dairy entrepreneurs technology.

S. No.	Practices	Extent of knowledge (%)	Rank order
1.	Breeds	59.58	IX
2.	Cattle shed	68.61	VII
3.	Insurance	76.38	V
4.	Balanced ration	61.49	VIII
5.	Diseases control	82.41	III
6.	Milk product	75.47	VI
7.	Method of milking	77.50	IV
8.	Lactation period	98.33	I
9.	Milk selling	86.25	II
10.	Records	50.16	X
	Over all average	73.61	

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Table 4: Analytical result of multiple linear regression analysis to findout the effect of different independent variables on the level of knowledge of dairy entrepreneur technology. N=120

S. No.	Independent variables	Coefficient of regression	Standard error of coefficient of regression	(t)	R^2 (%)
1.	Age	0.007	0.131	0.054	55.30**
2.	Education	2.937**	1.123	2.614	
3.	Caste	1.861	1.684	1.105	
4.	Family type	-0.256	2.646	0.097	
5.	Family size	0.192	0.300	0.640	
6.	Land holding	0.336	0.652	0.516	
7.	Housing pattern	-3.311	2.102	1.576	
8.	Occupation	-0.365	0.648	0.563	
9.	Social participation	3.469*	1.723	2.013	
10.	Annual income	-0.000	0.000	0.723	
11.	Overall material possession	-0.065	0.107	0.606	
12.	Animal husbandary experience	0.011	0.124	0.092	
13.	Milk production	0.473*	0.192	2.467	
14.	Extent of contact with formal sources	-0.967	1.706	0.567	
15.	Extent of contact with in formal sources	0.798	1.813	0.440	
16.	Extent of contact with mass media sources	0.163	1.710	0.095	
17.	Over all extent of contact with information sources	0.648	1.717	0.377	
18.	Economic motivation	-0.411	0.477	0.862	
19.	Scientific orientation	0.620	0.501	1.237	
20	Risk orientation	0.475	0.550	0.863	

* Significant of probability = 0.05, ** Significant of probability = 0.01

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Chemical and microbiological changes and shelf life studies in chhana as influenced by selected preservatives

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Abstract

Chhana samples prepared from milk of Sahiwal cows were treated with five preservatives at two levels, viz. calcium propionate (0.32 and 0.16%), potassium sorbate (0.20 and 0.10%), sodium benzoate (0.10 and 0.05%), oxytetracycline (7.0 and 3.5 ppm), potassium metabisulphite (250 and 125 ppm) and stored at 7°C, changes in sensory, chemical and micro-biological quality of product were assessed at three day interval. Protein, fat and total solids content of chhana indicated slight changes during storage. Changes in microbial quality as revealed by SPC, coliform, lipolytic and proteolytic counts and yeast and mold counts during various storage periods were very limited in preservative treated samples than in control samples. Higher concentrations of preservatives were more effective than lower concentrations. Sodium benzoate was found more effective in inhibiting yeast and molds, which were major spoilage organisms in the product. Results suggested that the samples treated with preservatives were acceptable upto 14-15 days with full concentration and upto 13-14 days with half concentration of the preservatives used in the study.

Keywards: Chhana, preservatives, chemical quality, microbial quality, shelf life.

Introduction

The quality of raw milk in India is relatively poor and the initial bacterial count is high. This is due to the fact that milk is a quickly perishable commodity on account of unhygienic milking, storage and handling due to the ambient temperature prevailing in most part of the country, which is quite high during large part of the year which reduces the keeping quality. It is, therefore, essential to promote hygienic milk production. Despite various constraints, India has become an important exporter of milk products. The Indian dairy industries have invested huge amounts to upgrade the quality and hygienic system so that the quality of milk products being exported attains the international standards. The industries have in fact created a special position for itself in the international market byway of providing consistently good quality products at a competitive price. The demands for acid-cum-heat coagulated milk products viz. chhana have increased consistently during the last decade but its shelf-life is a major constraint, as it is limited to 1-2 dalys at ambient temperatures, and 3-5 days at refrigeration temperatures. Hence, there is an urgent need to further improve the self-life of chhana at refrigeration temperatures by inhibiting the growth of spoilage organisms and arresting biochemical changes through use of preservatives.

Keeping in view this prime objective, the product (chhana) was treated with preservatives like calcium propionate, potassium sorbate, sodium benzoate, oxytetracyclines and potassium metabisulphite to enhance its shelf life at refrigeration temperatures. Some of these preservatives have already been used in meat and meat products but its use in dairy products except pot, sorbate in cheese in has been quite limited.

Materials and Methods

Preparation of chhana

Chhana was made in the laboratory from fresh, whole milk of Sahiwal cows, maintained at the University dairy according to the method suggested to Kundu and De (1972) with minor modification. Lactic acid (2%) was used as coagulant. The coagulum gathered in muslin cloth was slightly pressed during hanging to hasten the drainage of whey.

Treatment with preservatives

The chhana was divided into several lots and treated with the following preservatives in concentrations noted against each:

Preservatives	Concentrations	
	C_1	C_2
1. Calcium propionate (P_1)	0.32	0.16
2. Potassium sorbate (P_2)	0.20	0.10
3. Sodium benzoate (P_3)	0.10	0.05
4. Oxytetracycline (P_4)	7 ppm	3.5 ppm
5. Potassium metabisulphite (P_5)	250ppm	125 ppm

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The chhana samples were treated with the preservatives by thoroughly mixing the product with the specific preservative. Such samples were packed in sterile LDPE packets. The control samples were prepared without any preservative. All the samples were stored at 7°C. The changes in sensory chemical and microbiological quality of the product were monitored at three day interval.

Observations recorded

Changes in sensory (a 9-point headonic scale), chemical (total solids, fat and protein contents by BIS, 1961, 1964), and microbiological (standard plate count, coliform, lipolytic, proteolytic and yeast and mold counts by BIS,1962) qualities were ascertained. The yield of the product was also recorded.

Results and Discussion

The milk of Sahiwal Cows for Chhana making in the present study contained 4.40±0.20 (4.10 – 4.70%) fat, 3.38±0.31 (3.21-3.69)% protein and 14.18±0.45 (13.83 – 14.42)% total solids. The recovery of chhana ranged from 14.80 to 15.50 with an average of 15.18±0.36 oercent. All samples of fresh chhana had a normal yellow color, pleasant sweetish taste, soft and uniform compact body. The samples were highly relished and scored 8.5 on a 9-point hedonic scale.

Changes in chemical quality of chhana during storage

The chhana samples treated with five different preservatives (P_1 to P_5) at two different concentrations full (C_1) and half (C_2), as detailed previously, were assessed for changes in chemical quality, viz. changes in percentages of protein, fat and total solids on three day interval upto 8 days. The details of data are presented in Table 1 (C_1) and Table 2 (C_2).

Results revealed that the protein, fat and total solids contents of chhana underwent slightly changes during storage on three, five and eight day. Changes were observed both at full (C_1) and half (C_2) concentrations of all the preservatives (P_1 to P_5). Changes in the concentrations of protein, fat and total solids contents of chhana samples were observed on eight day. However, appreciable differences were not observed between full and half concentrations of the preservatives.

Changes in microbiological quality

Results on changes in total viable count (SPC), coliform, lipolytic, proteolytic and yeast and mold count in various chhana samples as influenced by treatment with various preservatives (P_1 to P_5), and two concentrations (C_1 and C_2) are presented in Table 3 and 4.

It is revealed (Tables 3 and 4) that the fresh samples had slightly higher SPC count (7.82 cfu/g) than the treated samples (lowet 7.32 cfu/g in potassium metabisulphite treated). Coliform and yeast and molds were not detectable while the lilpolytic and proteolytic organisms were observed in higher numbers (5.14 and 5.52) than in treated samples(lowest 4.77 and 5.29 in potassium metabisulphite, oxytetra cycline treated). Such counts (SPC, lipolytic and proteolytic) were slilghtly higher in samples treated with half of the concentrations (C_2) of the preservatives (Table 4). The SPC, lipolytic and proteolytic counts increased with increase in storage periods. On eight day (D_8), while the treated and control samples did not elicit the presence of coliform organisms, yeast and mold (5.42 cfu/g) organisms were visible in control samples, but in treated samples these were found in lesser number. Full concentration of preservatives (C_1) was found more effective than the half concentration (C_2). Yeast and molds were visible in control samples on second day, which continued to increase with increase in storage period, whereas in treated and control samples, coliform organisms were not observed but yeast and molds became apparent but in much lesser nlumber as compared to the control on eighth day (D_8). Sodium Benzoate was found more effective in inhibiting yeast and molds, which are major spoilage organisms in the product.

Shelf life of chhana

The keeping quality of chhana was adjudged on the basis of sensory score (100-point), general acceptability (9-point hedonic scale), chemical and

Table 1 (C_1) Changes in protein, fat and total solids content (%) at 7°C

Treatments	Days of storage											
	D_o			D_2			D_5			D_8		
	Protein	Fat	TS	Protein	Fat	TS	Protein	Fat	TS	Protein	Fat	TS
C_0	17.30	24.83	48.15	17.33	23.66	48.20	17.36	24.49	48.24	17.40	24.66	48.30
C_1P_1	17.32	23.99	47.60	17.35	23.99	47.65	17.38	24.66	47.70	17.41	24.33	47.75
C_1P_2	17.24	23.99	47.55	17.26	24.32	47.56	17.28	24.00	47.61	17.31	23.99	47.64
C_1P_3	17.36	23.99	48.16	17.39	24.99	48.19	17.41	23.99	48.23	17.43	24.33	48.24
C_1P_4	17.53	23.99	48.14	17.36	23.99	48.19	17.58	23.99	48.21	17.60	23.99	48.24
C_1P_5	17.43	24.33	48.28	17.46	24.31	48.32	17.48	23.66	48.34	17.48	24.31	48.38

C_0 – control, C_1 – full concentration, P_1 to P_5 preservatives, D_o to D_8 – days after manufacture

Table 2 (C_2) Changes in protein, fat and total solids content (%) at 7°C

Treatments	Days of storage											
	D_o			D_2			D_5			D_8		
	Protein	Fat	TS	Protein	Fat	TS	Protein	Fat	TS	Protein	Fat	TS
C_0	17.30	24.83	48.15	17.33	23.66	48.20	17.36	24.49	48.24	17.40	24.66	48.30
C_2P_1	17.24	23.99	47.46	17.28	23.99	47.52	17.30	24.33	47.59	17.34	24.99	47.65
C_2P_2	17.20	24.44	47.55	17.22	23.99	47.58	17.27	23.99	47.62	17.38	23.99	47.66
C_2P_3	17.35	23.99	48.11	17.36	23.99	48.17	17.40	23.99	48.21	17.44	24.64	48.26
C_2P_4	17.56	23.66	48.10	17.54	24.99	48.15	17.56	24.64	48.21	17.60	24.33	48.23
C_2P_5	17.41	23.99	48.23	17.43	24.64	48.26	17.46	23.99	48.30	17.49	24.64	48.34

C_0 – control, C_2 – half concentration, P_1 to P_5 preservatives, D_o to D_8 – days after manufacture

Table 3: (C_1) : Changes in bacteriological quality of chhana at 7°C (cfu/g)

Treat-ments	Days of storage															
	D_o				D_2				D5				D_8			
	SPC	Lipo-lytic	Proteo-lytic	Yeast-&mold	SPC	Lipo-lytic	Proteo-lytic	Yeast &mold	SPC	Lipo-lytic	Proteo-lytic	Yeast &mold	SPC	Lipo-lytic	Proteo-lytic	Yeat &mold
C_0	7.82	5.14	5.52	-	8.51	5.78	5.96	5.75	8.88	6.21	6.23	6.22	9.11	6.46	6.47	6.51
C_1P_1	7.66	5.98	5.40	-	7.83	5.22	5.57	-	7.98	5.46	5.75	5.27	8.40	5.76	5.94	5.68
C_1P_2	7.58	4.91	5.31	-	7.72	5.17	5.45	-	7.92	5.46	5.62	5.18	8.42	5.73	5.79	5.55
C_1P_3	7.54	4.83	5.34	-	7.73	5.09	5.49	-	7.92	5.34	5.65	5.11	8.36	5.57	5.81	5.41
C_1P_4	7.33	5.00	5.29	-	7.85	5.24	5.48	-	7.82	5.46	5.63	5.10	8.36	5.66	5.79	5.37
C_1P_5	7.32	4.77	5.32	-	7.59	5.11	5.54	-	7.83	5.34	5.65	5.57	8.36	5.53	5.89	5.74

C_0 – control, C_1 – full concentration, P_1 to P_5 preservatives, D_o to D_8 – days after manufacture

microbiological quality. It was observed that the control samples started deteriorating after seven days of storage at 7°C. These samples were completely unacceptable on eight day.

The treated samples were found to be acceptable (total score- over 70; hedonic scale, 7.52) even on eight day. The microbial counts were much lower than those prescribed by BIS (1983). Although the changes in chemical and microbiological quality (except yeast and molds) were not studied further beyond eight day, but based on sensory attributes and yeast and mold counts, it was noted that the samples treated with preservatives were acceptable upto 14 to 15 days with full concentration (C_1) and upto 13 to 14 days with half concentration (C_2) of the preservatives used.

The chemical quality of chhana prepred from Sahiwal cows as reported in this study is in accordance with reported data (Aneja *et al.* 2002)‘ However, published literature on changes in chemical constituents as influenced by treatments with preservatives during storage at refrigeration temperatures are meager to support the results of present investigation. However, Yadav *et al.* (1985) have reported the effect of sodium benzoate and potassium metabisulphite on protein, fat and total solids contents of chhana during storage and found a decrease in protein and total solids contents of chhana but no change in the fat content. Such results support the present data. Published data are lacking on effect of calcium propionate, potassium sorbate and oxytetracycline on changes in chemical constituents of chhana during storage, to corroborate our results.

Results on microbiological quality of chhana are also in agreement with Aneja *et al.*(2002). Published literature on microbiological quality of fresh and market paneer, which is a similar product, is abundant (Parashar, 1987; Singh *et al.* 1989; Singh and Singh, 2000; Kumari and Kalimuddin, 2002; Divya Srivastava, 2004), which support the preent microbiological quality of fresh chhana. However, data on changes in bacteriological quality of chhana as affected by various preservatives during storage are scanty to support present data. Aneja *et al.* (2002) have reported that during storage, the product (chhana) develops a sour smell and bitter taste at 25-37°C while its surface in sparsely covered with molds sulch as *Aspergillus, Mucor, Rhizopus, Fusarium etc.* which are major spoilage organisms.

The preservatives used in the present study, viz. calcium propionate, potassium sorbate, sodium benzoate, oxytetracycline and potassium metabisulphite are antibacterial in nature and hence inhibit growth of spoilage organisms in the product. Nisin and sorbic acid (and its salts) have, in fact, been recommended (PFA Act and BIS) for use in certain dairy products (various type of cheese) in order to prevent these products from spoilage (biochemical and microbial) so

Table 4: (C_2) : Changes in bacteriological quality of chhana at 7°C (cfu/g)

Treatments	Days of storage D_o				D_2				D5				D_8			
	SPC	Lipo-lytic	Proteo-lytic	Yeast-&mold	SPC	Lipo-lytic	Proteo-lytic	Yeast &mold	SPC	Lipo-lytic	Proteo-lytic	Yeast &mold	SPC	Lipo-lytic	Proteo-lytic	Yeat &mold
C_0	7.82	5.14	5.52	-	8.51	5.78	5.96	5.75	8.88	6.21	6.23	6.22	9.11	6.46	6.47	6.51
C_2P_1	7.75	5.09	5.41	-	7.87	5.32	5.61	-	8.04	5.59	5.81	5.30	8.49	5.85	5.97	5.68
C_2P_2	7.67	5.02	5.42	-	7.82	5.29	5.57	-	8.01	5.56	5.71	5.25	8.50	5.83	5.90	5.64
C_2P_3	7.61	4.95	5.39	-	7.82	5.20	5.69	-	7.98	5.43	5.72	5.26	8.49	5.71	5.88	5.54
C_2P_4	7.36	5.03	5.27	-	7.61	5.27	5.50	-	7.87	5.47	5.66	5.18	8.43	5.73	5.84	5.41
C_2P_5	7.35	4.86	5.39	-	7.63	5.17	5.56	-	7.88	5.35	5.72	5.60	8.46	5.55	5.81	5.75

C_0 – control, C_2 – half concentration, P_1 to P_5 preservatives, D_o to D_8 – days after manufacture

as to extend their shelf-life. Yadav *et al.* (1985) have used sodium benzoate and potassium metabisulphite in various concentrations (0.1 to0.2%), to prolong the keeping quality of chhana at room temperature. The shelf-life enhancement of chhana using sodium benzoate, sodium propionate and sugar has also been demonstrated (EIRI, 2006). Sarkar *et al.* (2002) studied the effect of sodium and potassium metabisulphite on shelf-life of cow milk burfi and noted that irrespective of storage temperature, added preservatives slowed down the rate of increase of acidity, suppressed microbial growth and retarded deterioration of orgnoleptic quality, thereby increasing shelf-life of the product. The reports substantiate results of present investigation, which indicate that the shelf-life of chhana could be extended by use of the preservatives employed in the present study.

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Irrigation water and fertigation management in Brinjal crop with drip Irrigation

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Abstract

Two experiments were conducted at Agricultural Research Station, Sriganganagar during 2009-10 to 2011-12 on brinjal crop to find out the optimum irrigation schedule and optimum dose & time of fertilizers application with drip irrigation. The soil of experimental site was sandy loam in texture, low in organic carbon (0.19%), having field capacity 16.2%, permanent wilting point 6.3%, medium in available P_2O_5 (33 kg/ha), and high in available K_2O (330 kg/ha). The pH (1:2) and EC (1:2) of the soil were 8.1 and 0.2 dS/m, respectively. Drip irrigation at 1.0 ETc was found optimum irrigation schedule for brinjal. It gave 30.95 % higher fruit yield of brinjal and saved 24.62 % irrigation water over conventional surface irrigation. Under drip irrigation application of 80% of recommended dose of N and K fertilizer gave significantly higher fruit yield of brinjal.

Key words: optimum irrigation schedule, organic carbon, brinjal

Introduction

India is the second largest producer of vegetables next to China. Vegetables occupy 7.73 million ha with total production of 122.26 million tones having a productivity of 15.82 tones/ha. In the last one and half decade, country's vegetable production has almost doubled. As compared to other developed countries India's productivity of vegetables is very low. Besides other constraints of production, irrigation water at critical stages of growth is an important aspect for lowering productivity. Regular and adequate water supply to vegetable crops does not only increase the yield, but it increases the quality and market acceptance of produce whenever irrigation water becomes important commodity, it becomes more imperative and vulnerable in respect of vegetables because almost all vegetables are fleshy and therefore, very sensitive to water stress at critical stages of growth. Vegetables are 80 to 95 percent water. Because they contain so much water, their yield and quality suffer very quickly from drought. Thus, for good yields and high quality, irrigation is essential to the production of most vegetables. If water shortages occur early in the crop's development, maturity may be delayed and yields are often reduced. If a moisture shortage occurs later in the growing season, quality is often reduced even though total yields are not affected. Most vegetables are rather shallow rooted and even short periods of two to three days of stress can hurt marketable yield.

Irrigation is likely to increase size and weight of individual fruit and to prevent defects such as toughness, strong flavor. Water requirement of any crop depend upon the nature of crop, type of soil, evapo-transpiration rate in that particular locality and stage of growth of plant. Water requirement for same vegetable would be different in different seasons and localities and therefore water requirement estimated in a particular area would not be exactly applicable in other areas. The results of researches in this regard should be used as guide line for refinement of water requirement in a given area. Lot of research work have been done in scheduling of irrigation water and total water requirement in vegetables in India however, there exist wide variability in water requirement for same crop

Materials and Methods

Two experiments were conducted at Agricultural Research Station, Sriganganagar during 2009-10 to 2011-12 on brinjal crop to find out the optimum irrigation schedule, to workout water use efficiency, to find out optimum dose & time of fertilizers and to work out the economics of drip irrigation in Brinjal. One experiment was conducted on irrigation scheduling under drip irrigation system under low tunnel with four levels of drip irrigation (0.6, 0.8, 1.0, 1.2 ETc) and one surface irrigation treatment.

The area considered for the irrigation was 50 % of total area through drip.

Another experiment was conducted on fertigation of brinjal crop under low tunnel with the combination of two fertilizer levels (80 & 60% of the recommended) with two split application (9 splits at

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an interval of 13 days and 12 splits at an interval of 10 days) under drip irrigation system with control (recommended dose of N, P_2O_5 and K_2O for brinjal ie 120, 80 and 60 kg/ha, respectively, with flood irrigation). Both the experiments were laid out under Randomized Block Design with four replications.

The soil of experimental site was sandy loam in texture, low in organic carbon (0.19%), having field capacity 16.2%, permanent wilting point 6.3%, medium in available P_2O_5 (33 kg/ha), and high in available K_2O (330 kg/ha). The pH (1:2) and EC (1:2) of the soil were 8.1 and 0.2 dS/m, respectively. During all three years brinjal variety Nishant was used in both the experiments. The crop was sown in nursery during third week of October and transplanted in the field during first week of December in all the years and experiments. A pre-sowing irrigation of 100 mm by surface method and drip irrigation for 8.5 hr in December was applied to ensure good establishment of seedlings. As the experiment was conducted under low tunnels during the winter, so after establishment of the crop, low tunnels were made effective from December and remained upto second week of February.

Results Discussion

Irrigation scheduling under low tunnel

On the basis of three years of experimentation it may be concluded that, the fruit yield of brinjal significantly increased with increase in the level of applied water up to 1.0 ETc, however when the water level further increased (1.2 ETc over 1.0 ETc), the increase in the fruit yield was not significant during almost all the three years and on pooled basis also. The fruit yield of brinjal 769.88, 906.71, 865.48 and 814.03 q/ha was recorded with drip irrigation at 1.0 ETc during 2009-10,2010-11, 2011-12 and pooled basis, respectively which were statistically at par with that of 1.2 ETc and significantly higher than other treatments tested in the study (Table 1). On the basis of three year pooled data of yield attributing character i.e No of Fruits/Plant, Weight of Fruits/Plant (kg), Plant Height (cm), and No of Branches/Plant was also significantly higher in this treatment. Thus drip irrigation at 1.0 ETc was found optimum irrigation schedule for brinjal (Table 2 a & b). Three years pooled basis it gave 30.95 % higher fruit yield of brinjal and saved 24.62 % irrigation water over conventional surface irrigation. The present findings are in accordance with those of Yadav et al. (2004) in brinjal, Patel et al.(2009) in okra and Jaikumar & Nandani (2001) in different vegetables.

Fertigation under low tunnel

Under drip irrigation application of 80% of recommended dose of N and K fertilizer gave significantly higher fruit yield of brinjal as compared to 60% recommended dose of fertilizer and recommended practice with flood irrigation during all the three years of experimentation and on pooled basis also (Table 3). Similar trend was also observed by Patel et al.(2009) and Narda & Lubana (2002) in okra, Yadav et al. (2004) and Singh & Maurya (1992) in

Table 1: Effect of drip irrigation on Number of fruit and Yield of Brinjal

Treatments	Fruit yield (q/ha)				No. of fruits/ha			
	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled
0.6ETc	567.45	506.08	595.86	556.46	2488426	2362284	2782099	2544270
0.8ETc	641.46	603.21	727.47	657.38	2659213	2804753	3403889	2955952
1.0ETc	769.88	806.71	865.48	814.03	3281343	3333580	3588086	3401003
1.2ETc	822.20	790.00	851.67	821.29	4162315	3441914	3705802	3770010
Flood	628.66	633.16	603.12	621.64	2779491	3002284	2863889	2881888
S Ed	18.79	9.19	31.98	22.06	96584	199162	321762	225481
CD	46.94	20.04	69.68	48.07	210456	433975	701118	491322

Table 2 a: Effect of drip irrigation on the Yield attributes of Brinjal

Treatments	No of Fruits/Plant				Weight of Fruits/Plant(kg)				Plant Height (cm)			
	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled
0.6ETc	135.8	130.2	153.3	139.8	3.1	2.8	3.3	3.1	74.4	75.8	74.5	74.9
0.8ETc	144.7	153.7	187.6	162.0	3.5	3.3	4.0	3.6	76.3	79.4	80.0	78.6
1.0ETc	178.1	180.7	196.1	185.0	4.0	4.2	4.6	4.3	78.6	79.4	81.3	79.8
1.2ETc	224.8	188.8	203.3	205.6	4.4	4.3	4.7	4.5	82.0	80.1	81.4	81.1
Flood	154.8	170.1	164.1	163.0	3.7	3.8	3.6	3.7	72.0	71.2	72.5	72.0
S Ed	5.4	10.9	17.4	12.3	0.1	.04	0.2	0.1	2.2	0.7	0.8	1.4
CD	11.8	23.7	38.0	26.7	0.2	0.1	0.4	0.3	4.7	1.4	1.8	3.0

Table 2 b: Effect of drip irrigation on the Yield attributes of Brinjal

Treatments	Plant Population/ha				No of Branches/Plant			
	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled
0.6ETc	18333	18148	18148	18210	15.65	15.67	15.00	15.44
0.8ETc	18380	18272	18148	18266	15.70	16.20	15.53	15.81
1.0ETc	18426	18457	18272	18385	16.15	16.33	15.67	16.05
1.2ETc	18519	18210	18210	18313	16.55	16.20	15.47	16.07
Flood	17963	17654	17469	17695	15.28	14.27	13.27	14.27
S Ed	157	170	191	173	0.67	0.62	0.37	0.57
CD	342	371	416	377	1.46	1.35	0.80	1.24

Table 3: Effect of fertigation on Number of fruit and Yield of Brinjal

Treatments	Fruit yield (q/ha)				No. of fruits/ha			
	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled
Control	660.1	664.8	633.3	652.7	2779491	3079259	2925309	2928020
80% 9	713.4	853.2	868.3	811.6	3023333	3946420	3975679	3648477
80% 12	746.9	827.7	834.0	852.4	3213426	3652778	3867099	3577767
60% 9	684.6	659.5	749.1	697.7	2875556	2889383	3470432	3078457
60% 12	691.9	658.0	778.1	675.6	2942870	2828642	3324938	3032150
S Ed	17.2	20.4	22.7	22.9	64978	146737	159102	130470
CD	37.4	44.5	49.4	49.9	141586	319740	346684	284295

Table 4 a: Effect of fertigation on the Yield attributes of Brinjal

Treatments	No of Fruits/Plant				Weight of Fruits/Plant (kg)				Plant Height (cm)			
	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled
Control	154.8	174.4	167.6	171.0	3.7	3.8	3.6	3.7	71.95	71.20	72.53	71.89
80% 9	163.3	214.5	216.9	215.7	3.9	4.6	4.7	4.7	77.38	79.13	80.80	79.10
80% 12	174.4	198.6	210.2	204.4	4.1	4.5	4.8	4.6	78.20	80.40	82.07	80.22
60% 9	155.7	156.5	188.7	172.6	3.7	3.6	4.1	3.8	72.90	71.00	72.67	72.19
60% 12	159.7	153.8	181.4	167.6	3.8	3.6	4.2	3.9	74.45	72.07	73.07	73.19
S Ed	3.7	7.7	9.1	7.2	0.1	0.1	0.2	0.1	1.63	0.65	0.75	1.10
CD	8.1	16.8	19.9	15.7	0.2	0.2	0.4	0.2	3.55	1.43	1.64	2.40

brinjal.

Increase in split application of N & K (9 to 12) did not affect the yield of brinjal significantly under drip irrigation system. Yield attributes were also significantly higher with the application of 80% of recommended dose of N and K fertilizer through drip over control (100% of recommended dose of N and K with flood irrigation and 60 % of recommended dose of N and K fertilizer through drip (Table 4 a & b).

Water use and water use efficiency under low tunnel

Total water use increased with every increase in the level of irrigation schedule (Table-5 a). The water expense efficiency was higher in the drip-irrigated treatments as compared to flood irrigation. Maximum water expense efficiency of 114.31 kg/ha mm was recorded under I_1 (0.6 Etc by drip system), followed by 109.43 kg/ha mm under I_3 (1.0 Etc by drip system) treatment (Table-5 a). The water expense efficiency further increased, if water soluble fertilizers were applied with drip irrigation system. Data of table 5 b indicates that the higher water expense efficiency of 120.16 kg/ha mm was recorded with 80% recommended dose of N, P_2O_5 and K_2O was applied with drip irrigation system in 12 splits, followed by 114.41 kg/ha mm under 80% recommended dose of N, P_2O_5 and K_2O was applied with drip irrigation system in 9 splits treatment.

Economics of drip irrigation

It is pertinent to mention here that brinjal under low tunnel started fruiting earlier about 15 to 20 days than the crop without low tunnel. Thus, picking of fruits started in advance under low tunnel crop which gave higher market sell price. Moreover, next crop cotton may be grown timely after brinjal crop raised under

Table 4 b: Effect of fertigation on the Yield attributes of Brinjal

Treatments	Plant Population/ha				No of Branches/Plant			
	09-10	10-11	11-12	Pooled	09-10	10-11	11-12	Pooled
Control	17963	17654	17469	17695	15.3	14.3	13.3	14.3
80% 9	18519	18395	18333	18416	17.6	17.2	15.9	16.9
80% 12	18426	18395	18395	18405	16.8	16.1	15.8	16.2
60% 9	18472	18457	18395	18441	16.4	16.8	16.1	16.4
60% 12	18426	18395	18333	18385	15.5	16.1	16.4	16.0
S Ed	145	84	79	107	1.0	0.4	0.4	0.7
CD	315	183	173	233	2.2	1.0	1.0	1.5

Table 5 a: Effect of different irrigation treatments on water use and expense efficiency (Ave. of 3 Years)

Irrigation schedule	Effective rainfall (mm)	Irrigation water applied (mm)	Total water use (mm)	WEE (kg/ha mm)	Incremental B:C
0.6ETc	67.8	419.00	486.80	114.31	1.29
0.8ETc	67.8	547.67	615.47	106.81	2.75
1.0ETc	67.8	676.10	743.90	109.43	5.87
1.2ETc	67.8	804.57	872.37	94.15	6.48
Flood	67.8	906.67	974.47	63.79	-

Table 5 b: Effect of different irrigation treatments on water use (mm) and expense efficiency (Ave. of 3 Years)

Irrigation schedule	Effective rainfall (mm)	Irrigation water applied (mm)	Total water use (mm)	WEE (kg/ha mm)	Incremental B:C
Control	67.8	906.67	974.5	67.98	—
80% - 9 Splits	67.8	676.10	743.9	109.10	11.51
80% - 12Splits	67.8	676.10	743.9	114.59	13.24
60% - 9 Splits	67.8	676.10	743.9	93.79	7.16
60% - 12 Splits	67.8	676.10	743.9	90.82	6.13

low tunnel. Incremental B: C ratio increased with increasing levels of drip irrigation schedule over conventional surface irrigation and higher IB: C ratio Rs 6.48 per rupees spent was recorded with the applied water up to 1.2 ETc followed by 1.0 ETc. In case of fertigation experiment IB: C ratio was also higher with the application of 80% of recommended dose of fertilizer application with drip irrigation in 12 splits followed by 80% of recommended dose of fertilizer application with drip irrigation in 9 splits (Table 5 a & b).

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Studies on farmers perception on growing fieldbean (var. Local) as intercrop with maize in central part of Karnataka

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Abstract

Maize is often inter-seeded with the pulse crop fieldbean using a replacement design intercropping in Southern Transitional Zone of Karnataka. A field study was conducted to evaluate knowledge of farmers about practicing the fieldbean as intercrop along with the maize during kharif *2010. From the survey, it was observed that maize and fieldbean was the most popular intercropping system of maize belt of study area, about 80 % of the maize growers are practicing row proportion of 8:2 with 200 kg DAP as basal dose and 50 kg of urea as top dress as and when they receive the subsequent rains. The study also indicates the major reason for adoption of this type of cropping system is all farmer are mainly growing fieldbean for the green pods as vegetables, about 80 % of farmers are using for fodder purpose and some of them are getting the benefits of half time employment and some famers are also aware of soil fertility improvement. In this research, source of extension agency for adopting maize-fieldbean intercropping systems were studied and the habituation of intercropping was gained by indigenous knowledge. Concurrently, experiment was conducted to standardize the maize-fieldbean intercropping systems and to explore options for improvement. The results of field study clearly indicate that recommendations for intercropping should be based on intercropping research and cannot simply be extrapolated from results obtained with pure stands of the respective component crops. The ideal intercropping combination was maize + fieldbean (4:2) with 100 % recommended dose of fertilizer to both the crops for better economic viability of the intercropping system.*

Key words: Farmers perception, intercropping, maize, fieldbean, economics

Introduction

The sustainability of current yield and prospects of higher yield are threatened by soil compaction, low level of organic carbon, extensive monoculturing, erosion of indigenous bio diversity and ill distribution of rainfall all of which are typical of study region. Intercropping of indigenous genotype like local fieldbean with maize not only provide additional yield but also cause for nutritional security, economics and environmental stability to the maize belt present and in future. Maize is one such crop which provides an opportunity for inclusion of intercrop because of the plasticity of the crop to row spacing. In Southern Transitional Zone of Karnataka, crops are being cultivated during rainy season. The amount and distribution of rainfall also favors for the cultivation of maize and fieldbean (var. local). With this background a field survey and field experiment was conducted to revalidate the suitability of this existing cropping system to standardize the maize + fieldbean intercropping system with respect to row proportion and nutrient management.

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Materials and Methods

Methodology followed was purposive random sampling method during June 2010, a field survey has been carried out in selected two talukas of Davanagere district (Channagiri and Honnali) and two villages in each thaluk were selected through purposive sampling. We have taken about 20 farmers from the each village for survey purpose, thus 40 farmers forms the sample size. The study area is located at $14^0.0^1$ to $14^0.1^1$ North latitude and $75^0.40^1$ to $75^0.42^1$ East longitude with an altitude of 650 meters above mean sea level. Both quantitative and qualitative data were collected. Unstructured and semi structured interviews were used for the collection of quantitative information. Questions and questionnaires were pre-tested. At each site, the villages of each thaluk as well as 20 farmers from each villages were selected. Each site was in addition described with key indicators such as the type of crops, land holding, source of irrigation, purpose of cultivation, marketing facility, economic viability and other information were collected.

Along with the field perception survey a field experiment on 'Standardization of maize and fieldbean intercrop intercropping system in Southern Transitional Zone of Karnataka', was carried out at Zonal

Agricultural Research Station, Navile, Shimoga on sandy loam soils during *kharif* 2010. The experiment was laid out in a randomized complete block design with nine treatments replicated thrice. The treatments comprises of maize + fieldbean (4:1, 4:2 and 8:2) with 100 per cent NPK to only main crop, maize + fieldbean (4:1, 4:2 and 8:2) with 100 per cent NPK to both the crops and sole crop of maize and fieldbean. To assess the biological feasibility and economic viability of the cropping mixture we have used the intercropping indices given by Willey (1979) and Heibseh (1978).

Results and Discussion

Crop mixtures

The most frequently encountered maize based intercropping system during survey was maize + fieldbean at 8:2 row proportion, followed by maize + pigeon pea at 8:2 row proportion. The cent per cent opinion obtained by the farmers about practicing of growing fieldbean along with maize, the probable reason might be the temporal difference between the component crops, because of this phenomenon for the period of six months farmers are getting the benefits of employment at field condition since maize will come in to harvest almost four month after sowing of the crop and after harvest of the maize fieldbean will be exist for another two month. Farmers are getting the additional benefits of get the short term income by selling the green pods during the December and January which is known for vegetable fieldbean consumption in various forms and the haulm of the fieldbean used as the very good palatable fodder than the growing red gram or any other pulses under intercropping condition (Table 1).

Opinion of farmers on system sustainability

Although the surveyed farmers expressed their desire to grow in particular fieldbean, which can full fill both economic viability and domestic need of the farmers when it was grown under maize in all the villages (Table 2). And in Joladalu and Gonana Katte villages farmers are also aware of soil fertility, market sustainability and insurance against natural calamities. The opinion survey reveals the purpose of inclusion of component crop along with the maize was to get the additional income from the crops of different duration and main aim is to get the fodder during lean period for livestock without losing the original yield of maize for marketing purpose.

Cropping geometry

All the farmers of the study area were practicing the crop combination with 8:2 row proportions without any discrimination in the nutrient application to the component crop rows with the spacing of 45 cm x 15 cm. probable reason for practicing above row proportion was farmers were habituated to use tractor drown four tooth cultivator for opening of rows and spacing between the plants may be to get the more number of maize plant per unit area to obtain higher maize yield for market purpose. Reason for adopting the above crop geometry might be the knowledge disseminated from the earlier fellow farmers only.

Awareness for intercropping of fieldbean with maize

Based on field survey feedback, the knowledge of practicing maize based pulse intercropping system

Table 1: Outcome of opinion survey of study area

Reasons for adoption of field bean in maize based intercropping system

Villages	Reason for adoption (%)			
	Green pods	Fodder	Fertility improvement	Employment
Joladalu	100	100	90	30
Gonana Katte	100	80	60	50
Belagutti	100	80	0	0

Opinion of farmers on system sustainability of maize + field bean intercropping system

Villages	Opinion of farmers on system sustainability (%)				
	Economics	Soil fertility	Market sustainability	Insurance against calamities	Domestic need
Joladalu	100	60	50	40	100
Gonana Katte	100	40	30	40	100
Belagutti	100	0	0	0	100

Source of extension agency through which knowledge / awareness for intercropping of field bean with maize

Villages	Source of extension for adoption of maize + field bean cropping system (%)			
	Fellow farmers	Department of Agriculture	University	Others
Joladalu	100	0	0	0
Gonana Katte	100	0	0	0
Belagutti	100	0	0	0

Table 2: MEY, LER, ATER, gross return (Rs. ha^{-1}), net return (Rs. ha^{-1}) and B:C ratio as influenced by maize and field bean intercropping system and nutrient management

Treatments	Yield advantages indices			Economics of intercropping			Field bean fodder yield (kg ha^{-1})
	MEY	LER	ATER	Gross returns	Net returns	B:C	
T_1	3846.52	0.928	1.039	44416	25270	2.32	273
T_2	3897.85	0.945	1.036	42869	25527	2.47	366
T_3	4182.14	1.018	1.092	48147	29002	2.51	350
T_4	4664.31	1.226	1.415	53609	34464	2.80	643
T_5	4888.65	1.376	1.685	56172	38830	3.24	932
T_6	4736.5	1.252	1.452	54457	35312	2.84	636
T_7	3729.94	0.999	1.171	43011	26811	2.66	650
T_8	4361.00	1.000	1.000	50596	32115	2.74	-
T_9	2122.73	1.000	1.000	24550	13372	2.20	2450
Mean	4048	1.083	1.21	46425.63	28967.36	2.64	
S. Em±	199.9	0.061	0.078	2597.2	2597.2	0.14	
CD (P=0.05)	599.4	0.183	0.235	7786.4	7786.4	0.43	
C.V. (%)	8.55	9.789	11.233	9.69	15.53	9.4	

Nutrient management practice followed by farmers: Basal dose: 200 kg DAP, top dressing: 50 kg Urea
T_1-Maize + field bean 4:1 with 100% NPK to main crop T_2- Maize + field bean 4:2 with 100% NPK to main crop
T_3- Maize+field bean 8:2 with 100% NPK to main crop T_4- Maize +field bean 4:1 with 100% NPK to both the crops
T_5- Maize + field bean 4:2 with 100% NPK to both the crops T_6- Maize + field bean 8:2 with 100% NPK to both the
T_7- Farmers practice T_8-Sole maize T_9- Sole field bean

especially fieldbean as a component crop was came from their forefathers, and was expressed by all the surveyed farmers of all the village. Reason might be special and temporal difference noticed between the crops with respect to growth and development and flexibility of maize under intercropping and popularity of fieldbean to produce the enormous amount of fodder yield compared to any other grain legume during lean period like post winter season.

Biological feasibilities

All the intercropping systems showed superiority to monocropping of either of the crops in term of maize grain equivalent yield, irrespective of row proportion which were fertilized with recommended dose of fertilizer to the both the crops. Highest MEY (4,888 kg ha^{-1}) was obtained with maize + fieldbean 4:2 with 100 per cent NPK to both the crops which was comparable with other treatments which were fertilized to both the crops. All intercropping situations recorded land equivalent ratio more than unity, indicating higher biological efficiency of the system. Again same treatment recorded better biological potential 37 % higher yield advantage compared to sole cropping. the ATER value recorded more than one indicating that maize gave more yield (1.68) than the sole cropping with respect to time and space dimension in maize + fieldbean 4:2 with 100 per cent NPK to both the crop, maize proved the dominant companion to intercrop in all the treatments irrespective of row proportion which were fertilized to both the crops, having the lower competition ratio, land equivalent coefficient and in case of aggressivity well fertilized treatments of intercropping showed relatively dominance of fieldbean over maize which help in getting the higher maize grain equivalent yield and better system productivity (Table 2). This might be due to efficient utilization of resources and less competition between the both component species. This is in line with the findings of Rana *et al.* (2006).

Economic viability

The monitory advantage indict superior economic viability of maize + fieldbean intercropping in 4:2 row proportions with 100 per cent NPK to both the crops, over other intercropping system. Maize + fieldbean intercropping in 4:2 row proportions with 100 per cent NPK to both the crops recorded highest net returns (Rs.38830 ha^{-1}) and B:C ratio (3.24) followed by maize + fieldbean intercropping in 8:2 row proportions with 100 per cent NPK to both the crops (35312) and B:C ratio (2.84) indicating the superiority of these systems over farmers practice, sole maize and other treatments (Table 2). This is due to increased proportion of net returns in relation to cost of cultivation.

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OFT on Weed Management in Kharif Maize in Garhwa District of Jharkhand

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Abstract

The OFT was planned in the Kharif of 2009. Farmer's practice selected was the age old traditional method of hand weeding. Since, several tools and equipments are now available, so dutch hoe was selected as one of the technological option vis a vis chemical control. Chemical weeding with Atrazin 50% dust @ 1.5 kg/ha after 2-3 days of sowing +one weeding at knee height stage with Dutch Hoe showed minimum weed population with highest yield (30.2 q/ha) and highest B:C ratio (3.5).

Key words: Maize, Weeds, weedicides, Garhwa, OFT

Introduction

Maize is the second major cereal crop grown in different regions of Jharkhand. Maize plant thrives well in a soil having neutral soil reaction and sandy to silty clay loam in texture. Most of the soils of Jharkhand are acidic and light in texture. The productivity of maize crop and per capita availability of maize in Jharkhand is quite low. Out of several reasons cited for its low productivity, the plethora of weed species competing with the maize crop for nutrition is the most limiting one. A host of weed diversity is found in Maize crop (Munda *et. al.,* 1997). The crop maize is very much susceptible to weed. Generally farmers of Jharkhand avoid applying weedicides. Good control of weeds can be attained through combining several techniques which can work co-operately to produce a weed suppressing cropping system. Studies by Mariga, I.K. (1990) found that a combination of 66 % of the recommended dosage of metolachlor in a maize/bean intercrop produced the best results under weed suppression and therefore it is the best package for small holder farmers. The same study revealed that a combination of intercropping and reduced herbicide dosages reduced the number of weeding in a maize crop from three to two. The introduction of the integrated weed Management (IWM) in farmers' field is the answer to the weed management problem. Maize is one of the major crops, but, it is labour intensive due to weed problem which is mainly done by farm women. Controlling weed by other means than hand weeding is time saving as well as labour (Legere *et al.,* 2005). Taking this problem at village area this OFT was designed.

Materials and methods

The OFT was planned in the Kharif of 2009. For this a 500m^2 plot in a preselected village named Narayanpura in Garhwa district of Jharkhand was selected. Farmer's practice selected was the age old traditional method of hand weeding. Since, several tools and equipments are now available, so Dutch hoe was selected as one of the technological option. Chemical control is by far the most commonly used weed control method, so it formed the natural choice of technological option. All the standard package of practices were followed the experiment was laid out in randomized black design with 10 replications. Test crop was Maize and there were four treatments as per the technologies selected which is given below

Details of technology selected:

Farmers Practices	: One hand weeding at 20 days after wowing
Technological options 1	: Two weeding with Dutch hoe first 10 Days after Sowing and 2nd at knee height stage
Technological Options 2	: Chemical Weeding with Atrazin 50% dust @ 1.5 kg/ ha after 2-3 days of sowing
Technological Options 3	: Chemical weeding (TO-2) + one weeding at Knee height stage with Dutch hoe (TO-1)
Year of Experiment	: Kharif, 2009
Experimental Design	: RBD
Replication	: 10
Crop	: Maize
Spacing	: 60 cm X 25 cm
Plot Size	: 500 m^2
A. Source of technology	: BAU, Ranchi
b. Production system & thematic area	: Integrated weed management

Results and discussions

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Table 1:Yield and yield parameters of Maize under various treatments combinations.

Technology Options	Technology Assessed	Weed Population (No.)/m^2	Yield attributing characters Plant Height(cm)	No. of Cob /Plant	Length of Cob (cm)	Grain Yied (q/ha)	B:Cratio
Farmer Practice	One hand weeding at 20 days after wowing	94.8	2.8	169.9	2.1	140.9	22.5
Technological options 1	Two Weeding with Dutch Hoe first 10 days after sowing and 2nd at knee height stage	39.9	170.7	2.5	15.83	27.8	3.4
Technological Options 2	Chemical weeding with Atrazin 50% dust @ 1.5 kg/ha after 2-3 days of sowing	31.3	170.3	2.6	15.77	26.9	3.2
Technological Options 3	Chemical weeding (TO-25) + One weeding at Knee height stage with Dutch Hoe (TO-1)	10.5	171.6	2.8	16.74	30.2	3.5
SEm		1.05	0.10	0.16	0.094	0.514	
CD(0.05)		2.16	0.21	0.332	0.19	1.06	
CV (%)		7.6	0.184	19.48	1.89	6.05	

Field tests were conducted to evaluate the performance of three different types of technological options selected over farmer‘s practice. Different parameters selected were No. of weed / m^2, height of plant (cm), no. of cobs / plant, weight of grain (g), Cob yield q/ha, B:C Ratio. Crop yield is a complex phenomenon which depends upon accumulation and partitioning of photosynthates from source to sink. This partitioning of photosynthates may vary depending upon the time of sowing, effective weed control which results in differential growth and development of the crop. As per results presented in table 1, weed suppression was highly significant in the technological option 3. Farmer's field had host of weed biomass and was no match to different treatment combinations of weed management. A perusal of the data presented in table 1 indicated that, the plant height increased gradually with successive technological options. The maximum plant height (171.6cm) was recorded with technological option 3 i.e. Chemical weeding (TO-25) + one weeding at knee height stage with Dutch Hoe (TO-1) which was significantly higher over farmer's practice and at par with other technological options tested. This indicated that chemical weeding (TO-25) + one weeding at knee height stage with Dutch Hoe resulted in increased plant height, which may be attributed to the favourable climatic conditions and availability of more water, nutrients due to effective weeds control, which coincided with the active growth period of the crop. Significantly higher number of cobs (2.8/ plant) were recorded in third technological option which was at par with technological option number 1&2. The number of cobs per plant increased gradually from 2.1 cobs per plant in farmer's practice of sowing to 2.8 cobs per plant with technological option 3 i.e. Chemical weeding (TO-25) + one weeding at knee height stage with Dutch hoe (TO-1) and then decreased gradually from technological options 1 onwards. This may be attributed to the facts that technological option 1 had no chemical treatment and crop attained less growth and development, which resulted in poor source to sink partitioning of the photosynthates and thus resulted in formation of lesser number of cobs per plant. Highly significant yield and yield parameters data were obtained in all the three technological options compared to farmer's practice. Cost benefit ratio calculated was significantly higher in the treatment three.

Conclusions & recommendations

Chemical weeding with Atrazin 50% dust @ 1.5 kg/ha after 2-3 days of sowing +one weeding at knee height stage with Dutch Hoe showed minimum weed population with highest yield (30.2 q/ha) and highest B:C ratio (3.5).

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Studies on genesis, classification and evaluation of chilli growing soils in Khammam district, Andhra Pradesh

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Abstract

Typical pedons representing major land forms of chilli growing soils in Khammam district of Andhra Pradesh were characterized, classified and assessed for their nutrient status. The depth of soils was moderately shallow to deep, yellowish brown to dark red in colour, sandy to clay in texture, slightly acidic to moderately alkaline, non-saline, low in organic carbon content and low to medium in cation exchange capacity. Soils are low to medium in available nitrogen and phosphorus, low to high in available potassium and high in available sulphur. However, the soils were deficient in DTPA-extractable Fe, sufficient in DTPA-extractable Zn, Cu and Mn. However the Entisol pedons did not show presence of any diagnostic horizon.

Key words: Chilli crop, Soil Classification, Soil Taxonom

Introduction

Soils provide food, fodder and fuel for meeting the basic needs of human and animal. With the growth in human and animal population, demand for more food production is on the increase. However, the capacity of the soil to produce is limited and limits to production are set by intrinsic characteristics, agro-ecological setting, use and management. This demands systematic appraisal of our soil resources with respect to their extent, distribution, characteristic, behaviour and use potential, which is very important for developing an effective land use system for augmenting agricultural production on sustainable basis (FAO, 1993).

Despite the significant growth in production, the sustainability of some cropping systems has been showing signs of figure.

Therefore, Comprehensive account of our land resource ascertaining its potential and problems towards optimizing land use on sustainable basis is necessary. In the recent past, productivity of agricultural soils worldwide in general is on the decline. This prompted the per capita availability of food grain fall from 510 g per day (1991) to 463 g per day (2004). The soils of Chilli growing area Khammam district have been classified as red loams, red earths and black soils. The characterization and classification of these soils were not based on systematic analysis of soils and as per Soil Taxonomy. Hence, the present study was undertaken to characterize the morphological, physical and chemical properties of dominant soil groups occurring in this area and to classify them.

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Materials and Methods

The area selected for the present study of Khammam District of Andhra Pradesh has total geographical area of 16, 029 Sq. km. The district is located between 16o 45' and 18o 35' North Latitude and 79o 47' and 80o 47' East Longitude. The climate of Khammam district is comparatively equitable and although it is very hot in May with mercury rising upto 52oC. The temperature dips to 13oC in winters during the months of December and January.

These seven pedons were studied in detail and the morphological characteristics are presented in table 1. The detailed morphological description of these seven pedons was studied in the field as per the procedure outlined in Soil Survey Manual (Soil Survey Division Staff 2000). The horizon-wise soil samples were collected, processed and analysed for important physical, physico-chemical properties and available nutrient status using standard analytical techniques (Piper 1950; Richards 1954; Jackson 1973; Watanabe and Olsen 1965; Lindsay and Norvell 1978). The soils were classified taxonomically (Soil Survey Staff 2003).

Results and Discussion

Morphological properties

The morphometric characterisitcs of the pedons have been given in Table 1. The depth of soils was moderately shallow to deep. It varied from 80 cm in Cherla to 95 cm in Aswaraopeta and Aswaraopuram. In the surface horizons, the boundary was clear smooth in all the profiles. It varied from clear smooth to clear wavy to diffuse wavy in other horizons.

The soil colour was yellowish red (Hue 10 YR to 2.5 YR) with Values between 3 and 5 and Chroma ranging from 1 to 6. The purity of colour decreased

with depth.The soil colour appears to be the function of chemical and mineralogical composition as well as textural make up of soils and conditioned by topographic position and moisture regime (Walia and Rao 1997). Soil texture varied from sandy loam to clay loam in surface horizons and sandy clay loam to clay loam to clay in sub- surface horizons. In surface horizon, sub angular blocky structure was observed in all the profiles. The structure was sub angular blocky to angular blocky in sub - surface horizons.

Physico-chemical characteristics: All the pedons were acidic (5.96) to slightly alkaline (8.24) in reaction. This wide variation was attributed to the nature of the parent material, leaching, presence of calcium carbonate and exchangeable sodium.

Organic carbon content of these soils was found to be low, ranging from 0.21 to 0.65 % (Table 3). The organic carbon content decreased with depth in all the pedons. This is attributed to the addition of plant residues and farmyard manure to surface horizons.. The CEC in all the pedons estimated by ammonium acetate extract varied from 14.93 to 32.63 cmol (p^+) kg^{-1} soil which corresponds to clay content in the horizons, organic carbon content and also type of clay mineral present in these soils. Similar results were reported by Ramprakash and Seshagiri Rao (2002).

Soil Classification

Based on morphological, physical, physico-chemical and chemical properties of the soils and the climate of the district, the profiles of chilli growing soils of Khammam district were classified upto family level (Table 4) as per the specification given by Soil Taxonomy (Soil Survey Staff,1998).The soils were classified into Alfisols, Inceptisols and Vertisols at order level. Bharathi (2008) reported Entisols, Inceptisols and Alfisols in the soils of oil palm growing area of Khammam district.

Pedons 5 and 7 which have cambic (Bw) sub-surface diagnostic horizon, were classified under Inceptisols. The two pedons 5 and 7 were grouped under Usteps at sub-order level due to ustic soil moisture regime and Haplustepts at great group level because these pedons did not have either duripan or calcic horizon and base satumation was more than 60% at a depth between 0.25 to 0.75 m from the surface.

Nutrient Status and Soil Fertility

Macronutrients: Soil fertility exhibits the status of different soils with regard to the amount and availability of nutrients essential for plant growth. The available nitrogen content varied from 144 to 320 kg ha^{-1} (Table 3) throughout the depth. However, available nitrogen content was found to be maximum in surface horizons and decreased regularly with depth which is due to decreasing trend of organic carbon with depth and because cultivation of crops is mainly confined to the surface horizon (Rhizosphere) only and at regular

Table 1 Physico chemical properties

Location	Depth (cm)	pH (1:2.5)	EC (dS m^{-1})	Exchangeable bases (cmol(p^+)kg^{-1})				CEC (cmol (p^+) kg^{-1})	ESP (%)	Base Saturation(%)
				Ca^{2+}	Mg^{2+}	Na^+	K^+			
Aswaraopeta	0-25	6.07	0.06	11.2	1.2	0.3	0.20	19.20	9.37	75
	25-40	6.10	0.06	13.2	1.0	0.4	0.20	18.60	7.52	85
	40-95+	5.96	0.07	14.7	3.0	0.4	0.10	24.53	2.44	75
Burgampadu	0-20	7.03	0.31	8.4	7.8	2.4	0.40	24.20	9.91	79
	20-35	7.10	0.41	5.6	5.2	2.0	0.30	18.40	10.80	71
	35-55	7.08	0.38	9.6	4.8	2.1	0.30	21.20	9.90	79
	55-80+	7.12	0.34	10.4	5.6	2.8	0.30	26.50	10.50	72
Jularupadu	0-15	7.82	0.39	9.2	1.4	2.4	0.20	18.10	13.25	72
	15-32	7.57	0.39	8.4	3.8	2.8	0.20	21.10	13.27	72
	32-75+	7.43	0.38	7.8	4.0	2.0	0.20	19.20	10.41	72
Cherla	0-15	8.05	0.10	16.4	4.1	2.2	0.30	28.30	7.77	81
	15-25	8.16	0.11	15.1	2.4	1.0	0.20	25.60	3.90	73
	25-60	8.20	0.08	7.5	5.4	0.9	0.20	27.42	3.85	80
	60-80	8.24	0.08	16.2	3.7	1.8	0.20	27.42	6.56	80
Vararama chandrapuram	0-30	7.86	0.08	14.3	6.6	3.6	0.60	31.40	11.46	80
	30-55	8.06	0.11	12.9	6.1	3.3	0.60	32.21	10.24	71
	55-90+	8.02	0.11	16.2	5.8	3.8	0.30	32.63	11.64	80
Singareni	0-15	7.62	0.30	7.0	2.5	1.5	0.20	14.93	10.00	75
	15-35	7.54	0.20	8.7	4.7	1.0	0.20	18.21	5.49	80
	35-65+	7.60	0.62	9.5	4.3	0.8	0.20	18.51	4.32	80
Ashwapuram	0-25	8.01	0.15	16.2	1.2	1.8	0.40	25.78	6.98	88
	25-48	7.85	0.21	15.2	3.3	0.8	0.30	23.16	3.45	85
	48-95+	7.95	0.17	16.2	3.6	0.9	0.30	26.10	3.44	80

interval the depleted nitrogen content is supplemented by the external addition of fertilizers during crop cultivation (Prasuna Rani *et al.* 1992).

The available phosphorus varied from 6.3 to 34.0 kg ha^{-1} in this district. However, the highest available phosphorus content was observed in the surface horizons and decreased with depth. Available potassium content of soils varied from 134 to 314 kg ha^{1}.

Micronutrients: The DTPA extractable Zn ranged from 0.20 to 1.41 mg kg^{-1} soil in surface soils. Vertical distribution of Zn exhibited little variation with depth. Considering 0.6 mg kg^{1} as critical level (Lindsay and Norvell 1978) the surface soils are sufficient in Zn. While sub-surface soils are deficient in Zn. The micronutrient analysis of the Khammam district indicated that the surface soils are sufficient while sub-surface soils are deficient in DTPA extractable zinc, deficient in Fe and sufficient in DTPA extractable Cu and Mn.

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Effect of Plant Growth Promoters on the yield of Moong bean (Phaseolus radiatus)

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Abstract

The field experiments were conducted in kharif 2008 and 2009 in Tarai region of Uttar Pradesh on Green gram (Moong) to asses the contribution of growth promoters commercially available in the market. For this purpose Aminos, Biozyme, Tracel and Planofix were sprayed on standing crop at 30 and 50 days after sowing. The seed of green gram was inoculated prior to sowing for all the treatments except control. Growth promoters were applied as alone and also their dual combinations. The data were recorded on plant growth characters at 40 and 70 days after sowing and yield attributing character were recorded at harvest. Among single applied growth promoters, Aminos (yield 8.90 and 9.32 q/ ha) contributed more as plant growth and yield attributing characters followed planofix (yield 8.66 and 9.11 q/ ha), tracel (yield 8.33 and 8.86 q/ ha) and biozyme (yield 8.10 and 7.86 q/ ha). Highest plant growth, yield attributing character and grain yield (yield 10.10 and 10.66 q/ ha) observed from dual application of aminos + planofix followed by aminos+ tracel (yield 9.90 and 10.35 q/ ha) aminos+ biozyme (9.86 and 10.26 q/ ha), biozyme+ planofix, planofix+ tracel and biozyme+ tracel from both the years of experiments.

Key words: Green gram, Aminos, Biozyme, Tracel, Planofix, Rhizobium.

Introduction

Agriculture productivity is very important to produce better quality and yield leads to profitability. However to achieve this goal with advancement of technology, use of excess fertilizer and pesticides in not adequate, now the time is to look at Bio-technological tools to achieve the goal of Farmers. For this purpose plants growth promoters may become a new techniques to increase productivity. The requirement of growth promoters, amino acids, micronutrients in essential quantities is well known as a means to increase yield. The foliar application of growth promoters is based on its requirement by plants. The plant absorbs amino acids, micronutrients, hormones and enzymes through stomata and used as ingredients in the process of Protein Synthesis. Most of the Indian farmers traditionally using recommended seed and fertilizers practices to produce their crops with their limited resources. There are many growth promoters available in the market which can increase productivity with minimum cost. For this purpose experiments were planned to assess the contribution of Aminos, Tracel, Biozyme and Planofix on legume Green gram (Moong) Palaniappan and Balasubramaniyam (1989) reported the yield of cereals and legumes, maximized by increasing plant density by increasing application of growth regulators. Sen and Swain (1994) also observed the effect of biozyme on grains under irrigated conditions. Jana and Paria (1996) calculated the best treatment was 0.5% spray of tracel on vegetables followed by aminos 0.2- 0.4 % at flowering and pod development stage growth and yield of pea.

Materials and Methods

The field experiments were conducted in kharif 2008 and 2009 at Tarai of Uttar Pradesh by using commercial growth promoters available in market on sprayed on standing crop of Green gram (Moong) at initial growth stage and just before flowering. Before sowing seeds were inoculated with rhizobium culture except control uniformly. The growth promoters were used in separate treatment and also with their combinations at 30 and 50 days after sowing. The experiments were conducted in RBD with three replication, data were recorded at 40 and 70 days after sowing (DAS) growth stage and at crop harvest. The growth promoter's descriptions as follows:

Aminos- It is an amino acid based Bio-stimulants, used 500 ml/ hectare at flower initiation stage.

Bio-zyme- It contains plant growth regulators as cytokinin, auxine precursors, enzyme and amino acids specially blended to retain their stability over long

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periods. Used 400 ml/ hect. sprayed at flowering stage.

Planofix- It is a Nephaline acetic acid (NAA) used 100 ml/ hectare. Spray was done at evening time to protect from sunlight. Lakshmamma and Rao (1996) recommended spray of 20 ppm NAA twice at 50 % flowering stage, decrease flower drop and increased seed yield in V. mungo.

Tracel- It is a mixture of micronutrient available in powder form and used 4 kg tracel dissolved in 500 liter of water spray at flower initiation stage.

The experimental site having soil loam soil with 7.3 pH and sowing was done in the second week of July in both the years.

Results and Discussions

The growth promoters were applied at 30 and 50 days after sowing. The effects of different treatments were recorded at three times during crop season in both the years. Plant height, nodule number, nodule dry weight was recorded at 40 and 70 days after sowing and The yield attributes number of pods per plant, number of grain per plant, plant dry weight per plant, grain yield q/ha and thousand grain weight recorded at harvest.

It was revealed from the data that at 40 DAS maximum plant height (34.66 cm), nodule number per plant (7.66), nodule dry weight (27.00 mg per plant) and plant dry weight (3.56 gm/ pl.) recorded from application of aminos among single applied growth promoters. Lowest plant height (30.66 cm), nodule number per plant (4.66), nodule dry weight (17.66 mg per plant) and plant dry weight (2.53 gm/pl.) recorded from control treatment followed by rhizobium inoculated treatment. It is also observed that at 40 DAS maximum plant height (35.63 cm), nodule number per plant (8.33), nodule dry weight (28.33 mg per plant) and plant dry weight (3.43 gm/pl.) recorded from aminos+ Planofix growth promoters applied in combination followed by aminos+tracel, aminos+biozyme, biozyme+planofix, planofix+tracel and biozyme+tracel compared to single applied growth promoters and rhizobium application.

The data were recorded at 70 DAS maximum plant height (56.33 cm), nodule number per plant (21.66), nodule dry weight (77.00 mg per plant) and plant dry weight (3.70 gm/pl.) from application of aminos among single applied growth promoters. Lowest plant height (50.00 cm), nodule number per plant (15.00), nodule dry weight (60.66 mg per plant) and plant dry weight (3.06 gm/pl.) recorded from control treatment followed by alone rhizobium inoculation. It was also observed at 70 DAS maximum plant height (62.33 cm), nodule number per plant (25.66), nodule dry weight (92.33 mg per plant) and plant dry weight (4.46 gm/pl.) recorded from aminos+ Planofix growth promoters applied in combination followed by aminos+ tracel, aminos+ biozyme, biozyme+ planofix, planofix+ tracel and biozyme+ tracel, also compared with single applied growth promoters and alone rhizobium application during first year of experimentation (table- 1). Lakshmamma and Rao (1996) said the application of growth promoters increased plant ht. DW and to increased seed yield in vigna mungo.

The yield contributing character were concern, lowest pods per plant (6.00) observed from rhizobium inoculation alone followed by control (5.0) treatment. Application of alone growth promoters was consider, aminos contributed more pod yield (7.33 pods/ pl.) followed by planofix (6.33 pods/ pl.), tracel (6.16 pods/ pl.) and biozyme (6.00 pods/ pl.) respectively.

Table 1: Effect of growth promoters on growth characters of green gram in Kharif 2008

Treatments	Pl. ht. cm 40 DAS	Nodule no/pl. 40 DAS	Nod dry wt. mg/pl.	Pl. dry wt. gm. 40 DAS	Pl. ht. cm 70 DAS	Nodule no/ pl. 70 DAS	Nod dry wt. mg/pl	Pl. dry wt. gm./pl
Control	30.66	4.66	17.66	2.53	50.00	15.00	60.66	3.06
Rhizobium	31.33	6.00	26.00	2.76	52.00	16.66	65.66	3.23
R+ Aminos	34.66	7.66	27.00	3.56	56.33	21.66	77.00	3.70
R+ Biozyme	31.66	6.25	26.20	2.83	54.66	19.00	71.66	3.43
R+ Planofix	32.66	7.00	26.66	3.26	55.33	20.66	72.66	3.53
R+ Tracel	34.00	6.50	26.33	3.13	55.66	19.33	72.33	3.50
R+ Amino+ Biozyme	35.33	8.15	27.53	3.23	60.33	24.33	82.33	4.20
R+ Biozyme+ Planofix	35.26	8.10	27.40	3.20	60.66	23.86	80.33	3.95
R+ Planofix+ Tracel	34.90	7.90	27.33	2.96	58.66	23.60	78.66	3.90
R+ Biozyme+ Tracel	34.80	7.83	27.10	2.86	58.33	22.66	78.00	3.82
R+ Aminos+ Tracel	35.43	8.24	27.70	3.30	61.66	24.66	87.66	4.38
R+ Aminos+ Planofix	35.63	8.33	28.33	3.43	62.33	25.66	92.33	4.46
	NS	NS	*	**	**	**	**	**
SEM	2.021	0.764	1.673	0.148	1.046	1.079	4.464	0.112
CD 5%	5.929	2.243	4.909	0.435	3.069	3.166	13.09	0.331

Table 2: Effect of growth promoters on yield attributes of green gram in Kharif 2008

Treatments	No. Pods/plant	Plant dry wt./pl. (gm) at harvest	No. Grain/plant	Grain yield (q/ha)	Thousand Grain wt. (gm)
Control	5.0	1.36	7.66	7.33	74.63
Rhizobium	6.0	1.43	9.66	7.66	74.74
R+ Aminos	7.33	1.63	11.66	8.90	75.21
R+ Biozyme	6.00	1.46	10.33	8.10	74.98
R+ Planofix	6.33	1.50	11.33	8.66	77.62
R+ Tracel	6.16	1.46	10.66	8.33	74.97
R+ Amino+ Biozyme	8.13	1.93	13.33	9.86	77.05
R+ Biozyme+ Planofix	7.96	1.86	12.66	9.66	76.54
R+ Planofix+ Tracel	7.86	1.83	12.33	9.33	76.37
R+ Biozyme+ Tracel	7.33	1.76	12.00	9.10	75.86
R+ Aminos+ Tracel	8.33	2.10	13.66	9.90	77.21
R+ Aminos+ Planofix	8.66	2.20	14.33	10.10	77.66
*	**	**	*	NS	
SEM	0.941	0.097	0.308	0.487	4.445
CD 5%	1.441	0.284	0.904	0.844	13.03

Maximum pod per plant (8.66 pods/ pl.) were obtained from spray of aminos + planofix treatment followed by aminos+ tracel (8.33 pods/ pl.), aminos +biozyme (8.13 pods/ pl.), and biozyme+ planofix (7.96 pods/ pl.) among applied growth promoters in combinations. Similar observations were found from number of grains per plant as related to pods per plant. Maximum plant dry weight (2.20 gm./ plant) was recorded by combined spray of aminos + planofix treatment followed by aminos+ tracel(2.10 gm./ plant), aminos+ biozyme (1.93 gm./ plant), biozyme+ planofix (1.86 gm./ plant) and planofix+ tracel (1.83 gm./ plant). Among single application maximum plant dry wt. (1.63gm. / plant)) was found with application of aminos followed by planofix (1.50 gm./ plant), tracel and biozyme (1.46 gm./ plant). Highest grain yield (10.10 q/ ha.) were obtained from combined application of aminos + planofix, followed by aminos+ tracel (9.90 q/ha), aminos+ biozyme (9.86 q/ ha), biozyme+ planofix (9.66 q/ha). Among single applied growth promoters highest yield (8.90 q/ ha) were found from aminos and followed by planofix (8.66 q/ ha), tracel (8.33 q/ ha) and biozyme (8.10 q/ ha). It was note that rhizobium inoculation was more contribute (7.66 q/ ha) compared to control (7.33 q/ ha) treatment in the first year (kharif 2008) experimentation (table-2). Subbain et al (1989) also reported that planofix (NAA) two foliar spray 20 and 40 ppm to black gram at flower initiation stage on black gram increased yield 10-15 % over control. Baghel and Yadava (1994) reported seed yield of black gram

Table 3: Effect of growth promoters on plant growth characters of green gram in Kharif 2009

Treatments	Pl. ht. cm 40 DAS	Nodule no/pl. 40 DAS	Nod dry wt. mg/pl.	Pl. dry wt. gm. 40 DAS	Pl. ht. cm 70 DAS	Nodule no/ pl. 70 DAS	Nod dry wt. mg/pl	Pl. dry wt. gm./pl
Control	28.33	5.00	16.33	2.00	48.50	14.00	58.33	2.96
Rhizobium	29.66	5.33	19.00	2.33	50.33	15.33	62.00	3.33
R+ Aminos	33.66	7.66	25.33	3.76	54.66	18.66	68.00	3.90
R+ Biozyme	32.33	6.66	23.00	2.86	52.66	17.00	65.00	3.43
R+ Planofix	32.66	7.33	24.66	3.56	53.86	17.66	67.66	3.77
R+ Tracel	33.00	7.00	24.33	3.23	53.66	17.33	66.66	3.66
R+ Amino+ Biozyme	34.33	8.00	26.10	3.93	58.00	21.66	75.33	4.80
R+ Biozyme+ Planofix	34.16	7.96	26.00	3.90	57.33	21.33	73.33	4.70
R+ Planofix+ Tracel	33.95	7.66	25.66	3.86	56.66	20.60	71.66	4.16
R+ Biozyme+ Tracel	33.76	7.33	25.33	3.46	56.33	19.66	69.00	4.13
R+ Aminos+ Tracel	34.66	8.33	26.33	4.10	59.33	22.66	77.66	4.90
R+ Aminos+ Planofix	35.33	8.66	26.66	4.23	60.33	23.33	79.33	4.96
	NS	NS	*	**	**	**	**	**
SEM	1.196	0.778	2.173	0.207	1.813	1.354	5.198	0.213
CD 5%	4.326	2.285	5.157	0.511	4.125	3.876	8.745	0.445

Table 4: Effect of growth promoters on yield attributes of green gram in Kharif 2009

Treatments	No. Pods/plant	Plant dry wt./pl. (gm) at harvest	No. Grain/plant	Grain yield (q/ha)	Thousand Grain wt. (gm)
Control	5.25	1.28	7.33	7.45	73.66
Rhizobium	6.10	1.36	7.66	7.86	75.40
R+ Aminos	7.86	1.86	10.33	9.32	78.21
R+ Biozyme	6.33	1.58	9.46	7.86	75.78
R+ Planofix	7.80	1.73	9.85	9.11	77.62
R+ Tracel	7.56	1.65	9.56	8.86	76.67
R+ Amino+ Biozyme	9.00	2.33	11.20	10.26	80.32
R+ Biozyme+ Planofix	8.66	2.10	11.30	9.95	79.46
R+ Planofix+ Tracel	7.95	1.90	10.82	9.86	79.15
R+ Biozyme+ Tracel	7.67	1.85	10.76	9.65	78.68
R+ Aminos+ Tracel	9.12	2.36	12.33	10.35	80.75
R+ Aminos+ Planofix	9.21	2.45	12.66	10.66	81.66
	*	**	**		NS
SEM	1.113	0.186	0.423	0.541	5.532
CD 5%	2.241	0.308	0.848	0.734	8.843

were highest with application of 30 ppm planofix (NAA). Thousand grain wt. were almost same from biozyme+ tracel and aminos+ tracel, lowest from biozyme application alone which was near to control treatment. Mathan et all (1996) also found application of NAA yield increased by 14 to 15 percent compare to control.

It was reveled from the data that at 40 DAS maximum plant height (33.66 cm), nodule number per plant (7.66), and nodule dry weight (25.33 mg per plant) and plant dry weight (3.76 gm/pl.) recorded from application of aminos among single applied growth promoters. Lowest plant height (28.33 cm), nodule number per plant (5.00), nodule dry weight (16.33 mg per plant) and plant dry weight (2.00 gm/pl.) recorded from control treatment followed by rhizobium inoculated treatment. It was also observed that at 40 DAS maximum plant height (35.33 cm), nodule number per plant (8.66), nodule dry weight (26.66 mg per plant) and plant dry weight (4.23 gm/pl.) recorded from aminos+ Planofix growth promoters applied in combination followed by aminos+ tracel, aminos+ biozyme, biozyme+ planofix, planofix+tracel and biozyme+tracel compared to single applied growth promoters and rhizobium application.

The data were recorded at 70 DAS maximum plant height (54.66 cm), nodule number per plant (18.66), nodule dry weight (66.00 mg per plant) and plant dry weight (3.90 gm/pl.) from application of aminos among single applied growth promoters. Lowest plant height (48.50 cm), nodule number per plant (14.00), nodule dry weight (58.33 mg per plant) and plant dry weight (2.96 gm/pl.) recorded from control treatment followed by alone rhizobium inoculation. It was also observed at 70 DAS maximum plant height (60.33 cm), nodule number per plant (23.33), nodule dry weight (79.33 mg per plant) and plant dry weight (4.96 gm/pl.) recorded from aminos+ Planofix growth promoters applied in combination followed by aminos+ tracel, aminos+ biozyme, biozyme+ planofix, planofix+ tracel and biozyme+ tracel, also compared with single applied growth promoters and alone rhizobium application during second year of experimentation (table-3). Singh and Chandel (2005) reported highest grain, straw and biological yields and protein content were recorded under Biozyme crop' spray 400 ml/ha + half of recommended NPK. This was also observed by Raut et al (1995) that seed yield was highest with biozyme spray containing cytokinins, Auxines, Enzyme and Amino acids. Thousand grain wt. were almost same from biozyme+ tracel and aminos+ tracel, lowest from biozyme application alone which was near to control treatment. Sen et al (1998) said that application of biozyme @ 15 kg in wheat crop along with NPK was highest yield produced.

The yield contributing character were concern, lowest pods per plant (6.10) observed from rhizobium inoculation alone followed by control (5.25) treatment. Application of alone growth promoters was consider, aminos contributed more pod yield (7.86 pods/ pl.) followed by planofix (7.80 pods/ pl.), tracel (7.56 pods/ pl.) and biozyme (6.33 pods/ pl.) respectively. Maximum pod per plant (9.21 pods/ pl.) were obtained from spray of aminos + planofix treatment followed by aminos+ tracel (9.12 pods/ pl.), aminos +biozyme (9.00 pods/ pl.), and biozyme+ planofix (8.66 pods/

pl.) among combined applied growth promoters. Similar observations were found from number of grains per plant as related to pods per plant. Maximum plant dry weight (2.45 gm. / plant) was recorded by combined spray of aminos + planofix treatment followed by aminos+ tracel (2.36 gm. / plant), aminos+ biozyme (2.33 gm./ plant), biozyme+ planofix (2.10 gm./ plant) and planofix+ tracel (1.90 gm./ plant). Among single application maximum plant dry wt. (1.86gm. / plant)) was found with application of aminos followed by planofix (1.73 gm./ plant), tracel (1.65 gm./ plant) and biozyme (1.58gm./ plant. Highest grain yield (10.66 q/ ha.) were obtained from combined application of aminos + planofix, followed by aminos+ tracel (10.35 q/ha), aminos+ biozyme (10.26 q/ ha), biozyme+ planofix (9.95 q/ha). Among single applied growth promoters highest yield (9.32 q/ ha) were found from aminos and followed by planofix (9.11 q/ ha), tracel (8.86 q/ ha) and biozyme (7.86 q/ ha). It was note that rhizobium inoculation was more contribute (7.86 q/ ha) compared to control (7.45 q/ ha) treatment in the second year (kharif 2009) experimentation (table-4). Dathe and Lara (1990) observed Yield improvement in soybean by foliar application of Biozyme and NAA on soybean.

It was concluded that rhizobium inoculation increased yield compared to control treatment. Also concluded that all growth promoters increased yield parameters when applied singly are different combinations. Kim and Chung (1993) also concluded that growth regulators were applied on two cultivars of soybean. This increased seed yield significantly with NAA.

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Trends of dryland farming and technological gap in selected crops in Eastern U.P.

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Abstract

Efforts are needed to proper selection of crops varieties and encouragement for oil seed, pulses cultivation and also carefully adopted viz. time of sowing, depth and distance of planting. There is strong need to use area and climate based mixed cropping, intercultural, weed control and plant protection. Besides the farmers need to be educated and assisted through training, demonstration and financial help to undertake water conservation, water harvesting, soil moisture preservation, overcoming soil physical constraints and making alternative land use system. The infrastructural sport needs revitalization that input are timely, adequately and early available and linkage with the district extension machinery and the university research system also need integration.

Key words: Mixed cropping, intercultural, soil moisture, conservation

Introduction

In Indian agriculture nearly, 70 per cent of the cultivated area are under dryland agriculture and contributes 42 per cent of total food grains and, 75 per cent of pulses and oil seed. The dryland /rainfed areas are habited mostly by the rural poor, who have negligible resources at their disposal and their land holding too are very small. Unirrigated areas in India are characterized by low and unstable crop yields. In the Northern State of Madhya Pradesh and U.P. only little more than half of the net cultivated areas is irrigated. The crop wise analysis shows that about 90 per cent of the area under sorghum, pearl millet, and groundnut, is rain fed. About 65 per cent of the area under rice and rape seed/mustered is rain fed. Nearly 80 per cent of the area under gram, maize and cotton spreads over dryland in wheat, only 35 per cent area in the country is rainfed. It is estimated that even by the end of the 20th country about 50 per cent of the cultivated area will continue to be under dryland agriculture. Thus it is clear that the dryland agriculture could contribute significantly in increasing production and scope for future. The specific objective of the present study was to ascertain the an analyse trends of dryland farming technological gap in selected crops.

Methodology

The study was conducted in C D block Chaka in district Allahabad of U.P. to investigate trends of dry land farming and technological gap for selected crops under study. Out of 36 villages in Chaka block, only five villages selected purposively for the study on the basis of the highest percentage area under dry land farm technology. Thirty farmers were selected randomly from each of the five villages in equal preportion from each categories (low, medium and high) of house holds. Thus a total sample of one hundred fifty respondents were selected for the present study. The independent variables included were: Age, caste, education, family size, social participation, scientific orientation, risk orientation, knowledge, economic variables, size of holding, occupation, source of income, farm mechanization etc.

Finding and Discussion

An attempt was made to study the gap in adoption of recommended varieties of dryland crops and their technological gap in selected crops.

Table 1: Distribution of categories of farmers adopting the recommended varieties of crops in dryland. (N=150)

S.No.	Crops	Recommended Varieties	Percentage of farmer adopting practices			
			High N=21	Medium N=46	Small N=83	Total N=150
1.	Gram	K468, Pant G 114	28.57	49.27	15.66	27.77
2.	Arhar	U.P.A.S. 120, T.21, T.17	26.98	36.95	29.31	31.55
3.	Wheat	K-65, Sonalika, C. 306, Mukta	25.41	39.85	42.57	41.33
4.	Paddy	Kavery, Saket-4	19.04	27.53	17.67	11.11

Table 2: Distribution of area of dryland crops under improved seed

S. No.	Crops	Categories of farmers High N=21	Medium N=46	Low N=83
1.	Gram	57.14	67.39	83.13
2.	Arhar	42.85	63.04	75.90
3.	Wheat	76.19	82.60	84.33
4.	Paddy	38.09	56.52	71.08

Table 3: Sowing resources gap on seed rate in selected crops

S. No.	Crops	Particulars	Categories of farmers High	Medium	Low
1.	Gram	%tage of gap	19.04	17.39	19.17
2.	Arhar		23.80	28.26	15.27
3.	Wheat		28.57	10.86	6.02
4.	Paddy		38.09	23.91	16.86

Table 4: Resources gap in fertilizer application in selected crops

Crops	Categories of Farmers	Percentage of gap N	$P_2 0_5$	$K_2 0$
Gram	Low	39.75	67.46	-
Medium	52.17	67.39	-	
High	33.33	57.14	-	
Arhar	Low	45.78	63.85	-
Medium	47.82	63.04	-	
High	38.09	57.14	-	
Wheat	Low	49.39	67.46	100.00
Medium	50.00	58.69	100.00	
High	52.38	76.19	100.00	
Paddy	Low	48.19	69.87	100.00
Medium	54.34	60.86	100.00	
High	47.61	71.42	100.00	

Table 5: Percentage distribution of households on adoption of technology of sowing of crops in rainfed condition

Crops	Farmers	Time of sowing	Method of sowing
Gram	Low	51.33	10.66
	Medium	52.66	12.66
	High	53.33	13.33
Arhar	Low	53.33	12.66
	Medium	50.66	11.33
	High	50.66	13.33
Wheat	Low	53.33	27.33
	Medium	52.66	26.00
	High	50.66	24.66
Paddy	Low	54.00	22.00
	Medium	51.33	22.66
	High	52.66	19.33

It is evident from table 1 that the whole adoption of recommended varieties of wheat viz. Sonalika, K-65, C-306, Mukta were found to the level of 41.33% of the sample farmers and followed by Paddy, Gram and Arhar was found to the extent, 11.11, 27.77and 31.55% respectively.

Table 2 shows that percentage area under recommended varieties of crops was found more in holding of small farmers to medium and high farmers in almost all the crops expecting wheat.

The analysis of the resources gap is concerned upon the extent of use of seed and fertilizer in dry land cultivation. It shows that there is higher percentage gap found in Paddy and Wheat crops. Averagely 'medium' categories of farmers have resources gap in selected crops. So that the production and productivity is also effected of above crops. Another reasons responsible for lower production of these crops like farmers those involve in farming having 'medium knowledge' about timely and method of sowing.

Table 6: Technology gap for method of fertilizer of application

Technological aspect	Wheat	Paddy	Arhar	Gram
A.No. of fertilizer application	110(73.33)	72(48.0)	51(34.0)	40(26.66)
(a) Method of fertilizer application				
i Basal dressing	12(10.90)			
ii Top dressing	110(100.0)	72(100.0)		
iii Basal + Top dressing	10(9.09)	-	-	-
B. Method of placement				
i Broad cast	110 (100.0)	72 (100.0)	51 (100.0)	40 (100.0)
ii In furrow	50(45.0)	-	-	-

Table 6 shows that method of fertilizer application were use in sufficient level only in Wheat and Paddy crop compare to another crops. But in case of intercultural 'medium' technological gap were presented in these crops. Technological gap is indirectly correlated with the poor production technology of these selected areas.

Table 7: Technological gap for Intercultural

Crops	Intercultural recommendation	Technological gap in percentage
Gram	Two weeding	46.66
	One thinning	30.00
Arhar	Two weeding	76.00
	One thinning	73.33
	One hoeing	53.66
Wheat	Two weeding	55.33
Paddy	Two weeding	48.66

Table 8: Number of farmers using plant protection measures

Name of Crops	Categories of Farmers High N=21	Medium N=46	Low N=83	Total N=150
Gram	4(19.04)	6(13.04)	7 (8.43)	17(11.33)
Arhar	3 (14.28)	9(19.56)	10(12.08)	21 (14.00)
Wheat	6 (28.57)	7(15.21)	9(10.84)	22 (14.66)
Paddy	4(19.04)	7(15.21)	11(13.25)	22 (14.66)

Table 8 clearly brought out that contur bunding and other important practices were use on 'small' basis in study area. So that moisture is also a constraint in germination of seed in selected crops. Which is indirectly harmful for better crop production.

Table 9 at a glance reveals that lack of knowledge is (1st rank) most important reasons for non adoption of land improvement and water harvesting practices followed by non practicable, lack of guidance, high cost and lack of credit is also another important reasons for above scenario. A less number of farmers fees that a lack of conviction, time requires high skill, poor weather and not profitable crops also other reasons of non adoption of land and water harvesting practices.

Table 10: Reasons for non adoption of land improvement and water harvesting practices.

S.No.	Reasons for non adoption	Rank order of the reason
1.	Lack of knowledge	I
2.	Non practicable	II
3.	Lack of guidance	III
4.	High cost	IV
5.	No. of need felt	V
6.	Lack of credit	VI
7.	Lack of conviction	VII
8.	Risky	VIII
9.	Lack of time	IX
10	Requires high skill	X
11.	Poor weather	XI
12.	Non profitable	XII

Table 9: Acceptance of land improvement and water harvesting practices in dryland condition

Dryland Agricultural Practices	High N=21	Medium N=46	Small N=83	Total N=150
Contour bunding	8(38.09)	25(54.34)	51(61.44)	89(59.33)
Land shaping and landleveling	11(52.38)	21(45.62)	43(51.80)	92(61.33)
Off season Etillage	10(47.61)	19(41.30)	35(42.16)	85(56.66)
Soil mulching	9(42.85)	20(43.47)	38(45.78)	75(50.00)
Water harvesting	2 (9.52)	-	-	2(1.33)

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A study on production and marketing system of milk in Lucknow city of Uttar Pradesh

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Abstract

The present study was conducted through randomly selected 60 dairymen through and 60 milk venders (dudhiyas) who involved in supply system of milk in Lucknow city directly to consumers or through milk markets during the agricultural year 2009-10. For this purpose dairymen and milk venders were personally interviewed for collecting necessary data The results indicated that whole milk supply of Lucknow city by private milk collection and distribution agencies is depend on dairymen of urban and urban periphery areas who directly involved in production and distribution of milk and on the other milk collection and distribution agencies. The collection of milk done by these collection and distraction agencies from rural areas of district and other districts was done with iron made milk containers. The milk supplied by private milk distribution agencies was not found in any classified forms. No any kind of standardization, and quality control of milk was followed by the agencies in the existing marketing system. The source of arrival of liquid milk in the milk markets were through small, medium and large dairymen of urban, urban periphery and rural areas and milk venders. The purchasing of liquid milk in the milk markets of Luck now city was done by primary and secondary milk venders, sweet makers/hotels, small dairymen, wholesalers, milk product makers. There were no any kinds of marketing charges were paid by milk purchasers in the markets. The dairymen reported that the average milk yield of crossbred cows came to the highest of 9.71 litres/day/milch animal followed by buffaloes and cows being to 7.02 and 3.70 litres/day/milch animal, respectively. The study pattern of milk of dairymen's showed that the highest being 43.19 percent milk sold on dairy site direct to consumers by dairymen followed by 28.64 and 28.17 percent milk sold in milk markets and door to door of consumers, respectively. It is interesting to note that most of dairymen were interested in the supply of milk direct to consumers due to regular ensured supply of milk at higher prices for longer period resulted better returns than that of other milk supply channels.

Key words: Standardization, dairymen's, marketing charges,

Introduction

The dairy industry in India is going through major changes with the liberalization policies of the Government and the restructuring of the economy. This has brought about greater participation of the private sector. This is also consistent with global trends, which can hopefully lead to greater integration of Indian dairying with the world market for milk and milk products. India is witnessing winds of change because of improved milk availability, a changeover to market economy, globalization and the entry of the private sector in the dairy industry. The value addition and variety in the availability of milk products are on everybody's agenda. There is an increasing demand for new products. Today, India is the world's largest milk producer. The milk production in the country has been reached up to 91 million tonnes in 2004 from 17.8 million tonnes from 1956 and availability of milk also have reached 232mg/capita/day from 124 mg/capita/day during aforesaid period. Out of total milk production about 46 percent used as liquid milk and remaining 54 percent converted into various dairy products, such as ghee, butter, milk powder, ice cream, cheese, condensed milk and for making various kind of sweets having distinct regional preferences. As India enters an era of economic reforms, agriculture, particularly the livestock sector is positioned to be a major growth area. The fact that dairying could play a more constructive role in promoting rural welfare and reducing poverty is increasingly being recognized. For example, milk production alone involves more than 70 million producers, each raising one or two cows/buffaloes.

Dairying is a valuable tool for poverty eradication, employment generation and social change. Traditional

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dairying in India is characterized by marginal and small scale backyard type production in rural areas and only a few small, medium and large scale commercial dairymen are found in urban periphery or near urban areas. In India, about 80 percent liquid milk produced in rural areas mainly by marginal and small dairy farmers on small scale for sale and consumption purpose. And milk is produced in urban and near urban periphery areas by the small, medium and large dairymen mainly for commercial purposes.

Efforts to increase milk production by dairy farmers are strongly influenced by the degree to which demand signals are transmitted through the marketing system. Since the demand in the urban scenario is rapidly increasing the supply generated by all the milk collection and distribution agencies with the help of rural milk venders as well as commercial dairymen of urban and urban periphery areas. Cooperatives / organized dairies have played an important role in supply of liquid milk and milk products direct to consumers at large extent. The demand of commercial sweet makers, hotels, other milk products sellers and some consumers fulfilled by the supply of private milk collection and distribution agencies. These private agencies are collecting liquid milk from rural areas and some extent from urban and urban periphery areas and sold in milk markets of urban areas. Uttar Pradesh is a largest milk producing state in the country, it produces about 16 million tonnes liquid milk which accounted more than 18 percent total milk production. The availability of milk in U.P. is about 150 mg/capita/ day which is very low in comparison of Punjab, Haryana, Rajasthan, Uttaranchal, J& K, Hamachal Pradesh and Gujarat. Lucknow city is second largest city in terms of population in Uttar Pradesh on one hand and capital of Uttar Pradesh which created higher demand of liquid milk than of other districts. There are more than two dozen milk markets situated in Lucknow city where private agencies sold and purchase liquid milk and milk products to fulfill the demand of urban consumers to a large extent. Thus considering the importance of these private agencies in supply system of milk in Lucknow city, the present study was conducted with the following objectives:

Objectives

The main objectives of milk present study were:

1. To examine the system of collection of milk by various collection and distribution agencies.
2. To study the production, marketed surplus and supply pattern (marketing channels) of milk by different categories of dairymen in urban and urban periphery of Lucknow district.
3. To examine the margin taken by collection and distribution agency.

Research Methodology

The present study was conducted in Lucknow city during the agricultural year 2009-10. Sixty dairymen were selected randomly from the urban and urban periphery of Lucknow who produced milk at commercial basis and some and some part of total produced sold in milk markets of Lucknow city. Similarly, sixty milk vender (Dhudhiya) were also selected randomly who carried out the milk from rural areas for selling in the milk markets of Lucknow city. Three milk markets namely Kisan Milk Product, Chhatha mile(Kamlbad Baraily) Kursi Road, Tedi Puliya (in front of Bio-Tech Park) and Aliganj (near Yadav Petrol Pump) were selected purposively for the study of marketing system of milk. The primary data were collected by survey method with the help of pre-prepared and well structured questionnaire. For this purpose 60 dairymen of urban periphery and 60 milk venders were personally interviewed and their response recorded in questionnaire. Simple statistical analysis was done for interpretation of results.

Production of milk

The production of milk depends up in the size of herd on the farms. The following table shows the size of herd on the farms.

Herd size of dairymen

Table 1: Herd size of various kinds of milch animals on different categories of livestock holders in the urban periphery of Lucknow city

S.No.	Particulars	Small	Medium	Large	Total
1	No. of dairymen	30	22	8	60
2	No. of milch animals				
a.	Buffalo	5.73	13.45	23.00	10.87
b.	Indigenous cows	1.33	1.27	1.13	1.28
c.	Crossbred cow	1.60	2.00	2.75	1.90
	Total animals	8.67	16.73	26.88	14.05

The table shows the average herd size of milch animals of dairymen was found to be 14.05 animals/ dairymen in urban periphery of Lucknow city which varied from 8.67 milk animals/dairymen on small category to 26.88 animals/dairymen on large category. Out of total herd size of milk animals, the average number of milch buffaloes accounted to the highest being of 10.87 animals/dairymen followed by number of crossbred and improved indigenous cows accounted to 1.90 and 1.28 milch animals/dairymen, respectively. Number of milch buffaloes per dairymen was found to be more than that of other milch animals due to better survival of buffaloes in horse environment.

Milk yield per milch animal

Table 2: Milk yield of various kinds of milch animal on different categories of livestock holders
(Litres/day/animal)

S. No.	Kind milch animal	Categories of livestock holders: Small	Medium	Large	Overall
1	Buffalo	6.50	7.20	8.50	7.02
2	Indigenous cow	3.40	3.80	4.55	3.77
3	Crossbred cow	9.40	9.80	10.60	9.71

The dairymen reported that the average milk yield of crossbred cows came to the highest of 9.71 litres/day/milch animal followed by buffaloes and cows being to 7.02 and 3.70 litres/day/milch animal, respectively (table 3). Across the categories of dairymen, milk yield of different kinds of milch animals showed an increasing trend with increase in category of dairymen due to better care and management of larger categories than that of smaller ones.

Annual milk production per milch animal per lactation

Table3:Total milk production of various kinds of milch animal on different categories of livestock holders
(Litres/animal/lactation)

S. No.	Kind milch animal	Categories of livestock holders: Small	Medium	Large	Overall
1.	Buffalo	1898.00	2145.60	2592.50	2081.39
2.	Indigenous cow	945.20	1071.60	1319.50	1041.45
3.	Crossbred cow	2763.60	2910.60	3201.20	2875.85

The annual milk production of crossbred milch cow came to the highest of 2875.85 litres/cow/lactation followed by buffalo and improved indigenous cow work came to 2081.39 and 1041.45 litres/cow/lactation, respectively (Table 4). Annual milk production of different kinds of milch animals directly correlated with the per day average yield of milk and length of lactation period of milch animals.

Total milk production on dairymen's farm

The average annual total milk production in urban and urban periphery worked out to 30823.46 litres/dairymen/annual which included the highest being 77.79 percent contribution of buffaloes milk to total milk production followed by crossbred and improved indigenous cows contributing 17.91 and 4.31 percent, respectively (Table 4). Across the categories of dairymen's farms in urban and urban periphery areas, annual total milk production varied from 16563.89 litres/dairymen on small category to 69915.24 litres/dairymen on large category. Among different categories of dairymen's farms, the percentage contribution of buffalo milk showed an increasing trend with the increase in category of dairymen and vise-versa in case of improved indigenous and crossbred cows, respectively. Annual quantum of total milk production on different categories of dairymen's farms directly depends on the herd size and breeds kind of milch animals on one hand and milk yield and lactation period of milch animals on the other.

Marketable and marketed surplus of milk

The marketed surplus of liquid milk on dairymen's farm came to 29174.67 litres/dairy farm/annum in urban and urban periphery of Lucknow city which accounted to 93.84% to total milk production. The marketed surplus of milk on different categories of dairymen's farms varied from 92.49% on category to 96.43% on large category dairymen's farms. It showed

Table 4: Total milk production on different categories of livestock holders (Litres/livestock/annum)

Kind milch animals	Categories of livestock holders/annum: Small	Medium	Large	Overall
Buffalo	10881.9(65.70)	28868.1(80.07)	59627.5(85.29)	23976.2(77.79)
Indigenous cow	1260.3(7.61)	1363.8(3.78)	1484.4(2.12)	1328.1(4.31)
Crossbred cow	4421.8(26.70)	5821.2(16.15)	8803.3(12.59)	5519.1(17.91)
Total	16563.9(100.00)	36053.1(100.00)	69915.2(100.00)	30823.5(100.00)

Table 5: Marketable surplus and marketed surplus of milk on different categories of livestock holders
(Litres/livestock hoder/annum)

Particulars	Categories of livestock holders: Small	Medium	Large	Overall
Total milk production	16563.89	36053.13	69915.24	30823.46
Home consumption	803.00(4.85)	1131.50(3.14)	1569.50(2.24)	1025.65(3.33)
Wastage	440.89(2.66)	761.63(2.11)	925.74(1.32)	623.14(2.02)
Total (consumption+ wastage)	1243.89(7.51)	1893.13(5.25)	2495.24(3.57)	1648.79(5.35)
Marketable surplus/marketed surplus	15320.00(92.49)	34160.00(94.74)	67420.00(96.43)	29174.67(93.84)

F.N.- Figures is parenthesis indicate percent to total production

Table 6: Supply pattern of milk by different categories of livestock holders in the urban periphery of Lucknow city

S.No.	Particulars	Categories of livestock holders			Overall
		Small	Medium	Large	
1	On dairy site	8420.00(54.94)	14300.00(41.86)	23600.00(35.00)	12600.00(43.19)
2	Door to door	4910.00(32.05)	9590.00(28.07)	16850.00(25.00)	8218.00(28.17)
3	In milk markets	1990.00(12.99)	10270.00(30.06)	26970.00(40.00)	8356.67(28.64)
4	Total	15320.00(100.00)	34160.00(10.00)	67420.00(10.00)	29174.67(100.00)

an increasing trend of marketed surplus with the increase in categories of dairy farms due to lower home consumption and wastage of milk in respect of total milk production on larger categories than that of smaller ones. Out of total milk production, home consumption and wastage of milk due to various adversities on an average came to 3.33 and 2.02 percent, respectively.

Milk marketing channels

The marketing system of milk plays an important role in the supply system where milk reaches from producer to ultimate consumers for their consumption. The various marketing channels are prevailing in the study area for transmission of milk from the point of producers to the point of ultimate consumers. The main marketing channels of milk are given below:

1. producer- consumers
2. Producer- sweet makers /hotels – consumers
3. producer- milk venders - consumers
4. producer- milk venders- sweet makers /hotels – consumers
5. Dairymen- Halwai – consumers

Supply pattern of milk on dairymen's farms

The supply pattern of milk on dairymen's farms who were situated in the boundary of urban and urban periphery areas of Lucknow city showed that the highest being 43.19% milk sold on dairy site/milking point direct to consumers in which system consumers himself come for purchase of milk on dairymen's farm (Table 6). The second system is supply of milk door to door direct to consumers by milk producer dairymen and this system accounted to 28.17% supply of milk. The supply of milk in above said both the channels is done on the basis of oral agreement between milk distributor / dairymen and purchaser (consumer) for regular supply by dairymen and regular purchase of milk by consumers. The payment of said milk quantity is done on the monthly basis by the consumer to milk distributors. Out of total marketable surplus of milk of urban and urban periphery dairymen, about 28.64 percent marketable sold in the different milk markets of Lucknow city. It is interesting to note that most of dairymen were interested in the supply of milk direct to consumers due to regular ensured supply of milk at higher prices for longer period resulted better return than that of other milk supply channels. The dairymen of urban and urban periphery sold only that quantity of milk in the different milk markets of Lucknow city which left balance from the supply of previous both channels.

Marketing charges

Except transportation charges no any kind of others charges paid by collection and distribution agencies for milk marketing within the boundary of milk markets or outside markets. Transportation charges depend upon the distance between production points and milk markets/ultimate distribution points. Presently, there is no provision of payment of any kind of charges for marketing of milk in the Lucknow city. Respondents reported that presently all the milk collection and distribution agencies are exempted from any kind of administrative barriers of bureaucracy and sampling of milk by Food Inspectors against milk adulteration.

Purchase price of milk

Table 7: Average purchase price of milk paid by milk collection agencies to milk producers

(Rs/litre)

S.No.	Particulars	Seasons		
		Rainy	Winter	Summer
A.	Rural areas of other districts			
1.	Buffaloes	10.50	11.70	13.55
2.	Indigenous cows	9.50	10.80	12.50
3.	Crossbred cows	9.00	10.00	11.50
B.	Rural areas of district Lucknow			
1.	Buffaloes	11.40	12.60	14.00
2.	Indigenous cows	10.50	11.40	13.20
3.	Crossbred cows	10.00	10.80	11.50
C.	Urban periphery areas of Lucknow city			
1.	Buffaloes	13.50	14.80	16.00
2.	Indigenous cows	13.00	14.00	15.00
3.	Crossbred cows	12.50	13.00	14.20

The data presented in Table 7 clearly indicated that the average purchase price of buffalo milk was found to some higher in comparison to indigenous and crossbred cows due to the presence of higher fat percent in buffalo milk than that of others. The average purchase price of milk for different kinds of milch animals decreases with the increase in distance from city due to various complications in remote areas like poor availability of milk collection facilities, low demand of milk in local area, higher transportation cost, more possibilities of wastage during transportation period and more time consumed between collection and

Table 8: Average sale price of milk paid by consumers to different milk collection agencies (Rs/litre)

S.No.	Particulars	Seasons		
		Rainy	Winter	Summer
A.	Retail price on dairymen's farm direct to consumers			
1.	Pure buffaloes milk	17.00	18.50	20.00
2.	Pure indigenous cows milk	16.00	17.00	18.00
3.	Pure crossbred cows milk	15.00	16.00	17.00
B.	Retail price on door to door supply system supplied by direct producer			
1.	Pure buffaloes milk	17.00	18.50	20.00
2.	Buffaloes milk adulterated with cows	16.50	18.00	19.00
3.	Buffaloes adulterated with cows and water	11.00-15.00	12.00-16.00	13.00-1800
C.	Retail price on door to door supply system supplied other distribution agencies			
1.	Pure buffaloes milk	17.00	18.50	20.00
2.	Buffaloes milk adulterated with cows	16.50	18.00	19.00
3.	Buffaloes adulterated with cows and water	11.00-15.00	12.00-16.00	13.00-18.00
D.	Wholesale price of milk in milk markets of Lucknow city			
1.	Pure buffaloes milk	16.00	18.00	22.50
2.	Pure indigenous cows milk	15.00	16.00	18.50
3.	Pure crossbred cows milk	14.00	15.00	18.00
4.	Buffaloes milk adulterated with cows	11.00-15.00	12.00-16.00	13.00-20.00
5.	Buffaloes adulterated with cows and water	10.00-14.00	11.00-15.00	12.00-18.00

distribution process. The details of season-wise and area-wise average purchase prices of milk paid by milk collection agencies to milk producers have been given in Table 8.

Sale price of milk in Lucknow city

The data presented in table 8 clearly indicated that the average sale price of buffalo milk was found to some higher in comparison to indigenous and crossbred cows due to the presence of higher fat percent in buffalo milk than that of others. The supply of breed-wise (buffalo, indigenous and crossbred cows) pure milk insured by only dairymen of urban and urban periphery of Lucknow where consumers direct purchase milk from dairymen's production point himself. In door to door system pure buffaloes milk was also supplied by some distribution agencies on limited scale. Except above mention previous supply system of milk whole milk was supplied in adulterated form either by pure buffalo with pure cows or by pure buffalo with cows and water or pure buffalo with cream separated milk or pure buffalo with other types of adulterations. Presently, there is no any kind of administrative control followed for prevention of adulteration milk on distribution agencies in Lucknow city which resulted selling of adulterated milk in milk markets as well as direct to consumers at different prices to large extent. The details of season-wise average sale prices of milk by different milk distribution agencies to consumers have been given in table 8.

Except transportation charges no any kind of others charges paid by collection and distribution agencies for milk marketing within the boundary of milk markets or outside markets. The average purchase price of buffalo milk was found to some higher in comparison to indigenous and crossbred cows due to the presence of higher fat percent in buffalo milk than that of others. The average purchase price different kinds of milk varied from Rs.11.00/litre to Rs.16.00 /litre and sale price varied from Rs. 11.00/ litre to Rs.22.50/litre in various seasons depending upon market demand and supply of milk in the market. It may be suggested that there is urgent need to improve the collection, transportation, packaging, weighing/ measurement, classification, grading, standardization and quality control system of milk for various milk collection and distribution agencies. The existing marketing system of milk by private agencies is not found satisfactory due to prevailing of various irregularities in the system. The study shows that more price margin is taken by distribution agencies in milk marketing.

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Impact of on farm trials and various varieties of Okra on the Farmers field

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Abstract

On farm trials were conducted during spring summer season of 2007-08 and 2008-09 on the farmer's field under Agra condition. On farm trials are powerful tool to find out the suitability of particular set of new technologies for a region. This was consisting of three varieties of okra. Viz. Kashi Pragati, Pusa A-4 and Arka Anamika and recommended doses of fertilizers (RDF) 120 kg N, 100 kg P2O5, 80 kg K2O and 30 kg Zn per ha. The results showed that among these three varieties as kashi pragati (V.R.O.6) performed the best in terms of better growth and yield parameters and pod yield. The maximum plant height, number of nodes on the main stem, number of green leaves, number of branches and pod yield/ha were recorded in Kashi Pragati during both the years.

Keywords: Variety, on farm trials, packages of practices

Introduction

Okra (ladies finger) belongs to malvacea family and is one of the very popular vegetable crops of tropical and subtropical countries including India. India is one of the largest producers of vegetable in the worlds next only to China. It is mainly grown in India, Nigeria, Pakistan, Sudan, Ghana, Saudi Arabia, Mexico and Cameroon. Okra is being cultivated in many countries due to its high nutritive value especially that of vitamin A and folicaeid, and carbohydrates, phosphorous, magnesium and potassium. Globally it is being cultivated with annual area and production of about 1148.0 thousand ha and 7896.26 thousand tons. The area, production and productivity of okra in India is 498.00 mha, 5784.00 mt and 11.60 tonnes/ha respectively during 2011 (Anonymous 2012). The productivity of okra in India is very low and there is great scope to enhance it through adoption of recommended advanced packages of practice and improved high yield varieties. An increasing population and degradation of natural resources requires application of new technologies to maintain a sustainable vegetable production without ecological imbalance. Horticultural crops especially vegetables are input intensive enterprise. Presently the costs of the planting material/seeds, nutrients, pesticides, water, power and labour are increasing enormously; whereas increase in crop productivity is at low pace (Kumar et al 2013). For better adoption of improved techniques of cultivation, there is need to sensitize the farmers about the impact of new varieties and package of practices. Keeping this in view experiments were under taken by Krishi Vigyan Kendra, R B S College, Bichpuri, Agra to demonstrate the impact of varietal response through on farm trials (OFT) at the farmer's field during 2007-08 and 2008-09.

Material and Methods

The on farm trials were conducted by Krishi Vigyan Kendra R.B.S College Bichpuri , Agra as per the guide lines of on farm trials to KVK by zonal coordinator of zone IV. The O F T under okra were laid out in adopted villages, Nagar, Garhi Doulta and Dawali of Agra district. Total ten numbers of the farmers in each village were selected in the study. The farmers were asked the question about the improved agro-techniques including the high yielding varieties of okra. Also KVK scientists visited regularly the OFT. The farmers were regularly guided for adoption of complete package of practices by the subject matter specialist through on farm and on campus training. Also capacity building progamme on improved okra cultivation were under taken by the scientist of KVK. Three varieties were sown with crop geometry of 60 cm row to row distance and 20 cm plant to plant distance. All the recommended agronomic practices were followed as and when required to produce good okra crop. The observations were recorded on plant height, numbers of nodes on the main stem, number of green leaves per plant, number of branch per plant, number of fruit per plant, productivity etc.

Results and Discussion

Plant Height

The data recorded on the plant height (cm) are presented in table 1. The perusal of the data revealed that the longest plant heights of three different varieties were 46 and 45.50 cm and it was recorded in variety Kashi pragati during both the year. Pusa A-4 and Arka Anamika were found better of okra against local check

Table 1: Effect of various varietal treatments on height of the main stem

Treatments	2007-08				2008-09			
	30	45	60	75	30	45	60	75
Kashi pragati (V.R.06)	14.00	24.30	33.20	45.00	13.30	23.75	32.20	46.50
PUSA A-4	13.20	22.18	28.00	40.20	13.00	21.99	26.00	40.50
Arka Anamika	13.50	23.20	32.00	45.30	13.20	22.00	31.50	41.00
CD at 5%	NS	NS	2.3	3.1	NS	NS	2.2	3.2

Table 2: Effect of various variety treatments on number of nodes on the main stem

Treatment	2007-08				2008-09			
	30	45	60	75	30	45	60	75
Kashipragati (V.R.06)	5.58	9.69	12.30	16.00	5.00	8.69	11.75	15.58
PUSA A-4	5.20	8.85	11.58	15.55	4.85	8.45	11.00	15.20
ArKa Anamika	5.30	9.09	11.75	15.77	4.90	8.60	11.70	15.60

at Nagar, and Garhi Doulata. Agrawal et al., 1991 and Adelana, B.O. (1983) also reported similar results.

Numbers of Nodes on the Main Stem

The data on number of nodes on the Main Stem as obtained in different varieties at recommended dose of fertilizing 120+100+80+30 kg/ha (NPK & Zn) are given in table 2 .The maximum (16.00 and 15.58) number of nodes were note in kasha pragati, which were significant than those Pusa A-4 and Arka Anamika. Gupta, et el., 1981 also reported in similar line of number of nodes on the main stem in improved cultivar of okra.

Number of Green leaves per plant

The effect of varieties, fertilizer doses (120+100+80+30 NPK and Zinc/hq) were statistically significant on number of green leaves per plant during both the year. The maximum number of leaves (33.34 and 32.12) were recorded in kashi pragati which was significantlyy higher than those in to Arka Anamika and Pusa A-4.

Number of Branch per plant

The data recorded number of branch as obtained in different varieties, fertilizer dose (120+100+80+30 NPK and Zinc/ha) were given in table 4. The maximum numbers of branch (4.18 and 4.12) was recorded in kasha pragati and were significantly higher than those in to Arka Anamika and Pusa A-4.

Number of fruit per plant

Among three varieties under on farm trials, maximum number of fruits (pod) per plant was recorded in variety Kashi pragati closely followed by Arka Anamika and Pusa A-4 during 2007 and similar trend was recorded during 2008. The data has been presented in Table 5.

Table 3: Effect of Various variety treatments number of green leaves per plant

Treatment	2007-08				2008-09			
	30	45	60	75	30	45	60	75
Kashipragati (V.R.06)	6.00	10.80	25.19	33.39	5.96	10.30	25.83	32.12
PUSA A-4	5.50	9.73	19.26	27.60	5.30	9.10	19.20	27.35
ArKa Anamika	5.80	10.00	19.68	28.20	5.72	9.18	19.30	28.10
CD at 5%	1.10	NS	1.80	1.90	1.20	NS	1.80	2.50

Table 4: Effect of Various variety treatments on number of branches per plant

Treatment	2007-08				2008-09			
	30	45	60	75	30	45	60	75
Kashipragati (V.R.06)	-	-	2.20	4.18	-	-	2.10	4.12
PUSA A-4	-	-	1.60	3.50	-	-	1.65	3.33
ArKa Anamika	-	-	1.80	3.90	-	-	1.69	4.8

Table 5: Effect of various variety treatments on number of fruit per plant

S. No.	Treatments	Number of fruit per plant 2007-08	2008-09
1	Kashi pragati	23.70	22.65
2	Pusa A-4	20.40	19.65
3	Arka Anamika	21.00	21.20
	CD at 5%	2.10	2.15

Table 6: Pod yield of different varieties of okra

S. No.	Treatments	2007-08 Pod productivity, tones/ha	% increase over check	2008-09 Pod productivity, over check	% increase tones/ha
1	Kashi pragati	15.5	52.0	17.2	62.3
2	Pusa A-4	13.5	32.4	14.2	34.0
3	Arka Anamika	12.1	18.6	12.1	14.2
4	Local Check	10.2	-	10.6	-
	CD at 5%	1.85		1.72	

Pod yield

The pod yield of the improved varieties of okra, Kashi Pragati and Pusa A-4 were higher as against local check. The highest pod yield was recorded from variety Kashi Pragati during both the year (Table 6). Mani and Ramanathan 1980 also reported better pod productivity of improved varieties of okra. The higher pod productivity of okra variety Kashi Pragati was realized due to the fact of its better growth and yield attributes. Compare to other varieties under OFT. More than 50 % increase in pod productivity was recorded over local check in improved variety Kashi pragati during both the years. However on an average 33.2 and 16.4 % increase in pod productivity of varieties Pusa A-4, Arka Anamika was observed over two years compare to local check of okra (Table 6)

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Role of Farm and Non-farm Activities on Rural Employment, Income and Expenditure Pattern: A Sectoral Analysis

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Abstrat

The analysis made in the study area leads to conclude that economic parameters of rural households like level of employment, income, expenditure on food and non-food items and saving are greatly influenced by availability and accessibility of resources to rural households. There exists a wide disparity in economy of households in irrigated and rain-fed area as household income and per-capita income was observed much higher in irrigated area as compared to rain-fed area. The study revealed that farm sector is the main source of employment and income in irrigated area while farm and non-farm were equally important at rain-fed area of Rajasthan. The marginal and small farmers of rain-fed area are equally depending on rural non-farm activities as the secondary source of income during slack agricultural season. It is fairly evident that with increasing population pressure, small and fragmented agricultural landholding, highly inequitous distribution of land and fragile environmental condition etc., agriculture alone cannot provide solution for rural un-employment and under-employment in the state of Rajasthan. There is need to provide urban facilities to rural areas to give boost to rural non-farm employment and source of livelihood.

Key words: Employment, population, rain-fed, livelihood

Introduction

In the recent time, farming in India has become non-viable, specifically for marginal and small farmers. They lead a miserable life since their meager land is not sufficient to earn adequate income to maintain their family. It has resulted in a sharp increase in the number of agricultural labourers (Rajshekhar, 1995; Pandey and Singh, 2003; Bhakar *et al.*, 2007). Although, agriculture is an important sector for the sustained growth of Indian economy but it alone cannot absorb the growing rural labour-force due to falling output elasticity's of employment within the sector (Singh *et al.*,2003) and the excess labour-force in agriculture do not get continuous employment.

The importance of non-farm sector for income and employment is gaining momentum in India as rural economy is becoming diversified and being extended well beyond agriculture. This may be interpreted that labour absorptive capacity of agriculture has reached the upper limit and it is not able to keep the rural workers engaged throughout the year. The rural households seek employment outside the agricultural sector to tide the inter-year and intra-year variation in agricultural income. The development factor like agricultural modernization, commercialization, increased demand for non-crop goods and services, urbanization, growing literacy and even welfare oriented policy intervention, etc. have tried to pull the labour-force away from agriculture, towards more lucrative non-farm activities (Shylendra and Thomas, 1995; Kalamkar, 2003, Bhakar *et al.*,2007). Several distress factors like poverty, unemployment, under-employment and frequent natural calamities like drought have pushed the rural households to go in search of various non-farm activities to supplement their income and employment.

The paper heavily drawn from the Ph. D. (Agricultural Economics) thesis of first author under guidance of second author, submitted to Rajasthan Agricultural University, Bikaner (Rajasthan).

The question of farm and non-farm relationship analyzing the trend, pattern and impact of farm and non-farm activities on income and employment of rural economy on macro level have been tackled by some studies by using the secondary data from National Sample Survey Organization (NSSO), none of the studies has examined the income and employment correlations by using the primary data in Rajasthan state. In view of this, the present study was undertaken to provide evidences towards the facts and show that how farm and non-farm activities can influence the income, employment, expenditure and saving pattern of rural households in Rajasthan state

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Data and Methodology

To select the ultimate sample, multi-stage sampling technique was adopted. The households of Rajasthan state were grouped under two strata, one representating the households belonging to irrigated and other to rain-fed area of Rajasthan. Two districts namely Sri-Ganganagar from irrigated area and Churu belonging to rain-fed area of Rajasthan were randomly selected. Two tehsils from each district and three villages from each tehsil were randomly selected through draw a lot, thus, making a sample of twelve villages for the purpose of study. The standard classification of farmers in different categories was not followed, because the size of landholding with farmers is very large in Rajasthan particularly, in rain-fed areas. Instead, cumulative total method was used to categories the rural households in small, medium and large category. A list of all farmers in acceding order of their holding size was prepared to categorize them into small, medium and large farm groups. The farmers from top of the list, accounting one third of the total cultivated area was termed as small farmers, the farmers from middle of list sharing next one third of total area was termed as medium farmers and from bottom of list accounting for remaining one third of total cultivated area was termed as large farmers. Thus, the households with landholding up to 4.05 hectare in irrigated area and up to 5.31 hectare in rain-fed area were considered small farmers. The households above 4.05 to 6.32 hectare in irrigated and above 5.31 to 8.85 hectare in rain-fed area were considered medium farmers. Large farmers included all households with landholding above 6.32 hectare in irrigated and above 8.85 hectare in rain-fed area. A representative sample of 25 households from each selected villages was selected using probability proportional to size technique, making a total of 300 respondents, constituting 173 small, 88 medium and 39 large farmers.

The selected households were interviewed using pre-structured questionnaire for collecting data on demographic characteristics, cropping pattern & intensity, income and employment generation pattern from farm and non-farm activities etc. during the year 2004-05.

Person, who were working or seeking work, constitute the labour force. Person, who were neither working nor seeking work for various reasons during the reference period were considered as out of labour force. In other words, economically active population were referred to the population that supplied or sought to supply labour for production, Therefore, labour-force included both employed and un-employed persons. The proportion of these economically active family members to the family size was referred to as "labour-force ratio" (LFR). Labour-force participation ratio (LFPR) in agriculture was defined as the number of person employed full time on farming activities in the labour-force.

Rural households were generating income and employment from farm and non-farm activities. The concept of income used in study was comprehensive, including income received in cash and kind. A money value was imputed to the receipts in kind at price prevailing in survey village. The working hours or days engaged in different economic activities were converted into human-days to estimate the employment in one year. One human-day was equivalent to 8 hours of working.

The "own farm income" was estimated as the value of main product and by-products net of the cost on account of seeds, fertilizers, pesticides, irrigation charges, payment of hired labour, draft and machine power. The farm employment included employment generated from crop cultivation by the family members. Income and employment generated by the family members as agricultural labour in other farmers field were taken as off-farm or other-farm income and employment. The income and employment generated from non-agricultural activities like casual labour, self employed and regular employment etc. were considered as non-farm income and employment, respectively.

Results and Discussion

Socio-economic profile of sample households

The socio-economic status of the selected households under irrigated and rain-fed is presented in Table 1, revealed that average family size of sample households was more or less the same in both the irrigated and rain-fed area with 5.26 members. The caste composition of sample households indicated that a majority of them were in the category of other back-ward classes (66.67 per cent) followed by scheduled castes (19.0 per cent). The literacy status of male and female households members were higher in irrigated area (69.56 per cent) than in rain-fed areas (61.31 per cent) of Rajasthan.

The average size of holding on the overall sample households was 4.94 hectare and net sown area was estimated to be 4.11 hectares. The total cropped area on the overall sample households was 5.92 hectare with cropping intensity of 119.84 per cent. The non-availability of irrigation facilities are the most limiting factor in development of agriculture in rain-fed area at Rajasthan. Consequent to this, cropping intensity in rain-fed area was observed very low (84.73%) as compared to irrigated area (170.62%). There is vast scope to increase cropping intensity by way of creating awareness about the rain-water harvesting techniques and effectively utilization of available water resource

to maximum possible production purpose in rain-fed areas of Rajasthan.

Table 1: General Characteristic of Sample Households Selected for Study

Particulars	Irrigated Area	Rain-fed Area	Overall
1.Number of sample households	150	150	300
2. Family members (Nos.)			
(a) Male	276	279	555
(b) Female	242	235	477
(c) Children	244	302	546
3. Average family size	5.08	5.44	5.26
4. Caste composition (%)			
(a) General	12.00	13.33	12.67
(b) Scheduled Caste (SC)	16.00	22.00	19.00
(c) Scheduled Tribe (ST)	-	3.33	1.66
(d) Back-ward Class (OBCs)	72.00	61.34	66.67
5. Literacy status (%)			
(a) Male	81.84	74.46	78.15
(b) Female	57.28	48.15	52.72
(c) Total	69.56	61.31	65.44
6. Average size of holding (ha)	4.05	5.83	4.94
7. Net sown area (ha)	3.28	4.94	4.11
8. Area sown more than once (ha)	3.63	-	1.81
9. Total cropped area (ha)	6.91	4.94	5.92
10. Cropping intensity (%)	170.62	84.73	119.84

Labour Force and Participation Ratio on Sample Households

The available labour force, economically active labour force and participation ratios on sample households are presented in Table 2, revealed that, not all members of selected farm family constituted the labour force. The average working members per households was more or less same in both irrigated and rain-fed area of Rajasthan with 3.44 members. Further, out of these working members, only 1.72 male and 1.23 female members on the irrigated area and 1.51 male and 1.31 female members on the rain-fed area were really active and constituted labour force. Rest of the family members were not economically active and were not earning members. Therefore, these were excluded from the constitutes of the labour force of the sample households (Gauraha, 1996). The labour force ratio, so obtained, was 85.51 per cent on the irrigated area and 82.21 per cent on rain-fed areas.

The overall labour-force ratio on the sampled households was estimated as 84.01 per cent, the male members constituting 47.09 per cent and female members 36.92 per cent. In comparative terms, female labour-force ratio was estimated higher in rain-fed areas and male labour-force was found to be higher in irrigated area of Rajasthan.

The labour participation ratio in agriculture was also estimated and obtained as percentage of economically active members engaged in farming operation and allied activities. The overall labour participation ratio in agriculture was thus estimated as 86.10 per cent on irrigated area and 81.20 per cent on rain-fed area. Both male and female labour-force participation ratio in agriculture was higher in irrigated areas as compared to the rain-fed areas.

Table 2: Labour force ad participation ratio of Sample Households

Particulars	Irrigated Area	Rain-fed Area	Overall
1. Average family size	5.08	5.44	5.26
2. Working members/households	3.45	3.43	3.44
3. Economically active adult members			
(a) Male	1.72	1.51	1.62
(b) Female	1.23	1.31	1.27
(c) Total	2.95	2.82	2.89
4. Adult family members working on farm			
(a) Male	1.45	1.14	1.29
(b) Female	1.09	1.15	1.12
(c) Total	2.54	2.29	2.41
5. Labour force ratio (%)			
(a) Male	49.86	44.02	47.09
(b) Female	35.65	38.19	36.92
(c) Total	85.51	82.21	84.01
6. Labour force participation in agriculture (%)			
(a) Male	84.30	75.50	79.63
(b) Female	88.62	87.79	88.19
(c) Total	86.10	81.20	83.39

Pattern of Labour Employment

The level of employment in farm and non-farm activities on selected irrigated and rain-fed area of Rajasthan are presented in Table 3, revealed that majority of households were generating employment from farm sector, the percentage contribution to total human-days employment on all all farm-households together was 64.01 per cent. Self-employment (19.38%) and regular employment (9.00%) were the other main non-farm occupations of rural households. However, the percentage of human-days employment from farm sector was significantly higher (72.37 per cent) in irrigated areas as compared to rain-fed area (50.00 per cent).

The contributions of farm sector in employment generation in irrigated area were higher (72.37 per cent) as compared to rain-fed area (50.00 per cent). These estimates clearly indicate that the well development agricultural scenario in irrigated area is main responsible for higher source of employment for rural households.

The level of labour employment from non-farm activities revealed that rural community in rain-fed area were generating significantly higher employment (50.00 per cent) from non-farm sector as compared to irrigated area (27.63 per cent) in the state of Rajasthan. This corroborated the Vaidyanathan's

Table 3: Farm and Non-farm Employment Pattern on Sample Households (human-days/ year)

Particulars	Irrigated Area	Rain-fed Area	Overall
1. Farm			
(a) Own farm	194 (53.59)	93 (43.05)	144 (49.83)
(b) Other farm	68 (18.78)	15 (6.95)	41 (14.18)
Sub-Total	262 (72.37)	108 (50.00)	185 (64.01)
2. Non-farm			
(a) Casual labour	10 (2.76)	34 (15.74)	22 (7.61)
(b) Self-employed	55 (15.19)	56 (25.93)	56 (19.38)
(c) Regular employment	35 (9.67)	18 (8.33)	26 (9.00)
Sub-Total	100 (27.63)	108 (50.00)	104 (35.99)
3. Total employment days	362 (100)	216 (100)	289 (100)
4. Per worker employment days	123	77	100

Note: Figures within parentheses are the percentage to total employment

(1986) assertion that labour absorptive capacity of agriculture in rain-fed is limited and rural population was migrating from farm to non-farm sector for generation of employment and income.

The overall annual employment generated per worker was 100 human-days in study area. It was remarkable higher (60 per cent) in irrigated area (123 human-days) as compared to rain-fed area (77 human-days). This is indicative of seasonality of employment in agriculture sector (Badatya, 2003) and shows that rural population has to face un-employment and under-employment due to seasonal work in crop production (Swaminathan, 1981).

The Rural Non-Farm Sector (RNFS) play a crucial role in rural economic development in terms of its contribution towards employment generation. The RNFS provided 108 human-days employment at rain-fed area accounting for 50.00 per cent of the total employment days. Total days of household employment in a year to the irrigated and rain-fed area's sample households have been estimated as 362 and 216 human-days, respectively. Having more of less same labour-force on the two set of households, these estimates shows a relatively better position of employment at irrigated area as compared to rain-fed area. The farm and non-farm sector provided employment of 262 and 100 human-days in irrigated area. The corresponding figures for rain-fed sample households were estimated only 108 human-days for each sector. This results again shows the influence of well developed agricultural scenario created by sources of irrigation facilities in the irrigated area. Thus, it can be concluded that the farm activities are domain to irrigated area and non-farm activities are

Table 4: Income, Expenditure and Net-Saving at the Sample Households (Rs/ households)

Particulars	Irrigated Area	Rain-fed Area	Overall
1. Farm			
(a) Own farm	110589 (89.19)	22607 (73.05)	66598 (85.97)
(b) Other farm	4755 (3.84)	1045 (3.38)	2900 (3.74)
Sub-Total	115344 (93.03)	23652 (76.43)	69498 (89.71)
2. Non-farm			
(a) Casual labour	607 (0.49)	1968 (6.36)	1287 (1.66)
(b) Self-employed	2800 (2.26)	2887 (9.33)	2843 (3.67)
(c) Regular employment	5233 (4.22)	2440 (7.88)	3837 (4.95)
Sub-Total	8640 (6.97)	7295 (23.57)	7967 (10.29)
3. Toal household income	123984 (100.00)	30947 (100.00)	77465 (100.00)
4. Per-capita income	24406.30	5688.79	15047.55
5. Expenditures			
(a) Food items	34564.32	21477.12	28020.72
(b) Non-food items	19431.24	5602.29	12516.77
(c) Total	53995.56	27079.41	40537.49
6. Net saving	69988.44	3867.59	36927.51
7. Per person saving	13777.25	710.95	7020.44

Note: Figures within parentheses are the percentage to total income

equally important with farm activities to rain-fed areas.

Income and Expenditure Pattern

The total income, expenditure and saving on the selected households in irrigated and rain-fed area are presented in Table 4, clearly depict the wide disparity of economy in irrigated and rain-fed area with above stated variables. The total income per household in irrigated area from all sources was considerably higher (Rs 123984) as compared to that of rain-fed area (Rs 30947). On per capita basis, a member in irrigated area earned Rs 24406 per annum, whereas a member in rain-fed area earned only Rs 5689. Thus, both the total household and per capita income of irrigated area were estimated nearly four times to rain-fed areas. Considering the fact that average size of holding and size of family of rain-fed area is higher but the marked difference in earning by the members of irrigated area is resulted of well developed agricultural situation, availability and accessibility of irrigation facility, adoption of latest technologies like high yielding seed, manure & fertilizers, proper insect & pest management practices etc.

Farm sector contributed more (93.03 per cent) to total income in irrigated area as compared to rain-fed area (76.43 per cent) while non-farm sector contributed significantly higher (23.57 per cent) in rain-fed area as compared to irrigated area. The households in rain-fed area supplemented their income from self employment (9.33 per cent) and regular employment (7.88 percent). These two activities were the main source of income from non-farm sector in rain-fed area. On the other hand, the main non-farm occupation of households in irrigated area was regular employment (4.22 per cent) and self employment (2.26 per cent). The households in rain-fed area also generate higher income from casual labour (6.36 per cent) as compared to irrigated area (0.49 per cent). Thus, rural households were more depended on non-farm sector in rain-fed area (23.57 per cent) as compared to irrigated area (6.97 per cent).

An enquiry into the consumption and saving pattern on the two categories of households indicated that the expenditure on non-food items was considerably higher (Rs 19431) in irrigated area as compared to that of in rain-fed area (Rs 5602). In percentage term, 27.88 per cent and 15.67 per cent of total income of irrigated area were invested on food and non-food items, while corresponding figures of rain-fed area were 69.40 per cent and 18.10 per cent. The expenditure on food and non-food items follow the consumer behiour of Engel's theory. The overall per person saving in irrigated and rain-fed area were Rs 13777.25 and 710.95, the difference also signified the key role played by well developed agricultural sector to the rural prosperity.

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Effect of integrated nutrient sources on fodder yield and quality of sweet sorghum and phillipesara intercropping system

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Abstract

Field experiment was conducted during Kharif *seasons of 2007 and 2008 to evaluate the eco-friendly source of nutrients for quality fodder production of sweet sorghum and phillipesara intercropping system. The green and dry fodder yield and quality parameters viz. crude protein content , crude protein yield and digestibility of sweet sorghum increased in both sole and intercropping systems due to application of all integrated sources of nutrients, significantly higher being with application of nitrogen 50 per cent through inorganic source + 50 per cent through vermicomposting. However, the green and dry fodder yield and all quality parameters of phillipesara were significantly higher under sole crop compared to its intercropping with sweet sorghum.*

Key words: Intercropping, integrated, nutrients,

Introduction

The requirement of green fodder is generally met through fodder sorghum grown as sole and intercropped with fodder legume. Among different sorghums, sweet sorghum is capable of producing high dry matter and biomass in its shorter growth period, with high *in vitro* dry matter digestibility compared to fodder sorghum (Morris and McCormic, 1994). Phillipesara (*Phaseolus trilobus*), commonly known as mudgaparni has been found to be an excellent cover/fodder crop under rain fed situation contributing 60 kg N/ha to soil (Abrol and Palaniappan,1988). The green and dry fodder yield has been found to be high with its better quality when sweet sorghum was intercropped with cow pea (Thippesami and Alagundagi, 2001). Rao and Willey (1980) also advocated the intercropping of legumes with cereal fodder for enhancing the production and quality of fodder over sole crop of cereals. However, information on fodder production in relation to integrated nutrient management in sweet sorghum as sole or intercropped with legumes like phillipesara is lacking. In view, an experiment was conducted to work out suitable integrated nutrient sources for quality fodder of sweet sorghum grown as sole or intercropped with phillipesara.

Materials and Methods

The experiment was conducted at Instructional Dairy Farm of G.B. Pant University of Agriculture and Technology, Pantnagar, India, during *kharif* seasons of 2007 and 2008. Soil of the experimental field was silty clay loam in texture with pH 7.3 and contained high organic carbon (0.77%), low available nitrogen (280 kg/ha), medium available phosphorus (27.3 kg/ha) and potassium (247 kg/ha). The treatments, three cropping system (sole sweet sorghum, sole phillipesara, sweet sorghum + phillipesara intercropping) and six different sources of nutrients [100% of recommended N through inorganic source (F_1), 75% of recommended N through inorganic sources + 25% through vermicompost (F_2), 50% of recommended N through inorganic source + 50% through vermicompost (F_3), 75% of recommended N through inorganic source + 25% through FYM (F_4), 50% of recommended N through inorganic source + 50% through FYM (F_5) and 50% of recommended N through inorganic source + 25% through vermicompost + 25% through FYM (F_6)] were tested in a randomized block design with 4 replications. The phillipesara crop was intercropped in between the sweet sorghum rows (1:1) in an additive series.

The recommended dose of NPK applied to sole sweet sorghum was 120-60-40 kg/ha, sole phillipesara was 25-60-0 kg/ha and for intercropping of sweet sorghum + phillipesara was 80-60-40 kg/ha. Nitrogen was applied through different sources as per treatments. Half of the nitrogen and full dose of P and K was applied at the time of sowing as basal. Rest of the nitrogen was applied in two equal doses each at 30 and 50 days after sowing of sweet sorghum. However, in sole phillipesara, whole amount of N and P was applied as basal. The sowing of both the crops was done on 22 and 25 May during 2007 and 2008, respectively. The fodder of both the crops was harvested at 80 days stage. The N content of forage on dry weight basis was determined by microkjeldhal

method (Jackson, 1973), crude protein content was calculated from N content values. The *in vitro* dry matter digestibility was determined by nylon bag method given by Lowery (1969).

Results and discussion

Green and dry fodder yield

Sweet sorghum intercropped with phillipesara produced highest green and dry fodder yield, however, it was significantly higher during 2008, while reverse was the trend with phillipesara intercrop (Table 1). Higher yield of sweet sorghum in intercropping system may be ascribed to complementary effect of phillipesara which might have supplemented the nitrogen to sweet sorghum. Beneficial effect of legumes on fodder sorghum under sorghum + cowpea intercropping system has been reported earlier (Sood and Sharma, 1992 and Ram and Singh, 2003). The poor yield of phillipesara under intercropping might be due to suppressing effect of sweet sorghum and unavailability of sufficient light and space to phillipesara. Integrated use of inorganic and organic sources in different ratios significantly increased the green and dry fodder yield of phillipesara compared to 100 per cent nitrogen through inorganic source during both the years, however, green and dry fodder yield of sweet sorghum was significantly higher with application of nitrogen 50 per cent through inorganic source + 50 per cent through vermicompost. Increased green and dry fodder yield with integrated source of nutrients may be attributed to slow release of applied nitrogen thereby adequate nutrient availability throughout the growing period due to inclusion of organic sources (Arya and Niranjan, 1994).

The interaction between nitrogen sources and cropping systems with respect to green forage yield was found significant during both the years (Table 2). Application of nitrogen 50 per cent through inorganic source + 50 per cent through vermicompost to all the cropping systems increased the green forage yields with significant increase when it was applied to intercropping system compared to all other treatment combinations during both the years. A significant reduction in green forage yield of cropping systems was noticed due to application of 100 per cent nitrogen through inorganic source (F_1) to sole phillipesara compared to all other treatment combinations during both the years, except F_5 and F_6 applied to sole phillipesara during both the years and F_3 applied to sole phillipesara during 2008. This interaction may have occurred because the applied nutrients with organic sources might have released slowly and were made available to crop plants with added advantage of legumes contributing more nitrogen to main crop. Contrast to this inorganic source may have lost quickly due to lack of binding material, causing reduction in yield.

Fodder quality

Higher crude protein content and yield of sweet sorghum was noticed due to intercropping but it could not attain the level of significance, while crude protein content and yield of sole phillipesasra increased significantly compared to intercropping during both the years (Table 3). All the integrated sources of nutrients caused comparably higher crude protein content and yield of both component crops, but application of 50 per cent nitrogen through inorganic source and 50 per cent through vermicompost (F_3) caused significantly higher crude protein content and yield of both crops compared to 100 per cent nitrogen through inorganic source (F_1) during both the years.

Increased availability of nitrogen under integrated nutrient sources and nitrogen contribution from

Table 1: Green and dry fodder yield of phillipesara, sweet sorghum as influenced by the treatments

Treatment	Green forage yield (q/ha)				Dry fodder yield (q/ ha)			
	Phillipesara		Sweet sorghum		Phillipesara		Sweet sorghum	
	2007	2008	2007	2008	2007	2008	2007	2008
Cropping system								
Sole	107.9	97.9	414.5	332.7	31.2	23.9	86.0	71.4
Intercropping	49.4	45.9	417.7	338.0	12.1	9.2	86.8	73.0
S.Em.±	1.0	0.8	1.6	1.7	0.3	0.2	0.4	0.5
CD at 5%	3.0	2.3	NS	4.8	0.7	0.4	NS	1.5
N source								
F_1	65.9	60.4	406.8	324.2	19.2	13.5	82.4	67.0
F_2	78.6	68.5	419.0	336.7	21.3	16.4	89.4	73.8
F_3	97.5	93.3	433.6	342.5	25.4	21.7	92.0	76.0
F_4	86.6	80.6	412.1	334.2	23.7	18.4	84.8	68.8
F_5	69.3	63.7	410.6	334.0	19.8	14.6	84.4	73.1
F_6	73.9	65.0	415.5	340.7	20.8	14.8	85.6	74.6
S.Em.±	1.8	1.4	2.8	2.9	0.5	0.3	0.7	0.9
CD at 5%	5.1	3.9	8.0	8.5	1.5	0.7	2.0	2.7

Table 2: Interaction between nitrogen sources and cropping systems

N source	Green forage yield (q/h)							
	2007				2008			
	Sole phillipesara	Sole sweet sorghum	Intercropping system	Mean	Sole phillipesara	Sole sweet sorghum	Intercropping system	Mean
F_1	90.3	406.3	466.6	321.1	82.1	323.2	385.8	263.7
F_2	107.1	419.5	473.3	333.3	96.0	334.4	380.2	270.2
F_3	133.4	429.8	498.2	353.8	125.3	338.0	435.6	299.6
F_4	119.2	411.3	466.6	332.4	112.4	331.4	385.8	276.6
F_5	95.3	409.8	462.6	332.6	85.7	329.1	382.7	265.8
F_6	101.7	410.1	467.2	326.3	86.2	340.2	385.0	270.5
Mean	107.8	414.5	472.4		97.9	332.7	392.5	
	Cropping system	N- source	Interaction		Cropping system	N- source	Interaction	
S.Em.±	1.9	2.7	4.6		3.5	4.9	8.5	
CD at 5%	5.3	7.5	13.1		9.8	13.9	24.1	

phillipesara may have enhanced nitrogen uptake which gets converted into protein leading to higher crude protein content. Higher protein yield might be as a result of increased crude protein content and higher dry matter accumulation by crops as the protein yield is a function of dry matter yield and its protein content. This comborate the findings of Gill *et al.* (1988) and Pereira *et al.* (1989). The digestibility of sweet sorghum fodder was increased significantly due to intercropping and application of nitrogen 50 per cent through inorganic source + 50 per cent through vermicompost (F_3) t. All other integrated sources of nutrient remained *at par* with (F_3), except F_2 during both the years and F_4 during 2007. However, neither cropping system nor source of nitrogen could influence significantly the digestibility of phillipesara. The increased digestibility of sweet sorghum due to intercropping and integrated nutrient source may be attributed to its higher crude protein as there exists positive correlation between crude protein and fodder digestibility (Ram and Singh, 2003). These results collaborate with the finding of Rekib *et al.* (1987).

On the basis of the results obtained it can be concluded that for higher green and dry fodder yield with higher crude protein content, yield and digestibility of the mixed fodder, phillipesara should be intercropped with sweet sorghum and application of nitrogen 50 per cent through inorganic source and 50 per cent through vermicompost should be applied to this intercropping system.

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Effect of phosphorus and lime interactions on content and uptake of phosphorus in Greengram - Sesamum cropping sequence

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Abstract

This experiment was taken on an Alfisol of instructional cum Research farm of Assam Agricultural University, Jorhat to study the interaction effect of sources and levels of phosphorus on phosphorus acquisition by greengram – sesamum cropping sequence during the Kharif *season of 2002. Application of various sources of phosphorus increased the phosphorus content both in grain and stover significantly. SSP being water soluble form of phosphorus showed its significant effect on both phosphorus content in grain as well as stover over insoluble form i.e. MRP. Significant increase of phosphorus content was observed both in grain and stover due to application of 50 percent of lime over no lime. Higher uptake of phosphorus by grain and stover at higher levels of 52.5 kg P_2O_5 /ha was the result of higher grain and stover yield as well as higher phosphorus concentration in plant materials including grains.*

Key words: Phosphorus, Residual effect, SSP, Sesamum, Greengram, Stover.

Introduction

Phosphorus plays a key role in the balanced nutrition of plants. Assam soils are acidic in nature. Literature is abundant regarding poor phosphorus availability in acidic soils and acquisition by crops. Most of the applied phosphorus are rendered unavailable within a short period due to its fixation in such soils. In this regard, sources of phosphorus play a very important role for correction of phosphorus deficiency in crops. Water soluble phosphorus source was found to release phosphorus slowly and steadily by minimizing leaching loss and fixation. Phosphorus when applied to the soil, leaves residual phosphate in soil for the succeeding crops grown in sequence. Liming of acid soil is also known to boost up the yield of grain legumes with significant residual effect on subsequent crop by enhancing the availability of phosphorus. Therefore , the present investigation was undertaken to study their effects on on content and uptake of phosphorus in Greengram - Sesamum cropping sequence.

Methods and Materials

The study was conducted at Instructional cum Research farm of Assam Agricultural University, Jorhat, Assam during summer season of 2000-2001 which is located at 26.47'N latitude,94.12'E longitude and at an altitude of 86.6 m above the main sea level. The experiment was laid out in a randomized block design with three replications. The soils of the experimental site was sandy loam in texture, acidic in reaction, low in available N and K_2O,medium in available P_2O_5 and organic carbon. The treatment combinations consisted of 3 phosphorus sources (SSP,DAP and MRP),3 levels of Phosphorus(0,35 and 52.5 kg P_2O_5/ha) and 2 lime levels (No lime and 50 percent of lime requirement) respectively. The greengram variety S.G.1 was sown during the summer season. After harvest of greengram, sesamum variety R.T. 1 was sown on residual fertility. Samples were collected for both the crops for analysis of various parameters. The data were recorded from time to time for both the crops. Available phosphorus content in soil after greengram and sesamum harvest were estimated using standard procedures (Subbiah and Asija,1956 and Jackson,1973).

Results and Discussion

Direct effect of Phosphorus content and Uptake

Application of various sources of phosphorus increased the phosphorus content both in grain and stover significantly. SSP being water soluble form of phosphorus showed its significant effect on both phosphorus content in grain as well as stover over insoluble form i.e. MRP. Superiority of SSP was due to it's easy access by crops right from the early stage of growth. Sagar *et.al*(1985) have also observed such results in rice-wheat rotation. The increase in uptake was also due to enhanced biomass production as well as increased phosphorus concentration in the plant system. The water soluble sources of phosphorus in SSP might have provided an easy access of phosphorus to plant in adequate quantity (Naik and Sinha,1993).Phosphorus uptake was also higher due to higher seed and stover yield(Singh and

Table 1: Effect of phosphorus and lime on phosphorus content (%) and uptake(kg/ha) of greengram

Treatment	P Content(%)		P Uptake (kg/ha)		Total Uptake
	Grain	Stover	Grain	Stover	(Kg/ha)
Sources of phosphorus					
SSP	0.406	0.256	4.46	6.05	10.52
DAP	0.388	0.251	4.23	5.91	10.14
MRP	0.386	0.247	4.15	5.79	9.95
S.Ed ±	0.006	0.002	0.11	0.07	0.13
C.D.(0.05)	0.012	0.005	0.22	0.15	0.28
Levels of phosphorus(P_2O_5kg/ha)					
0	0.364	0.233	3.62	5.36	9.20
35	0.395	0.249	4.29	5.84	10.15
52.5	0.421	0.273	4.94	6.55	11.48
S.Ed ±	0.007	0.003	0.11	0.07	0.13
C.D.(0.05)	0.014	0.006	0.24	0.15	0.28
Levels of lime (%)					
0	0.386	0.247	4.07	5.77	9.98
50	0.401	0.256	4.50	6.07	10.57
S.Ed ±	0.007	0.003	0.09	0.60	0.11
C.D.(0.05)	0.014	0.006	0.19	0.12	0.22

Table 2: Residual effect of phosphorus and lime on phosphorus content(%) and uptake(kg/ha) of sesamum

Treatment	P Content(%)		P Uptake (kg/ha)		Total Uptake
	Grain	Stover	Grain	Stover	(Kg/ha)
Sources of phosphorus					
SSP	0.590	0.067	3.08	1.07	4.21
DAP	0.570	0.065	2.68	0.97	3.65
MRP	0.610	0.073	3.48	1.13	4.55
S.Ed ±	0.015	0.002	0.15	0.038	0.15
C.D.(0.05)	0.031	0.004	0.32	0.077	0.32
Levels of phosphorus(P2O5 kg/ha)					
0	0.541	0.060	2.53	0.91	3.43
35	0.591	0.068	3.03	1.04	4.09
52.5	0.638	0.077	3.68	1.21	4.89
S.Ed ±	0.015	0.002	0.15	0.038	0.15
C.D.(0.05)	0.31	0.004	0.32	0.077	0.32
Levels of lime (%)					
0	0.581	0.067	2.93	1.04	3.98
50	0.598	0.069	3.22	1.07	4.30
S.Ed ±	0.012	0.002	0.12	0.031	0.13
C.D.(0.05)	NS	NS	0.26	NS	0.26

Verma,1994).Lower phosphorus uptake for MRP might be attributed to lower concentration and lower dry matter production at all stages of growth.

Aapplication rates and sources also increased significantly phosphorus content both in grain and stover, and was higher when 52.5 kg P_2O_5 /ha was applied compared over 0 kg and 35 kg P_2O_5/ha, respectively. The higher phosphorus content recorded with higher levels of phosphorus might be attributed to the fact that at maturity stage, translocation of phosphorus from vegetative to the reproductive parts took place and this reduced the phosphorus content in plant parts. Such findings were also reported by Singh and Singh(1983). Arya and Kalra(1988) reported higher phosphorus uptake by greengram due to application of phosphorus.

Significant increase of phosphorus content was observed both in grain and stover due to application of 50 percent of lime over no lime. Liming increased phosphorus availability by correcting soil pH and enhancing mineralization of soil organic phosphorus (Nath and Ghose,1981). Lime application also increased phosphorus uptake over unlimed plots. The combined effect of higher percent of phosphorus content in grain and stover yield resulted in higher uptake of phosphorus under 50 percent limed plot.

Residual Effect of Phosphorus Content and Uptake

Sources of phosphorus had significant residual influence on phosphorus content in seed as well as stover. Application of MRP was found to be significantly superior over DAP and SSP in phosphorus content both in seed as well as stover. Both the water soluble phosphorus were found to be inferior so far phosphorus concentration was concerned. This might be due to lower availability of soluble phosphorus in the vicinity of root zone of succeeding crop sesemum from both the water soluble phosphorus. Hence, uptake of phosphorus were less when compared to MRP.(Phhokan,1990). Goswami(1990) also recorded significantly higher phosphorus uptake by wheat when applied to rice crop due to application of MRP over SSP and DAP. Phosphorus content both in seed and stover increased with increasing levels of phosphorus and significantly higher phosphorus concentration was registered due to application of 52.5 kg P2O5 P_2O_5/ ha to the proceeding crop greengram. The uptake of phosphorus also increased significantly due to phosphorus application to the previous crop. The highest uptake of phosphorus was found at 52.5 kg P_2O_5/ha which might be attributed to high seed and stover yield and higher concentration of phosphorus in plant materials. Hazarika (1991) also recorded the similar trend of highest uptake of phosphorus by greengram crop when applied to rapeseed.

The residual lime significantly increased phosphorus uptake of sesamum seed. The highest

uptake of phosphorus in seed was recorded at 50 percent lime level which might be attributed to higher phosphorus content in seed and higher seed yield of crops. The long term beneficial effect of liming in subsequent years as carry over effect had also been reported by Lim and Shen (1978) and Hazarika(1991).

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Quality and uptake behavior of lentil (*Lens esculenta Moench*) as influenced by fertility levels and Bio-fertilizers under *Leucaena* based agro-forestry system

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Abstract

*A field experiment was conduct during the winter season of 2002-03 and 2003-04 at the research farm of Raja Balwant Singh College , Bichpuri, Agra (U.P). To assess the quality and uptake behavior of lentil (*Lens esculenta Moench*) as influenced by fertility levels and Bio-fertilizers under* Leucaena *based agro-forestry system. The treatment were (i) five fertility levels viz. control(F_0), 20 Kg N+80 Kg P_2O_5 ha^{-1} (F_1) ,10 Kg N +40 Kg P_2O_5 ha^{-1}(F_2), 3 q ha^{-1}* Leucaena *litter fall (LLF) +10 Kg N+40 Kg P_2O_5 ha--$^{-1}$ -(F3) and 3 q ha-1 LLF+25 q ha^{-1} FYM (F_4) and (ii) four bio-fertilizers viz, control (B_o) Rhizobium (B_1) Phosphate solubilizing bacteria (PSB) (B_2) and Rhizobium +PSB (B_3). Protein Content and Protin Yield of Lentil were significantly Improved by the application of q ha^{-1}* Leucaena *litter fall + 10 Kg N+ 40 Kg P_2O_5 hq-$^{-1}$. Similarly ,all these Quality characters were significantly increased owing to combined inoculation of Rhizobium + PSB over individual and no inoculation. Nitrogen and Phosphorus content in grain and* straver *were significantly increased with F_3 and B_3 over rest to treatment. The uptake of nitrogen and phosphorus in grain and straver as well as in total produce was appreciably higher with F_3 when compared with control F_3, F_2, and F_4 similarly both nutrient uptake significantly improve with B_3 (Rhizobium + PSB) over rest of the treatment in both the seasons. The more N,P and K contents and uptake were recorded in treatment F_3 (3 q ha^{-1}* Leucaena *litterfall + 10 kg N,+ 40kg P_2O_5 ha^{1}) F_4 (3 q ha^{-1}* Leucaena *litterfall + 25 q ha $^{-1}$ FYM) Then rest of the treatment. These were also maximum in bio fertilizer treatment B_3 (Rhizobium +PSB) to rest of the treatment during both years, except and content in first year where, the more N content was recorded in B-$_1$ (Rhizobium) then B_3 (Rhizobium +PSB)*

Key words: Agro-forestry, *Leucaena*, Lentil, Fertility levels, Bio-fertilizers, Quality and uptake

Introduction

The increase in human and live-stock populations is the prime cause for over exploitation of natural resources resulting in to land degradation and ecological imbalance. It is a challenging task in this new millennium to bridge the wide gap that exists between demand and supply of food, fodder, and fuel wood. Agro-forestry has much to in meting the demand of food, fodder, fuel wood, fiber and medicine. Agro-forestry practice has been vague sine times immemorial. In recent years, efforts have been made to grow tree and crop together so as to get the advantage of their association for improve soil fertility, controlling erosion, maintaining physical properties, promote efficient nutrient cycling, leading to higher bio-mass productivity and sustainability. The aim of agro-forestry system is to produce bio-mass without affecting crop yield. These conditions could easily be matched with the tree species like Leucaena Leucocephala in northern parts of India. *Leucaena* Leucocephala being a tree with coppicing property, its cultivation, besides providing fodder, fuel wood and industrial wood also contributes to the improvement of soil fertility. It fixes about 80-120 kg N per year hectre (Sing and Pawar,1988) and 3.76 metric tones dry leaf matter per ha annually is produced which is rich in nutrients, gets decomposed easily in the soil and nurses the field crop to better yield.

Lentil is an important pulse crop of winter season. It is mostly used as "dal" which contain 25% protein and 60% carbohydrates and also rich in calcium, iron and niacin. The productivity and quality of a crop is controlled by many factor. Of which the mineral nutrition, especially nitrogen and phosphorus, is by and large the most important factor, though the chemical fertilizer alone cannot sustain the productivity of land since these chemical fertilizers do not add all nutrients in balanced matter. On the other hand, nutrient supply through organic matter can hardly fulfill the need of existing crop with regard to major nutrients. Therefore, to sustain the productivity of land and sustainability ion the productivity and quality of the crop, judicious use of the fertilizers and integration of the organic matter and bio-fertilizer and their scientific

management is important. Therefore the present investigation was carried out to study the yield and quality behavior of lentil(*Lens esculenta* Moench) as influenced by fertility levels and bio-fertilizer under Leucaena based agro forestry system. The trees, therefore, arises to plan a system by which pulses fuel wood and fodder problem is solved by growing lentil with Leucaena tree under agro-forestry system. In this the piece of research, an attempt has been made to asses the quality and uptake behavior of lentil (*Lens esculenta* Moench) as influenced by fertility levels and bio-fertilizer under Leucaena based agro forestry system.

Materials and Methods

A field study was conducted for two consecutive winter season of 2002-03 and 2003-04 at there search farm of Raja Balwant Singh College, Bichpuri campus, Agra, UP, India. To study the quality and uptake behavior of lentil (*Lens esculenta Moench*) as influenced by the fertility levels and bio-fertilizers under Leucaena based agro forestry system. Five fertility levels viz. control(F_0),20 kg N + 80 kg P_2O_5 ha $^{-1}$, ($F_{1)}$ 10kg N +40 kg P_2O_5 ha-1, (F_2) 3 q ha-1 Leucaena litter fall + 10 kg N + 40 kg P_2O_5 ha-1, (F_3) and 3 q ha-1 Leucaena litter fall +25 q ha-1 FYM, (F_4) with four bio fertilizer viz. control (Bo) Rhizobium (B1) Phosphate solubilizing bacteria (PSB), (B2) and Rhizobium + PSB, (B3).Thus twenty treatments were taken in a randomized block design with three replications. As per the treatment, seed was treated with culture having Rhizobium leguminosaram bacteria and phosphate solubilizing bacteria (PSB) for the lentil just before sowing. The research site is situated at a height of 168 m above, mean sea level, intersected by 27.2^O N latitude and 77.9^0 longitude. The soils of the experimental area are sandy loam in nature having pH of 7.9, organic carbon 0.72% available N,P and K are 194.0, 17.20 and 276.0 kg ha $^{-1}$ respectively. The average rainfall of the area is 700 mm out of which more than 84% is received during the monsoon season(July – Sept.). Summer are very hot and windy with maximum temperature 45^O C or oven hotter during the crop growth period varying from 37.7^O C to 17.0^O C minimum from 23.4^{O}C to 4.2^{O}C.

The plantation of Leucaena tree having a single row boundary of two year old tree, already existing 1 m X 5m distance and oriented in North-South direction. Leucaena tree were pruned in October during 2002-03 and 2003-04, coinciding with the sowing time of lentil. Seed of lentil variety DPL-62 at the rate of 50 kg ha^{-1} was sown by kudali at the distance of 25 cm in rows. The sowing of lentil was done on nov.12 And Nov. 01 in the first and second year respectively. The crop was irrigated as per need and subsequent irrigations were provided to the crop. The following growth parameter of lentil crop viz. plant stand, plant height, no. of branches per plant and total dry matter per plant (g) at the harvest stage and yield of the lentil crop was recorded. The data were subjected to an analysis of the variance and test for the significance according to Fisher And Yates (1963).

Results and Discussion

Effect of fertility levels

The yield increment due to F_3(3q ha- Leucaena litter fall+10kg N+40Kg P_2O_5 ha-1, F_4(q ha-1 leucaena litter fall 25 q ha -1 FYM), F_1 (20 kg N + 80 kg P_2O_5

Table 1: The grain yield per hectare, green leaf fodder and fuel wood production (kg/ tree) as influenced by various treatments

Treatments	Grain yeild (kg/ ha)			Green leaf production (kg/tree)		Fuel wood production ([kg/tree)	
	2002-03	2003-04	Mean	2002-03	2003-04	2002-03	2003-04
Fertility level:							
F_0	768.31	810.96	789.63	5.18	5.91	1.90	3.24
F_1	1042.67	1089.05	1065.86	5.67	6.72	2.08	3.68
F_2	990.92	1035.60	1013.26	5.59	5.97	1.97	3.59
F_3	1377.94	1441.83	1409.89	5.60	7.28	2.08	4.13
F_4	1123.02	1172.54	1147.78	5.82	6.82	2.22	3.74
S'EM= =	12.23	12.13	8.61	-	-	-	-
CD at 5%	34.33	34.72	24.63	-	-	-	-
Bio-Fertilizer:							
B_0	945.86	960.65	953.26	5.25	5.87	1.80	3.59
B_1	1072.64	1124.90	1098.77	5.58	6.81	1.93	3.69
B_2	1040.09	1076.6	1058.38	5.53	6.45	2.11	3.70
B_3	1183.68	1277.8	1230.74	5.92	7.03	2.36	3.70
S'EM= =	10.94	10.85	7.70	-	-	-	-
CD at 5%	31.25	31.06	22.03	-	-	-	-

F_O=Control, F_1=20kg N +80kg P_2O_5 ha-^{1}, F_2 = 10kg N + 40kg P_2O_5 ha $^{-1}$, F_3 = 3q ha -^{1} LLF +10 kg N +40 kg P_2O_5 ha $^{-1}$, F_4= 3 q ha $^{-1}$ LLF +25 q ha $^{-1}$ FYM; Bo=Control, B_1= *Rizobium*,B_2= PSB, B_3= *Rhizobium* + PSB

Table 2: Protein content(%) and Protein yield (kg per ha.) in grain and straver of lentil as influenced by various treatments

Treatments	Protein content(%)				Protein yield(kg/ ha $^{-1}$)			
	2002-2003		2003-2004		2003-2004		2003-2004	
	Grain	Straver	Grain	Straver	Grain	Straver	Grain	Straver
Fertility level:								
F_0	23.35	7.37	24.81	7.69	179.55	74.98	201.80	83.30
F_1	24.20	7.75	25.31	8.06	252.82	107.70	276.76	117.65
F_2	23.87	7.68	25.12	7.99	237.01	95.46	261.38	104.59
F_3	24.70	8.05	25.75	8.37	340.79	136.25	373.10	149.50
F_4	24.36	7.82	25.50	8.12	273.79	114.64	300.10	125.12
S'EM==								
CD at S%	0.23	0.18	0.19	0.17	10.14	3.69	9.86	3.81
Bio-Fertilizer:								
B_0	23.50	7.46	23.70	7.77	223.31	91.97	228.49	98.44
B_1	24.37	7.78	25.53	8.10	262.13	107.83	287.54	119.00
B_2	23.96	7.66	25.27	7.96	250.01	99.87	272.72	109.09
B_3	24.55	8.03	26.68	8.35	291.72	123.55	341.76	137.60
S'EM==								
CD at 5%	0.20	0.16	0.17	0.15	9.070	3.30	8.82	3.41

Table 3: Nitrogen content (%) in grain & Stover and Phosphorus uptake (kg ha^{-1}) through grain, Stover and total produce as affected by various treatments

Treatment	2002-2003					2003-2004				
	N Content(%)		N uptake (kg Ha $^{-1}$)			N Content(%)		Ni uptake (kg Ha $^{-1}$)		
	Grain	Straver	Grain	Straver	Total	Grain	Straver	Grain	Straver	Total
Fertility level:										
F_0	3.75	1.18	28.84	11.99	40.83	3.97	1.23	32.29	13.33	45.62
F_1	3.87	1.24	40.45	17.23	57.68	4.05	1.29	44.28	18.83	63.11
F_2	3.82	1.23	37.92	15.27	53.19	4.02	1.28	41.82	16.78	58.60
F_3	3.95	1.29	54.53	21.80	76.33	4.12	1.34	59.70	23.93	83.63
F_4	3.90	1.25	43.73	18.34	62.08	4.16	1.30	48.02	20.02	68.04
S'EM==	0.013	0.010	0.575	0.206	0.758	0.040	0.010	0.551	0.211	0.738
CD at S%	0.036	0.028	1.647	0.591	2.170	0.114	0.028	1.577	0.605	2.133
Bio-Fertilizer:										
B_0	3.76	1.19	35.73	14.72	50.45	3.86	1.24	36.56	15.75	52.31
B_1	3.90	1.24	41.96	17.25	59.22	4.08	1.29	46.01	19.07	65.08
B_2	3.83	1.23	40.00	15.98	55.98	4.04	1.27	43.64	17.47	61.10
B_3	3.94	1.28	46.68	19.77	66.45	4.27	1.33	54.68	22.02	76.70
S'EM==	0.011	0.009	0.514	0.184	0.678	0.036	0.009	0.493	0.189	6.660
CD at 5%	0.032	0.250	1.473	0.528	1.941	0.102	0.025	1.141	0.541	1.890

ha $^{-1}$) and F_2 (10 kg N + 40 kg P P_2O_5 ha^{-1}) over the F_0(control) in the first season were 79.34, 46.16, 35.71, & 28.97 per cent respectively. While in second season in the increment F_3(3q ha $^{-1}$ leucaena the litter fall + 10 kg N 40 kg P_2O_5 ha^{-1} , F_4 (q ha^{-1} Leucaena the litter fall + 25 q ha $^{-1}$ FYM), F_1 (kg N + 80 kg P_2O_5 ha $^{-1}$) and F_2 (10 kg N + 40kg P P_2O_5 ha^{-1}) over the Fo (control) were 77.79, 44.58, 34.29 and 27.70 per cent respectively. The maximum green leaf fodder production and fuel wood production per tree were recorded in treatment in F_3&F_4 in both the year. The quality of produce (grain and straver) as effected by different treatments was judged by protein content (%) the data pertaining to these characters are given in table 01 treatment F_3 (3 q ha^{-1} Leucaena litterfall + 10 kg N +40 Kg P_2O_5 ha^{-1}) showed its significant superiority in protein content(%) 24.70 in grain and 8.05 in straver in 2003-04 over the rest of the treatment in both year. Table(1) All the fertility levels under the study viz. F_3 (3 q ha^{-1} Leucaena litterfall +10 kg N + 40 kg P_2O_5 ha $^{-1}$) F_4 (3 q ha^{-1} Leucaena litterfall +25 q ha^{-1} FYM) F_1 (20 kg N +80 kg P_2O_5 ha^{-1}) and F_2 10 kg N + 40 kg P_2O_5 ha^{-1} showed their significant superiority the protein production grain and straver over control (Fo) in both season of the field trial. This may be arranged in significant order of $F_3 > F_4 > F_1 > F_2 > F_0$.

Table 4: Phosphorus Content(%) and Phosphorus yield (kg per ha.) in grain and straver of lentil as influenced by various treatments

Treatments	2002-2003					2003-2004				
	P content(%)		P uptake(kg ha $^{-1}$)			P content(%)		P uptake(kg ha $^{-1}$)		
	Grain	Stover	Grain	Stover	Total	Grain	Stover	Grain	Stover	Total
Fertility level										
F_0	0.40	0.14	3.10	1.45	4.55	0.42	0.15	3.42	1.64	5.06
F_1	0.44	0.18	4.62	2.54	7.16	0.46	0.19	5.05	2.79	7.84
F_2	0.42	0.16	4.20	2.02	6.22	0.44	0.17	4.56	2.24	6.80
F_3	0.46	0.20	6.38	3.44	9.83	0.48	0.21	7.09	3.78	10.79
F_4	0.45	0.19	5.06	2.81	7.87	0.47	0.20	5.53	3.09	8.62
S'EM==	0.009	0.008	1.139	0.114	0.236	0.007	0.008	0.113	0.125	0.230
CD at S%	0.025	0.022	0.376	0.328	0.675	0.020	0.023	0.324	0.357	0.658
Bio-Fertilizer										
B_0	0.41	0.15	3.93	1.93	5.86	0.40	0.16	3.85	2.08	5.93
B_1	0.44	0.18	4.75	2.61	7.36	0.46	0.19	5.21	2.89	8.11
B_2	0.43	0.17	4.56	2.22	6.78	0.45	0.17	4.93	2.45	7.38
B_3	0.46	0.19	5.44	3.05	8.50	0.50	0.20	6.46	3.41	9.87
S'EM==	0.008	0.007	0.118	0.102	0.211	0.006	0.007	0.101	0.112	0.206
CD at 5%	0.023	0.019	0.337	0.293	0.604	0.018	0.020	0.290	0.320	0.589

Table 5: Nitrogen, Phosphorus and Potash (%) in leuceana as influenced by different treatments

Treat-ment	N Content (%) 2002-03	03-04	P Content (%) 2002-03	03-04	KContent (%) 2002-03	03-04
Fertility level						
F_0	2.75	2.92	0.66	0.69	1.47	1.51
F_1	2.81	3.66	0.65	0.74	1.46	1.61
F_2	2.80	2.98	0.67	0.72	1.46	1.55
F_3	2.85	3.18	0.69	0.78	1.50	1.62
F_4	2.88	3.11	0.72	0.75	1.52	1.60
Bio-Fertilizer						
B_0	2.79	2.98	0.65	0.67	1.44	1.52
B_1	2.86	3.08	0.68	0.73	1.50	1.60
B_2	2.81	3.02	0.68	0.75	1.50	1.57
B_3	2.82	3.12	0.69	0.78	1.50	1.61

Lateral at 2000 more or less similar tendencies in the percentages of nitrogen & phosphorus in grain and straver might be possible reason for marked variation with different fertility levels (Table 2&3). The uptake of nitrogen and phosphorus increased to the highest limit of the fertility levels F_3 (3 q ha^{-1} Leucaena litterfall +10 kg N + 40 kg P_2O_5 ha $^{-1}$) the observation are in the accordance with the findings of Zyasa et al (1990 b) Who found that incorporation of the Leucaena green manure increased 'N' uptake throughout the rice irrespective of mineral 'N' level Dikshi (2002) have also reported that the combined application of NPK and FYM enhanced the uptake of N, P, and K significantly. The quality aspect in N,P,& K contents and its uptake were more in treatment F_3 , because the treatment F_3 (3 q ha $^{-1}$ Leucaena litterfall + 10 kg N ,+ 40 kg P_2O_5 ha^{-1}) might have increased N and P supply causing more and more carbohydrates to be utilized for production of nitrogenous compound, thus increasing the N, P, & K contents in tree pruned material (Table 4 & 5)

The uptake of nutrients (N, P & K) is closely associated with the yield of Leucaena pruned material and N, P & K content which were higher in treatment F_3 . Thus consequently showing its higher uptake in plant Lal, *it al;* (2000) who reported that in corporation of residue of subabul leaves in soil, significantly increased the nutrient status of soil.

Effect of the Bio fertilizer:

The green yield percentage increases due to B3 (Rizobium + PSB), B1 (Rizobium) and B2 (PSB) over the control (Bo) in the first season were 25.14, 13.40, and 9.96 respectively.The maximum green leaf fodder production (5.92 and 7.03 kg) and fuel wood production (2.36 and 3.73 kg) per tree were seen in treatment B3 (Rizobium +PSB) followed by B1 (Rizobium), B2 (PSB) and Bo (control) in both the year. (Table 01) Protein content in grain and straver and protein production in grain & were significantly more in treatment B_3 Rhizobium + PSB) than rest of the treatment under text except protein content in grain B_1 (Rhizobium) in 20002-03. Rathor, *et al* (1992) also found that the seed inoculation with PSB recorded significantly higher protein content in grain of the lentil.

Nitrogen and phosphorus content in grain (3.83), (0.43), and (4.04), (0.45) and straver (1.23), (017) and (1.27), (0.17) of lentil were influenced significantly due to the treatment B_2 (Rhizobium + PSB) during 2002-

Table 6: Nitrogen, Phosphorus and Potash uptake (q ha $^{-1}$) at each cutting of leuceana tree as influenced by different treatments

Treatments	Nitrogen uptake(q ha^{-1})		Phosphorus uptake(q ha^{-1})		Potash uptake(q ha^{-1})	
	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04
Fertility level						
F_0	190.22	259.24	45.90	62.18	102.60	136.32
F_1	200.68	291.50	46.22	69.98	103.26	152.64
F_2	198.22	269.42	47.74	64.22	103.36	137.74
F_3	191.44	315.12	46.52	77.24	100.78	161.58
F_4	207.28	292.34	52.42	69.92	110.16	115.90
Bio-Fertilizer						
B_0	182.88	260.86	42.98	58.46	93.98	132.72
B_1	196.92	294.88	47.24	70.04	102.40	159.80
B_2	197.88	280.16	48.06	70.28	107.18	146.58
B_3	212.60	306.20	52.76	76.02	112.54	157.22

03 and 2003-04 (Table 2&3).

In the investigation, the uptake of N and P in grain and straver was appreciating higher with B_3 (Rhizobium +PSB). Shrivatava and Ahlawat 1995 reported that the combined inoculation of (Rhizobium + PSB) increased the nitrogen and phosphorus uptake significantly over inoculated control Shukla and Dixit (1996) reported that inoculation of Rhizobium increased the nutrition uptake. The minor improvement of Leucaena tree yield quality and uptake aspects with B_3 (Rhizobium + PSB) may be due to the improved soil health due to bacterial inoculation (El Sayed Sam, 1999). This caused the uptake of various nutrients by leuceana plant and ultimately improved the health of plants and increased the growth, yield and quality of leuceana tree.

The lentil crop (*Lens esculenta Moench*) variety DPL62 can successfully be grown in the Alleys of the Sababul (*Leucaena Leucocephala Lam*, De WIT) tree under agro forestry system. This package of practices will not only reduce the N need of lentil crop through organic sources but also paved for better quality and uptake.

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Attitude of rural families about ICDS practices

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Abstract

Today, ICDS represents one of the world's largest and most unique programmes for early childhood development- an initiative unpararelled in history. ICDS is foremost symbol of India's commitment to her children. ICDS is also the foundation of the National effort for universalization of primary education. The study was carried out in randomly selected block Badagaon of Jhansi district of Uttar Pradesh to study the level of attitude of rural families about ICDS practices. The study revealed that very high majority of the respondents i.e. 91.00 % have favourable attitude pertaining to 'Children learn good habits at Anganwadi Kendra' followed by 90.33 per cent. 'The children of 0-6 years age group are attracted by Anganwadi Kendra through informal education', 89.67% "There has been improvement in the habits of children through informal education', 87.33% 'Pregnant ladies may be protected from tetanus by vaccination through training programme', 86.67% 'Vaccination may protect the children from fatal diseases', 84.33% "Health and food nutrition training has brought change in food habits'. Majority of the respondents have Neutral attitude in case of 'Loss of interest for going to schools has been observed in the children of 0-6 years age group due to attending Anganwadi centre' (89.67%). Majority i.e. 82.00 per cent respondents have unfavourable attitude in case of 'There is no use of sending the children to Anganwadi Centre'. Very high majority of i.e. 87.00, 82.00 per cent, respondents have favourable attitude regarding utility of ICDS practices in case of 'Mother's milk is nutritive and digestive to the children' and 'Immunization of children may be increased by using mother's milk'. The percentage of respondents who have Neutral attitudes were below 22.00% while the percentage of respondents who have unfavourable attitudes were below 13.00% except in case of statement viz. 'There is no change in food habits' (65.23%).

Key Words: Anganwadi, Attitude, Families, ICDS, Rural, Utility

Introduction

Children together with women in child bearing age constitute a large and important segment of India's population. Despite the spectacular progress achieved since independence the quality of life of most of these children unfortunately remained below the standards envisaged by the national policy makers, this is reflected in the key health, and development indicators like high infant mortality rate, high level of morbidity, higher incidence of malnutrition and nutritional related diseases, lower literacy rates and higher school dropout rates.

Today, ICDS represents one of the world's largest and most unique programmes for early childhood development- an initiative unpararelled in history. ICDS is foremost symbol of India's commitment to her children. India's response to the challenge of breaking the vicious cycle of malnutrition, morbidity, reduced learning capacity and mortality. Founded on this conviction, Integrated Child Development Services (I.C.D.S.) programme was launched on 2nd Oct. 1975, in 33 blocks nearly of a quarter of a century ago. ICDS is also the foundation of the National effort for universalization of primary education. It provides increased opportunities for promoting early development, associated with empowered cognitive and social skills, enrolment and retention in the early primary stage. By releasing girls from the disadvantaged care, it also enables them to participate in primary education ICDS is a major programme channel for addressing the rights of young children, as defined in the UN convention on the rights of child, to which India acceded in 1992.

ICDS is a holistic early childcare and development programme that addresses the interrelated needs of children, adolescent girls and women from disadvantaged communities, across the life cycle. So keeping in mind the use of Integrated Child Development Services in the process of social change,

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the present study was undertaken to analyze and understand the level of attitude of rural families about ICDS practices.

Research Methodology

The study was carried out in randomly selected block Badagaon of Jhansi district of Uttar Pradesh. C.D. block Badagaon consists of 39 villages, out of which 5 villages were randomly selected. Sixty (rural women) respondents were randomly selected from each village, thus making a total sample of 300 respondents were finally selected. The structured interview schedule was developed and was pre-tested on non sampled respondents. The data were collected through personal interview with the help of pre-tested schedule. The collected data were processed, tabulated, classified and analyzed with the help of parametric and non-parametric statistical tests.

Findings and Discussion

Attitude of respondents regarding ICDS practices:

Table 1 clearly reveals that very high majority of the respondents i.e. 91.00 % have favourable attitude pertaining to 'Children learn good habits at Anganwadi Kendra' followed by 90.33 per cent 'The children of 0-6 years age group are attracted by Anganwadi Kendra through informal education', 89.67% "There has been improvement in the habits of children through informal education', 87.33% 'Pregnant ladies may be protected from tetanus by vaccination through training programme', 86.67 per cent 'Vaccination may protect the children from fatal diseases', 84.33 per cent "Health and food nutrition training has brought change in food habits', 81.33 per cent "Community enjoys advantages of the advice given by Anganwadi workers (ANW)', 81.00 per cent 'Children develop sense of cooperation at Anganwadi centre', 75.67 per cent 'Improvement was revealed after the use of nutritious food obtained from Anganwadi', and 64.00 per cent 'Health and food nutrition programme has brought change to atmosphere and habits' regarding ICDS practices.

Majority i.e. 89.67 per cent, 85.33 per cent, 80.67 per cent, 80.00 per cent, 80.00 per cent, 78.67 per

Table 1: Attitude of rural families regarding ICDS practices

S.No.	Statements	Attitude					
		Favourable		vNeutral		Unfavourable	
		No.	%	No.	%	No.	%
1.	Improvement was revealed after the use of nutritious food obtained from Anganwadi Kendra.	227	75.67	40	13.33	33	11.00
2.	No improvement was revealed after the use of nutritious food obtained from Anganwadi Kendra.	26	8.67	240	80.00	34	11.33
3.	There is no advantage of nutritious food supply to the respondents	21	7.00	240	80.00	39	13.00
4.	Vaccination may protect the children from fatal diseases.	260	86.67	25	8.33	15	5.00
5.	Pregnant ladies may be protected from tetanus by vaccination through training programme.	262	87.33	6	2.00	32	10.67
6.	Children of community cannot be protected from fatal diseases through vaccination programmes.	40	13.33	207	69.00	53	17.67
7.	Pregnant ladies cannot be protected from tetanus through training programme.	31	10.33	216	72.00	53	17.67
8.	Health and food nutrition training has brought change in food habits	253	84.33	31	10.33	16	5.33
9.	Health and food nutrition programme has brought change to atmosphere and habits.	192	64.00	68	22.67	30	13.33
10.	No change is brought in health and food nutrition by cooking habits	15	5.00	242	80.67	43	14.33
11.	No change is revealed in house- keeping through health and food nutrition programme.	20	6.67	236	78.67	44	14.67
12.	Community enjoys advantages of the advice given by Anganwadi workers (ANW).	244	81.33	48	16.00	8	2.67
13.	Community does not enjoy advantage of the advice given by ANW /Anganwadi workers in gettingadvise on medical help.	16	5.33	256	85.33	28	9.33
14.	The children of 0-6 years age group are attracted by Anganwadi centre through informal education.	271	90.33	23	7.67	6	2.00
15.	There has been improvement in the habits of children through informal education.	269	89.67	13	4.33	18	6.00
16.	Children learn good habits at Anganwadi Kendra.	273	91.00	13	4.33	14	4.67
17.	Children develop sense of cooperation at Anganwadi Kendra	243	81.00	12	4.00	54	15.00
18.	Loss of interest for going to schools has been observed in the children of 0-6 years age group due to attending Anganwadi Kendra	18	6.00	269	89.67	13	4.33
19.	There is no use of sending the children to Anganwadi centre	16	5.33	38	12.67	246	82.00

Table 2: Attitude of rural families regarding the utility of ICDS practices

S.No.	Statements	Attitude					
		Favourable		vNeutral		Unfavourable	
		No.	%	No.	%	No.	%
1.	There is no change in food habits.	39	13.00	65	21.67	196	65.33
2.	There is change in food habits.	212	70.67	56	18.67	32	10.67
3.	Use of green vegetables is beneficial to the mother and children	225	75.00	47	15.67	28	9.33
4.	Use of milk and milk product is beneficial to mother and children	242	80.67	35	11.67	23	7.66
5.	Use of fruits are beneficial for making good health and protect from illness.	234	78.00	27	9.00	39	13.00
6.	The use of overall ICDS practices increases in diet.	222	74.00	48	16.00	30	10.00
7.	Adverse effect of disinfected needle causes child illness and infection to baby.	236	78.67	36	12.00	28	9.33
8.	Benefit of immunization protects from TB/Cough etc.	227	75.67	42	14.00	31	10.33
9.	Smoking causes harmful effect on child.	244	81.33	33	11.00	23	7.67
10.	Mother's milk is nutritive and digestive to the children.	261	87.00	21	7.00	18	6.00
11.	Immunization of children may be increased by using mother's milk	246	82.00	29	9.67	25	8.33

cent, 72.00 per cent and 69.00 per cent respondents have Neutral attitude regarding ICDS practices namely, 'Loss of interest for going to schools has been observed in the children of 0-6 years age group due to attending Anganwadi centre, 'Community does not enjoy advantage of the advice given by ANW / Anganwadi workers in getting medical help', 'No change is brought in health and food nutrition by cooking habits', 'No improvement was revealed after the use of nutritious food obtained from Anganwadi'. 'No advantage of nutritious food supply to the respondents', 'No change is revealed in house-keeping through health and food nutrition programme', 'Pregnant ladies cannot be protected from tetanus through training programmes' and 'Children of community cannot be protected from fatal diseases through vaccination programmes', respectively.

Very high majority i.e. 82.00 per cent respondents have unfavourable attitude in case of 'There is no use of sending the children to Anganwadi Centre', while less than 18% respondents have unfavourable attitude regarding ICDS practices.

Attitude of respondents regarding the utility of ICDS practices:

Table 2 clearly reveals that very high majority of respondents i.e. 87.00 per cent, 82.00 per cent, 81.33 per cent, 80.67 per cent, 78.67 per cent, 78.00 per cent, 75.67 per cent, 75.00 per cent, 74.00 per cent and 70.67 per cent of respondents have favourable attitude regarding utility of ICDS practices in case of 'Mother's milk is nutritive and digestive to the children', 'Immunization of children may be increased by using mother's milk', 'Smoking causes harmful effect on child', 'Use of milk and milk product is beneficial to mother and children', 'Adverse effect of disinfected needle causes child illness and infection to baby', 'Use of fruits are beneficial for making good health and protect from illness', 'Benefit of immunization protects from TB/Cough etc.', 'The use of overall ICDS practices increases in diet', 'Use of green vegetables is beneficial to the mother and children', and 'There is change in food habit'.

The percentage of respondents who have Neutral attitudes were below 22.00 per cent while the percentage of respondents who have unfavourable attitudes were below 13.00 per cent except in case of statement viz. 'There is no change in food habits' (65.23%).

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Effect of elevated temperature and carbon dioxide on germination and growth of groundnut crop plants (Arachis hypogaea L.)

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Abstract

Understanding the influence of growth temperature and carbon dioxide (CO_2) on seed quality in terms of seedling stage total carbohydrates, total sugar, free amino acid and protein, subsequent seedling emergence and early seedling vigour is important under present and future climates. The objective of this study was to determine the combined effects of elevated temperature and CO_2 during seed filling of parents plants on seedling emergence and seedling vigour and biochemical analysis of groundnut crops (Arachis hypogaea l.).Plants of cultivar 'Montcalm 'were grown at day time maximum/nighttime minimum sinusoidal temperature regimes of 28/18°C and 34/24°C at ambient CO_2 and at elevated CO_2 from emergence to maturity. Seed size, seedling emergence, early seedling vigour, total dry weight, root and shoot ratio and biochemical were analyzed. Elevated CO_2 did not influence morphological and biochemical produced either at 28/18°C and 34/24°C.seed produced at 34/24°C had smaller seed size ,decreased free amino acid, protein concentration and total sugars but significantly increased concentrations of starch and total carbohydrates compared to 28/18°C.elevated growth temperature during seed production decreased the subsequent per cent emergence and seedling vigour of the seeds and seedling dry matter production of seed production either at ambient and elevated CO_2 .

Keywords: Carbon Dioxide, Growth Temperature, Seedling Emergence, Seed Quality, Seedling Vigour,

Introduction

Groundnut is one of the important oil seed crops grown in various parts of India, changes in climate particularly an increasing concentration of atmospheric carbon dioxide and an associated temperature increase (IPCC, 2007) might influence plant growth and reproduction. Growth at elevated CO_2 will increase yield in most C_3 crop species due to increased rate of photosynthesis and increased vegetative growth under optimal light, temperature and growth conditions (Kimbal 1983,frake et al 1997,Kimball et al.2002)studies have shown that the negative effects of high temperature on reproductive traits such as pollen viability, seed set, seed size and harvest index will nullify the beneficial effects of elevated CO_2 on photosynthesis and growth(baker et al1989) changes in climate may also influence seed composition and subsequent establishment of plant species by influencing seedling emergence and early seedling vigour.

Growth at elevated temperature decreased seed yield and seed size of dry bean(phaseolus vulgaris L; Sexton et al 1994,Sanhewe andEllis199,porch 200),peanut (Nigam et al 1998,2003) and soybean(Pan199),several studies investigated the influence of growth temperature on composition of soybean seed, while no of data is available on others grain legumes. There were negative effects of temperature increases from 28/18 through 44/34°C on N,Total Sugar, Free Amino Acid, Total oil, Fatty Acids and non structural carbohydrates in soybean(Thomas et al 2003). Oil concentration in soybean seed decreased at temperature above 28°C, while protein concentration at temperature above 25°C (Wolf et al 1882, Mullen 1992) soybean seeds obtained from plants grown at high day (35°C) and high night (30°C) temperature had lower seed germination and seedling vigour (Gibson and Mullen 1996b). However, there was no influence of moisture stress on seed viability and seedling vigour in peanut (Ramamurthy and Basu 1996).

Studies on combined and interactive effects of elevated growth temperature and CO_2 on seed quality of crops are uncommon and limited to few crop species such as wheat (Sanhewe et al 1996) and soybean (Thomas 2001).A better understanding of combined effects of super optimal temperature and elevated CO_2

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on seed quality in other species is essential and will provide wider combine impact assessments. The impact of combined effects of elevated temperature and CO_2 on groundnut phenology, growth, reproductive processes and yield quantified .which is an important food grain legume grown in many parts of the world.

Materials and Methods

The research was conducted at the open top chambers with ambient CO_2 and elevated CO_2 levels. Groundnut crop were grown at two different sowing dates were temperature increased seedling growth condition studies. The day time maximum/night time minimum temperature regimes of 28/18 and 34/24^{0}C at ambient CO_2 and at elevated CO_2 from emergence to maturity in eight sunlit controlled environments chambers attached 60cm deep soil bins. Detailed information on growth chamber growing conditions, uniformity environmental conditions and control of sunlight controlled environment chambers. The CO_2 cylinders were placed inside the control room in the manifold system and flow of gas was regulated and maintained by the regulators. Inside the open top chambers the CO_2 concentration of 600=50ppm was monitored throughout the growth period of the crops by using infra red gas analyzers (photosynthesis systems) of CID, USA. Plants were sown surface irrigated using sprinkler from sowing 20das after sowing, thereafter subsurface irrigation was provided by automated float valves that controlled water the water table at 45cm below the soil surface. Plants in all treatments were healthy and did not have any a biotic and biotic stress others than the treatment effects. Seeds from two temperature treatments (28/18^{o}C and 34/24^{o}C) at ambient or elevated CO_2 were analyzed for seedling growth parameters such as germination percentage, seedling size, seedling emergence, and seedling vigour, dry weight (g/seedlings) were measured and recorded. In addition to that above said parameters like chlorophyll (arnon), total sugar, free amino acid, protein, total carbohydrates, were estimated and recorded**.**

Data analysis

Data analyses for all the measured and calculated variables were conducted using ANOVA procedures in SAS .The combinations of two CO_2 concentrations ambient CO_2 and elevated CO_2 and two temperature (28/18^{o}C and 34/24^{o}C) were regarded as treatments. The data were analyzed as a randomized complete block design. There were three replications for biochemical analysis, and four replications for seedling emergence, seedling vigour and component total dry weight.

Results and discussion

There were no significant effects of elevated CO_2, interaction between CO_2 and temperature on total soluble protein concentration, or crude protein concentration (Table.1).Only the interaction between CO_2 and temperature was significant for N concentration, which decreased under elevated CO_2 at growth temperature of 28/18^{o}C, but not 34/24^{o}C.Elevated temperature of 34/24^{o}C compared to by 28/18^{o}C significantly decreased oil concentration by 16%. Interaction between CO_2 and temperature showed that elevated CO_2 increased oil concentration by15% at growth temperature of 28/18^{o}C but decreased it by7% at 34/24^{o}C .elevated temperature decreased concentration of starch, total carbohydrates by 44%,while it increased concentration of total sugars, free amino acids, phenols, protein by 25% respectively. There were no effects of elevated growth temperature on concentrations of glucose, starch and total carbohydrates. There were no of elevated CO_2 on carbohydrates with the exception of free amino acids ,which was significantly decrease by 27% at higher CO_2.There were no effects of the interactions of elevated CO_2 and temperature on concentration of total sugars and protein tested.

Seedling vigour

Temperature was the only influencing factor on seed size, per cent seedling emergence and early seedling vigour (Table.2). There were no effects of growth at elevated CO_2 or interaction between CO_2 and temperature on seed size, subsequent total per cent seedling emergence, time to emergence, time to vegetative stage, rate of emergence and rate of

Table.1: Effect of different temperature and elevated Carbodioxide concentration of biochemical analysis of seedling growth stage

Trait	28/18^o C			34/24^o C		
	365ppm	550+50ppm	Mean	365ppm	550+50ppm	Mean
Nitrogen (%)	6.50	7.10	6.80	6	5.90	5.95
Crude protein (%)	40.63	44.38	42.50	37.50	36.88	37.19
Oil content (%)	41.25	47.84	44.55	39.85	37.52	38.685
Total sugars (%)	5.82	5.27	5.55	6.93	7.79	7.36
Free Amino acids (%)	0.042	0.044	0.04	0.038	0.035	0.037
Starch (%)	22.14	28.67	25.41	27.52	24.87	26.20
Total carbohydrates (%)	32.56	37.54	35.05	39.42	40.13	39.78

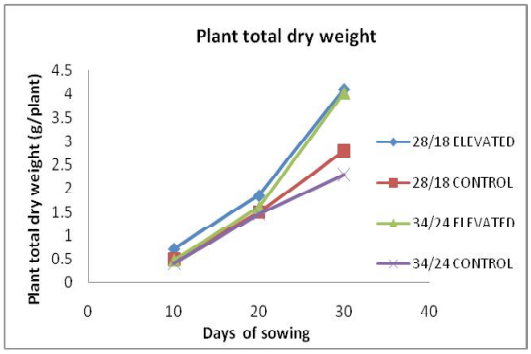

Fig. 1:

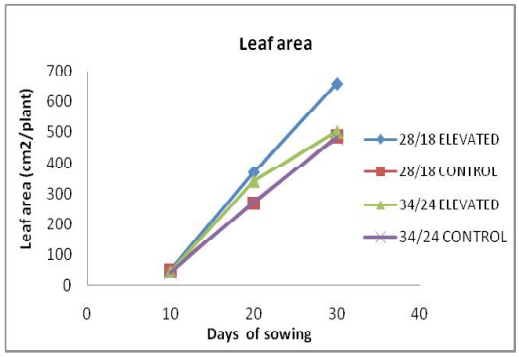

Fig. 2:

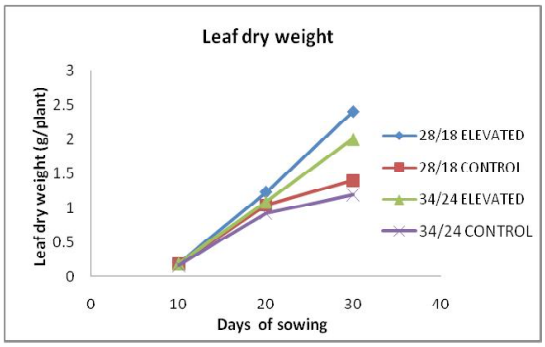

Fig. 3:

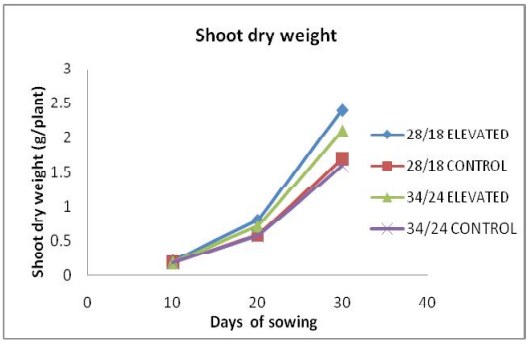

Fig. 4:

development to vegetative stage.

Growth at elevated temperature of 34/24°C compared to 28/18°C significantly decreased subsequently total per cent seedling germination from 93% to 75% when averaged across CO_2 treatments (Table.2).There was a significant effect of growth temperature on rate of emergence from seed produced at 34/24°C ,and the timing of leaf emergence was more uniform ,compared seedlings from seed produced at 34/24°C .Similarly ,developmental time to vegetative stage was longer and rate of development was significantly slower in seeds formed at 34/24°C compared to 28/18°C (Table.2).Moreover seeds produced at 34/24°C developed unevenly with some individual plants lagging behind the rest of the population.Unifoliate leaves were often crinkled and flowering was slightly delayed in seedlings from seed produced at high temperature.

There were significant effects of growth temperature on subsequent seedling growth and component dry weights at different times after sowing (fig.1).Seedling grown from seed produced at elevated temperature (34/24°C) were shorter in height with

Table 2: Effect of growth temperature (28/18°C and 34/24°C) ambient and elevatedCO_2 during seedling stage of germination percentage

Trait	28/18° C			34/24° C		
	365ppm	550+50ppm	Mean	365ppm	550+50ppm	Mean
Seed size (g/seed)	0.53	0.56	0.55	0.37	0.42	0.40
Germination (%)	89.67	98.00	93.835	76.67	74.33	75.50
Speed of germination	32.12	36.68	34.40	18.87	25.50	22.185
Speed of emergence (%)	34.57	31.47	33.02	18.65	23.47	21.06
Seedling vigour	912.67	1172.73	1042.7	682.36	622.14	652.25
Time of emergence	5.54	5.63	5.585	6.65	6.63	6.64

smaller total plant leaf area (fig.2) when compared to those produced at 28/18°C art 10, 20 and 30das, regardless of CO_2 treatment during seed formation. The per cent decrease due to growth at elevated temperature ranged from 10% to 20%in plant height and by 20% to 40% leaf area. Similar decreases in leaf, stem and total plant dry weight caused by elevated temperature during seed growth were observed across all harvest dates at 10,20,30DAS(fig.1,2,3,4).The percentage decrease in leaf dry weights of seedlings produced from seeds formed at elevated temperature (34/24°C)when compared to ambient temperature (28/18°C) were 10%,20% and66%at 10,20and 30 Das respectively (fig.3).the corresponding decrease at 10,20 and 30 DAS in stem dry weights were 10%,36% and 41% respectively. Total dry weights were 6%, 25% and 35% respectively. There was no effect of parental CO_2 or interaction between CO_2 and temperature on seedling growth or dry matter accumulation across all harvest dates (fig.1, 2, 3, 4).

Seed quality of groundnut crop in terms of subsequent seedling emergence and seedling vigour was negatively influenced by growth temperature of the parent plant, but was not influenced by elevated CO_2. Previous studies on soybean (Rogers et al.1980) showed no effect of growth at elevated CO_2 on per cent germination and early vigour..

The day/night temperature of 28/18°C during growth in studies of sanhewe and Eills (1996) are close to the upper limit of typical temperatures where beans is currently grown. Therefore any further increase in temperature due to climate change or climate variability in these regions would not only decrease seed yield but also decrease the seed quality due to adverse effects on seed composition and loss of early seedling vigour. These issue and interactions of climate change factors and nutrients need further research.

In conclusion our research has shown that elevated temperature (34/24°C compared with 28/18°C) during seed development will decrease seed size, alter seed composition, decrease nutritional value of seeds, and decrease subsequent emergence and seedling vigour.it is important to test if such changes occur over multiple years and also in other plant species, as continuous change may have potential to changes crop ecologies and competition.

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A study of breed-wise production, consumption and marketing surplus of milk in western plain zone of Uttar Pradesh

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Abstract

The study conducted during 2005-06 in Meerut districts of Uttar Pradesh showed milk marketed surplus is concerned. While milk had positive and significant impact on both production and marketed, surplus of milk in Meerut district. The study also showed lower production and marketed surplus during summer season followed by rainy and winter seasons. However, the percentage marketed surplus was the highest in summer season followed by winter and rainy seasons. The higher percentage of marketed surplus in summer season was due to lower milk production, higher demand and higher prices offered by various agencies compared to other seasons. This proportion differed in different seasons and herd size categories. An analysis drawn from Marketed Surplus Function (MSF) also showed that total milk production in the household was the single most significant factor contributing to marketed surplus of milk. The next important variable positively affecting the marketed surplus of milk was the education level of the head of the household, particularly in control area of the districts. In general, price of milk had very little influence on the marketed surplus of milk. Relatively small variation in price of milk within a season could be one of the reasons for lack of impact of price on marketed surplus of milk.

Key words: Marketed Surplus Function

Introduction

Today, India is the world's largest milk producer. The milk production in the country has been reached upto 104.84 million tonnes in 2007-08 from 17.8 million tonnes in 1955-56 and availability of milk also had reached 232 mg/capita/day in 2004-05 from 124 mg/capita/day in year 1955-56. Out of total milk production about 46 per cent used as liquid milk and remaining 54 per cent converted into various dairy products, such as ghee, butter, milk powder, ice cream, cheese, condensed milk and for making various kinds of sweetmeats having distinct regional preferences. As India enters an era of economic reforms, agriculture, particularly the livestock sector, is positioned to be a major growth area. The fact that dairying could play a more constructive role in promoting rural welfare and reducing poverty is increasingly being recognized. For example, milk production alone involves more than 70 million producers, each raising one or two cows/buffaloes.

The livestock sector of Uttar Pradesh contributes to over 28 per cent of the total value of output arising from the agricultural sector in the state. The agriculture and allied sectors contribute to over 32 per cent of the GDP of the state hence the contribution of animal husbandry works out to be approximately 9 per cent to the GDP of the state. The state has got the second highest cattle population and highest buffalo population in the country. The average milk yield per cow was 3.090 kg/day while for buffalo it was 4.328 kg/day as per 2006-07 sample survey.

Efforts to increase milk production by dairy farmers are strongly influenced by the degree to which demand signals are transmitted through the marketing system. Since the demand in the urban scenario is rapidly increasing so is the supply generated by all the milk collection and distribution agencies with the help of rural milk venders as well as commercial dairymen of urban and urban periphery areas.

Western Plain Zone is one of the few developed and prosperous in zone of Uttar Pradesh where animal husbandry practices followed by farmers are some better than that of rest districts/zones of the state. A large number of milch animal holders households having improved breeds of milch buffaloes, crossbred cows and improved indigenous cows in the all the districts of Western Plain Zone which resulted high milk productivity per animal and more milk production in comparison to other districts / zones of the state. However, farmers are facing various serious problems in rearing of milch animals, production and marketing of milk and milk products due to various socio-economic reasons especially by marginal and small categories households.

Thus, keeping in view the importance of economics of milk production of different breed of milch animals in the socio-economic transformation, income and employment generation in agricultural economy of the study area, the present study entitled "Study of Bread-

Wise Production, Consumption and Marketing Surplus of Milk in Western Plain Zone of Uttar Pradesh" was undertaken with the following objectives.

Research Methodology

A purposive random sampling technique was adopted to the select the sample districts, villages and animals holders. Western Plain Zone and its all the districts were selected purposively due to more advancement of dairy practices in this zone than other zones. A sample of 7 villages (one village from each district) was selected randomly. A farmer having at least two milch animals either milch buffaloes or cows treated milch animal rearer household. A list of all the milch animals holder households was prepared with the help of Gram Pradhan as well as progressive farmers along with their size of land holding. These animals' holder households 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 holder 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 by researcher themselves.

Results and discussion

This paper deals with the average size of land holding, herd size, different types of milch animals, production pattern of milk of different breeds of milch animals like buffaloes, crossbreed and indigenous cow, on-farm/ family consumption and utilization and marketable surplus under different categories of households in the following sub-sections:

Size of holding

Table 1 indicates that the average size of holding of sample households came to 2.19 hectares per household, varied from 0.88 hectare per household on marginal category to 5.48 hectare per household on large category of farms. The households belonging to marginal category of farms constituted 3% to total number of sample households and occupied only 13.96 per cent of total cultivated area. As against to this situation, 15, 20 and 30% households of large, medium and small categories of households occupied 37.34, 26.62, and 22.08% area to total cultivated area, respectively. It clearly shows an uneven distribution of the cultivated land among different categories of the sample households which resulted more variations in socio-economic status of among the same in the study area.

Herd size of livestock

The results presented in Table 2 shows that the overall herd size of sample household came to 8.57 animals/ household varied from 6.16 animals/household on small category of holding to 12.14 animals/ household on large category of holding. Out of total herd size of households, milch animals came to 5.61 animals/ household which included the highest number of 2.76 crossbred cows/ household followed by buffaloes (2.49/household) and local cow (0.36 / household). Across the size of holdings, number of milch animals like buffaloes, crossbred cows and local cows per households increases with the increase in size of holding due to better investment capacity and better care and maintenance, sufficient availability of farm produced feed and fodder and more risk bearing ability on the other. Numbers of milch crossbred cows per household were found to be quite some higher than that of other milch animals due to higher milk yield of crossbred cows in comparison to buffaloes and indigenous cows. However, farmers as well as consumers more prefer the buffalo milk due to presence of higher fat and Solid Not Fat (SNF). These figures show that the animal rearing was an important enterprise for households. The households which are reared milch animals reported that previously these were reared mainly for the domestic milk consumption purpose but now the pattern have been changed to large extent and these animals are reared especially for the commercial milk production purpose and domestic milk purpose is secondary.

Breed-wise milk production

The perusal of Table 3 shows that on overall basis total milk production came to 13273 litres/household varied form 8773.21 litres/household on marginal category household to 19797.16 litres/household on large category household. Across the categories of households, milk production indicating an increasing trend with the increase in category of households due to more number of milch animals of different breeds on one hand and higher milk yield/milch animal on larger categories households in comparison to smaller

Table 1: Distribution of sample households and area under different size of holdings

S. No.	Particular	Category of households				Total
		Marginal	Small	Medium	Large	
1.	No. of sample farms	49(35.00)	42(30.00)	28(20.00)	21(15.00)	140.00(100.0)
2.	Total cultivated area (ha)	43.00(13.96)	68.00(22.08)	82.00(26.62)	114.00(37.34)	308.00(100.00)
3.	Average size of holding (ha)	0.88	1.62	2.93	5.48	2.20

Figures in parentheses indicate their percentage to total

Table 2: Number of animals per household on different categories of sample households

S. No. Particular	Category of households				Total
	Marginal	Small	Medium	Large	
1. Milch animals					
a. Buffaloes	86(1.76)	96(2.29)	90(3.21)	76(3.62)	348(2.49)
b. Cross bred cows	92 (1.88)	115(2.74)	100(3.57)	80(3.81)	387(2.76)
c. Local cows	20(0.41)	15(0.36)	10(0.36)	6(0.29)	51(0.36)
Sub-total	198(4.04)	226(5.38)	200(7.14)	162(7.71)	786(5.61)
2. Growing and young heifers	60(1.22)	65 (1.55)	58(2.07)	54(2.57)	237(1.69)
3. Drought animals	44(0.90)	50(1.19)	44(1.57)	39(1.86)	177(1.26)
Total herd size	302(6.16)	341(8.12)	302(10.79)	255(12.14)	1200(8.57)

categories households on the other. Out of total milk production of 13273.08 litres/household, the highest quantity of milk production of 7677.79 litres/household received from crossbred cows constituted 57.84% of total milk followed by 5145.17 and 450.12 litres/ household were received from buffaloes and indigenous cow constituting 38.76 and 3.39%, respectively. Contribution of crossbred cows in total milk production of household was found more in all the categories of households in comparison to other categories households indicating changing pattern of milch animals rearing from milch indigenous cow and buffaloes towards crossbred cows due to higher milk yield and production capacity of crossbred cows than that of others.

Season-wise milk production

Table 4 portrays that on an average the highest being 37.78% milk produced in rainy season to total milk production followed by 34.13 and 28.09% in winter and summer seasons, respectively. The milk production in rainy season was found higher in comparison to summer and winter seasons due to availability of green fodder in large scale on one hand and presence of normal temperature of environmental. Whereas in winter and summer seasons milk production decreases due to temperature of environmental reached too low and too high, respectively in comparison to normal temperature on one hand and lower availability of green fodders on the others.

Milk consumption and marketable surplus

The perusal of Table 5 shows that on an average 1192.70 litres/ household quantity of milk retained for family consumption purpose by the sample households constituted 8.99% to total household production of milk which varied from 936.68 litres/household (10.68%) on marginal category household to 1644.28 litres/household (8.31%) on large category household. It showed decreasing trend with the increase in categories of households in absolute terms due to large size of family

Table 3: Production of milk on different categories of households

S. No. Particular	Category of households				Total
	Marginal	Small	Medium	Large	
A. Milk production/ annum/animal (litres)					
1.Buffaloes	1924.60	2001.45	2141.04	2239.29	2038.17
2.Crossbred cows	2616.00	2705.00	2856.89	2970.00	2743.98
3.Indigenous cow	1199.59	1213.11	1280.93	1336.58	1235.63
B.Total annual milk production in category (Litres/household)					
1.Buffaloes	165515.60	192139.20	192693.60	170186.04	720534.44
2.Crossbred cows	240672.00	311075.00	285689.00	237600.00	1075036.00
3.Indigenous cow	23991.80	18196.65	12809.30	8019.48	63017.23
Total	430179.40	521410.85	491191.90	415805.52	1858587.67
C. Per household total annual milk production (Litres)					
1.Buffaloes	3377.87(38.48)	4574.74(36.85)	6881.91(39.23)	8104.10(40.93)	5146.67 (38.77)
2. Crossbred cows	4911.67(55.95)	7406.55(59.66)	10203.18(58.16)	11314.29(57.14)	7678.83 (57.84)
3.Indigenous cow	489.63(5.58)	433.25(3.49)	457.48(2.61)	381.88(1.93)	450.12(3.39)
Total	8779.17(100.0)	12414.54(100.0)	17542.57(100.0)	19800.26(100.0)	13275.63 (100.0)
D. Bred wise per day milk production (Litres/household)					
1.Buffaloes	9.25	12.53	18.85	22.20	14.10
2.Crossbred cows	13.46	20.29	27.95	31.00	21.04
3.Indigenous cow	1.34	1.19	1.25	1.05	1.23
Total	24.05	34.01	48.06	54.25	36.37

Note: figures in parentheses show their respective percentage to total.

Table 4: Season-wise milk production on different categories of households (Litres/ household)

S. No.	Season	Category of households				Overall
		Marginal	Small	Medium	Large	
1.	Summer	2449.36 (27.90)	3469.61 (27.95)	4907.80 (27.98)	5666.34 (28.62)	3729.68 (28.09)
2.	Winter	3032.01 (34.54)	4221.71 (34.01)	5964.93 (34.00)	6731.19 (34.00)	4530.39 (34.13)
3.	Rainy	3297.81(37.56)	4723.22 (38.05)	6669.84 (38.02)	7402.74 (37.39)	5015.55 (37.78)
	Total	8779.17 (100.0)	12414.54 (100.0)	17542.57 (100.0)	19800.27 (100.0)	13275.62 (100.0)

on one hand and higher per capita consumption on the other on larger categories households in comparison to smaller categories of households.

Table further shows that on overall basis marketable surplus of milk came to 12038.80 litres/ household which constituted 91.01 per cent to total milk production of household. It varied from 7836.53 litres/household on marginal category household to 18152.88 litres/household on large category household. In case of per day basis, marketable surplus came to 33.10 litres/day which also constituted 91.01% (Table 6). Per day marketable surplus varied from 21.49 litres/ day on marginal category to 49.74 litres/day on large category. The quantity of marketable surplus of milk showed an increasing trend with the increase in categories of households due to higher number of milch animals per household and their more milk yield per milch animal on larger categories of households in comparison to smaller categories households.

Breed-wise milk consumption

The perusal of Table 7 shows that on overall basis 1192.70 litres/ household quantity of milk retained for family consumption purpose by the sample households. In the total domestic milk consumption of household, the contribution of buffalo's milk came to the highest being 66.86%, followed by crossbred and indigenous cows constituted to 25.03 and 8.10%, respectively. A similar trend was found across the categories of households. This clearly indicated that milch animals rearer households prefer more consumption of buffalo milk in comparison to crossbred and indigenous cows instead of higher milk production of crossbred cow on their farms due to presence of higher fat and Solid

Table 5: Production, consumption and marketable surplus of milk on different categories of household (litres/annum/household)

S. No.	Particular	Category of households				Total
		Marginal	Small	Medium	Large	
1.	Production	8779.17(100.0)	12414.54(100.0)	17542.57(100.0)	19800.26(100.0)	13275.62 (100.0)
2.	Consumption	936.68(10.67)	1140.44(9.19)	1380.43(7.87)	1644.28(8.30)	1192.70(8.98)
3.	Marketable surplus	7842.49(89.33)	11274.10(90.81)	16162.14(92.13)	18155.98(91.70)	12082.92(91.02)

Table 6: Production, consumption and marketable surplus of milk on different categories of household (litres/day/household)

S. No.	Particular	Category of households				Total
		Marginal	Small	Medium	Large	
1.	Production	24.05 (100.00)	34.01(100.00)	48.06(100.00)	54.25(100.00)	36.37 (100.00)
2.	Consumption	2.57(10.67)	3.12(9.19)	3.78(7.87)	4.50(8.30)	3.27(8.98)
3.	Marketable surplus	21.49(89.33)	30.89(90.81)	44.28(92.13)	49.74(91.70)	33.10(91.02)

Table 7: Breed-wise milk consumption on different categories of households (Litres/household)

S. No.	Particular	Category of households				Total
		Marginal	Small	Medium	Large	
1.	Buffaloes	562.01(60.0)	741.51(65.02)	966.44(70.01)	1233.37(75.01)	797.44(66.86)
2.	Crossbred cows	273.42(29.19)	309.97(27.18)	307.70(22.29)	322.11(19.59)	298.53(25.03)
3.	Indigenous cow	101.26(10.81)	88.95(7.80)	106.29(7.70)	88.79(5.40)	96.70(8.11)
	Total	936.68(100.0)	1140.44(100.0)	1380.43(100.0)	1644.28(100.0)	1192.70(100.0)

Note: figures in parentheses show their respective percentage to total.

Table 8: Breed-wise marketable surplus of milk under different categories of households (Litres/annum/household)

S. No.	Season	Category of households				Overall
		Marginal	Small	Medium	Large	
1.	Buffaloes	2815.86(35.91)	3833.23(34.00)	5915.47(36.60)	6870.73(37.84)	4349.23 (35.99)
2.	Crossbred cows	4638.25(59.14)	7096.58(62.95)	9895.48(61.23)	10992.18(60.54)	7380.30 (61.08)
3.	Indigenous cow	388.37(4.95)	344.30(3.05)	351.19(2.17)	293.09(1.61)	353.42 (2.93)
	Total	7842.49(100.0)	11274.10(100.0)	16162.14(100.0)	18155.98(100.0)	12082.93 (100.0)

Note: figures in parentheses show their respective percentage to total.

Table 9: Breed-wise marketable surplus of milk under different categories of households (Litres/day/household)

S. No.	Season	Category of households				Overall
		Marginal	Small	Medium	Large	
1.	Buffaloes	7.71(35.91)	10.50(34.00)	16.21(36.60)	18.82(37.84)	11.92 (35.99)
2.	Crossbred cows	12.71(59.14)	19.44(62.95)	27.11(61.23)	30.12(60.54)	20.22 (61.08)
3.	Indigenous cow	1.06(4.95)	0.94(3.05)	0.96(2.17)	0.80(1.61)	0.97 (2.93)
	Total	21.49(100.00)	30.89(100.00)	44.28(100.00)	49.74(100.00)	33.10 (100.00)

Note: figures in parentheses show their respective percentage to total.

Table 10: Seasonal marketable surplus of milk on different categories of households (Litres/household)

S. No.	Season	Category of households				Overall
		Marginal	Small	Medium	Large	
1.	Summer	1887.35(24.07)	2728.10(24.20)	3941.36(24.39)	4432.96(24.42)	2932.22 (24.27)
2.	Winder	2758.59(35.17)	3911.74(34.70)	5657.23(35.00)	6409.08(35.30)	4231.84 (35.02)
3.	Rainy	3196.55(40.76)	4634.26(41.11)	6563.54(40.61)	7313.94(40.28)	4918.86 (40.71)
	Total	7842.49(100.00)	11274.10(100.00)	16162.14(100.00)	18155.99(100.00)	12082.92 (100.00)

Not Fat (SNF) percentage buffalo milk.

Breed-wise marketable surplus of milk

Breed-wise break-up of marketable surplus of milk shows that the contribution of buffalo milk came to the maximum of 7379.22 litres/household constituted 61.08 per cent total marketable surplus followed buffalo and indigenous cow milk came to 4347.70 and 353.46 litres/household which constituting 35.99 and 2.93 per cent, respectively (Table V-42.A). In case of per day basis, it came to maximum of 20.22 litres/day/household of crossbred cow followed by buffalo and indigenous cow came to 11.92 and 2.93 litres/day/household, respectively (Table 9). The percentage contribution of indigenous cow milk in marketable surplus shows decreasing trend with the increase in categories of households due to smaller number of indigenous cows on larger categories than that of smaller ones whereas in case of buffalo and crossbreed cow it showed zigzag trends. In absolute terms, across the categories of households, the quantity of marketable surplus of buffalo and crossbreed cow showed an increasing trend with the increase in categories of households due higher number of milch animals on larger categories than that of smaller ones.

Seasonal marketable surplus of milk

Season-wise trend of marketable surplus of milk shows that it was found to be highest being 38.26 per cent in rainy season to total marketable surplus of milk followed by winter and summer seasons accounted to 34.04 and 27.70 per cent respectively (**Table 10**). The higher marketable surplus of milk was found in rainy season due to higher milk production in the same in comparison to other seasons.

Marketed surplus of milk

Milk is a highly perishable nature of goods which can not be stored/held on farmer's level for longer hours from any view points of better price expectations or any other resulted urgent need to dispose off liquid / fresh milk. The milk producer households reported that they do not stored/hold any kind of quantity of milk except present family requirement of fresh/liquid milk for consumption purpose. The producer's of study zone sold whole quantity of marketable surplus of milk within the same day. Hence, the marketable surplus and marketed consisted same.

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Trace and Heavy Metal Contents of Sewage and Ground Water Irrigated Surface and Subsurface Soils under Musi River Basin in Hyderabad, Andhra Pradesh, India

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Abstract

A study was conducted to monitor the long-term effect of sewage water irrigation on trace and heavy metal contents under Musi River Basin, peri urban areas of city of Hyderabad in Andhra Pradesh. Soil samples were collected from five villages practicing sewage irrigation, four villages practicing ground water irrigation and one village (control) using no irrigation (rain fed condition). The study area geographically falls between $17^0 – 19^1$ to 17^0 - 30^1 N latitude and $78^0 – 23^1$ to $78^0 –30^1$ E longitude. Standard DTPA (Diethylene Tri-amine Penta acetic acid) extraction method was used to extract Copper (Cu), Manganese (Mn), Iron (Fe), Zinc (Zn), Lead (Pb), Nickel (Ni) and Cadmium (Cd). This study revealed that some of the analyzed values for heavy and trace metals were found to be higher than the safe limits suggested by Food and Agricultural Organization (FAO). Higher load of heavy metals in soil is a matter of serious concern to all those who encounter such situation world over.

Key words: Sewage /Effluent irrigation, trace and heavy metals

Introduction

Raw or untreated and / or injudicious application of effluents may give rise to accumulation of heavy metals in the top soil (Williams et al., 1980) and hence in tissues of plant grown on them (Mays et al., 1973; Day et al., 1979). A major environmental concern due to dispersal of industrial and urban wastes generated by human activities is the contamination of soil. Controlled and uncontrolled disposal of waste, accidental and process spillage, mining and smelting of metaliferous ores, sewage sludge application to agricultural soils are responsible for the migration of contaminants into non- contaminated sites as dust or leachate and contribute towards contamination of our ecosystem. A wide range of inorganic and organic compounds cause contamination, these include heavy metals, combustible and putriscible substances, hazardous wastes, explosives and petroleum products. Major component of inorganic contaminates are heavy metals (Alloway, 1990).

Therefore, the present study was conducted with the objective to evaluate the long term effect of sewage water irrigation on trace elements and heavy metals of soils in some of the peri-urban villages of Hyderabad under Musi River Basin.

Materials and Methods

The study region falls under Agro-climatic zone AZ-118. It has a typical semi-arid climatic conditions characterized by mild winters and moderate summers, with occasionally severe summers with moderate relative humidity during the months of June to September. The average rainfall of the region is 518 mm.

Soil samples were collected from five villages practicing sewage irrigation, four villages practicing ground water irrigation and one village (control) using no irrigation (rain fed condition). These villages are located in Ghatkesar Mandal of Ranga Reddy district, which forms the eastern part of the peri-urban area of Hyderabad city.

A total of 100 soil samples were collected from five villages during the month of June, which represented the end of summer and start of monsoon (1-10th of June). Out of the 100 soil samples collected, 50 samples were from sewage irrigated land, 40 samples were from groundwater-irrigated land and 10 were from unirrigated land. Thus, it was easy to study the impact of sewage irrigation on soil parameters in comparison with groundwater irrigated soils and unirrigated soils. The names of sewage irrigated villages were: (1) Peerjadiguda (PJG) 2) Parvathapur (PP) 3) Kachavanisingaram (KS) 4) Pratap Singaram (PS) 5) Muthuwaliguda (MTHG). The ground water irrigated villages were: (1) Sadat Ali Guda,2)

Korremula,3) Chowdarguda and 4) Narapally. The control village which did not use any irrigation was Annojiguda. . Composite soil samples were collected from two depths viz. 0-15 and 15-30 cm.Each sample was composite of 2 sub samples. Thick and good quality polythene bags of 1 kg capacity were used to collect the soil samples. For making composite sample, small portion of soil upto the desired depth (i.e 0-15 cm and 15-30 cm) using suitable sampling tools i.e crowbar and kurfi was collected, after scrapping off the surface litter, if any, without removing soil. The 'V' shaped cut were first made upto certain depth and a uniformly 2 cm thick slice was taken out from one clean side. From fields having standing crop, samples were drawn in between the rows- mixed the soil collected from two spots by hand on a clean piece of cloth or polythene sheet. Reduced the bulk to about 500 gm by quartering process in which the entire soil is spread, divided into four quarters, two opposite ones were discarded and remaining two were remixed. Repeated this process until about 500 gm soils was left over . These steps were repeated for all the samples. Samples were labeled for identification and kept inside the sample bag, another label carrying same details of field etc. was pasted/tagged outside the bag.

Samples were brought to the laboratory and dried under shade. By using pestle and mortar, the samples were processed and passed through a 2 mm sieve for estimating various chemical parameters.

Soil samples were analyzed for different soil quality parameters using standard methods as given in.

DTPA extractable Micronutrients and Heavy metals

Ten gm of soil was taken in 100 ml conical flask. To this 20 ml of the DTPA reagent (0.005 M DTPA, diethylene triamine pentacetic acid +0.1M TEA, triethanolamine + 0.01 M $CaCl_2$, pH 7.3) was added and shaken for 2 hrs on a mechanical shaker. Filtered the contents using What man No.42 filter paper (Lindsay and Norvell, 1978). Trace and heavy metals were determined by using Inductively Coupled Plasma Spectrophotometer (ICP-XP, GBC, Australian model).

Statistical methods recommended by Gomez and Gomez (1984) were employed to process the data generated from laboratory. The data were computerized and subjected to the statistical analysis to compute means, Standard Deviation (SD), Coefficient of Variation (% CV) and correlations.

Results and Discussion

The data on long term effects of sewage and ground water irrigation on accumulation of trace elements and heavy metals in surface and surface soils have been presented in Figs. 1 to 7.

1. Copper (Cu)

The DTPA extractable Copper (Cu) content in surface and subsurface soils ranged from 0.33 to 4.51 and 0.45 to 4.60 mg kg^{-1} in sewage water treated soils and 0.75 to 3.96 and 0.57 to 4.58 mg kg^{-1} in ground water irrigated soil with the mean values of 1.86 and 1.64 and 1.74 and 1.98 mg kg^{-1} respectively. However, in control it varied from 0.74 to 1.83 and 0.78 to 1.64 mg kg^{-1} with the mean values of 1.24 and 1.10 mg kg^{-1}. There was increase in copper content under both sewage and ground water irrigated plots

2. Iron (Fe)

The DTPA extractable Iron (Fe) content in surface and subsurface soils was found to the extent of 4.96 to 72.77 and 4.14 to 73.00 mg kg^{-1} in case of sewage water treated soil and 3.62 to 61.75 and 3.45 to 61.67 mg kg^{-1} in case of ground water irrigated soils with the corresponding mean values of 33.03 and 32.36 and 21.03 and 23.46 mg kg^{-1} respectively. Whereas, in control soils, in surface and subsurface layer, it varied from 2.54 to 12.50 and 2.09 to 11.57 mg kg^{-1} with the mean values of 6.40 and 6.10 mg kg^{-1} respectively. There was an increase in iron content under both sewage and ground water irrigated soils .

3. Manganese (Mn)

DTPA extractable Manganese (Mn) content in surface and subsurface soils ranged from 2.93 to 20.60 and 2.69 to 15.93 mg kg^{-1} in sewage irrigated soil 0.52 to 37.04 and 0.43 to 46.76 mg kg^{-1} in ground water irrigated soil with the mean values of 9.95 and 8.48 and 7.26 and 8.33 mg kg^{-1} respectively. Whereas, in control soils, in surface and subsurface soils Mn content varied from 2.20 to 7.71 and 2.57 to 8.93 mg kg^{-1} with the mean values of 4.14 and 4.29 mg kg^{-1} respectively. In case of manganese also, there was more accumulation under sewage and ground water irrigated soils over no irrigation.

4. Zinc (Zn)

DTPA extractable Zinc content in surface and subsurface soils ranged from 0.74 to 3.75 and 0.57 to 3.25 mg kg^{-1} in sewage water irrigated soil and 0.25-2.59 and 0.11 to 3.10 mg kg^{-1} in groundwater irrigated soil with the mean values of 1.95 and 1.74 and 1.27 and 1.20 mg kg^{-1} respectively. Whereas, in control soils, in surface and subsurface soils, it varied from 0.98 to 1.41 and 0.78 to 1.31 mg kg^{-1} with the mean values of 1.18 and 1.09 mg kg^{1} respectively.

5. Cadmium (Cd)

Among the DTPA extractable heavy metals, Cadmium (Cd) content in surface and subsurface soils varied from 0.96 to 4.12 and 0.56 to 5.22 in sewage water irrigated soils and 0.56 to 3.84 and 0.57 to 4.15 mg kg^{-1} in groundwater irrigated soil with the mean values of 2.39 and 2.60 and 2.23, 2.10 mg kg^{-1} respectively. However, in control soils, in surface and subsurface layer, it varied from 0.19 to 1.98 and 0.17 to 1.72 mg kg^{-1} with the mean values of 0.64 and 0.97 mg kg^{-1} respectively. These data also indicated build

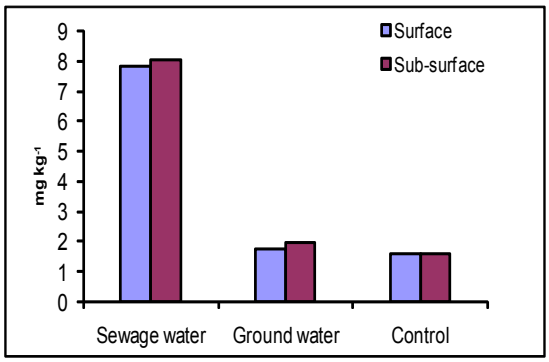

Fig.1: DTPA extractable Cu content of surface and sub-surface soils as affected by sewage, ground water irrigation and control

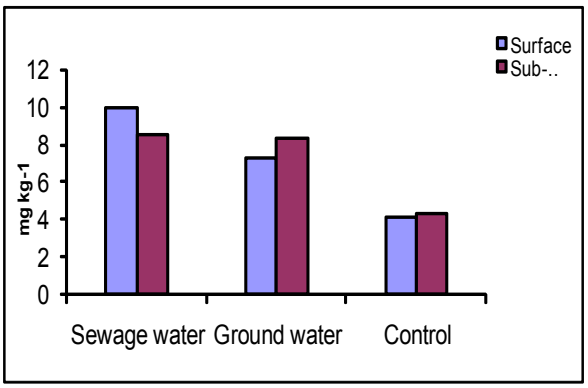

Fig.2: DTPA extractable Mn content of surface and subsurface soils as affected by sewage, groundwater irrigation and control

up of Cd in sewage and ground water irrigated soils.

6. Nickel (Ni)

DTPA extractable Nickel (Ni) content in the surface and subsurface soil layers ranged from 0.63 to 7.47 and 0.50 to 9.92 mg kg^{-1} in sewage water treated soils and 2.28 to 4.88 and 1.80 to 5.93 mg kg^{-1} in groundwater irrigated soils with the mean values of 4.03 and 4.88 and 3.98 and 3.86 mg kg^{-1} respectively. Whereas, in control soils, the corresponding surface and subsurface values varied from 0.63 to 2.77 and 0.90 to 6.77 mg kg^{-1} with the mean values of 1.59 and 2.39 mg kg^{-1} respectively.

7. Lead (Pb)

DTPA extractable lead (Pb) content in surface and subsurface layers ranged from 46.33 to 105.90 and 46.14 to 103.86 mg kg^{-1} in sewage water irrigated soils and 42.74 to 98.00 mg kg^{-1} and 42.00 to 97.00 mg kg^{-1} in ground water irrigated conditions with the mean values of 68.08 and 72.47 and 65.08 and 62.71 mg kg^{-1} respectively. Whereas, in control, the values varied from 6.42 to 24.40 in surface and in 19.26 to 37.24 mg kg^{-1} in sub-surface soils with the mean values of 14.38 and 26.96 mg kg^{-1} respectively.

From the results presented above, it was observed that among the micronutrients, the mean content of Cu in sewage and ground water treated soils in surface and subsurface soil horizons were 1.86 and 1.64 and 1.74 and 1.98 mg kg^{-1} respectively. Whereas, in control soils, these values were 1.24 and 1.10 mg kg^{-1}. Thus, the increase in Cu content in surface and subsurface soil under sewage irrigation over control was to the tune of 50% and 49%. The corresponding increases underground water irrigated soils were 40% and 80% respectively.

In surface and sub surface soils, the mean Fe contents under sewage and ground water irrigation were 33.03 and 32.36 mg kg^{-1} and 21.03 and 23.46 mg kg^{-1} respectively, whereas in control soils, these values were 6.40 and 6.10 mg kg^{-1}. This revealed that the buildup in Fe content under sewage and ground water irrigation over control was very high in both surface and sub-surface soil layers.

However, the maximum accumulation of Fe was observed in sewage treated soils. The mean manganese (Mn) contents of surface and subsurface soils under sewage and ground water irrigation were 9.95 and 8.48 mg kg^{-1} and 7.26 and 8.33 mg kg^{-1} respectively. Whereas, in control soils, the corresponding values in surface and subsurface soil horizons were 4.14 and 4.29 mg kg^{-1} respectively, thus indicating a buildup in Mn content under both sewage and ground water irrigated situations. The mean Zn contents of sewage and ground water treated soils were 1.95 and 1.74, 1.27 and 1.20 mg kg^{-1} in surface and subsurface soils respectively. Whereas, in control soils, the corresponding values were 1.18 and 1.09 mg kg^{-1} respectively. The percent increases in Zn content under sewage and ground water irrigation were 65% and 59% and 7.6% and 10% in surface and subsurface soils respectively. .

Trace elements which are also known as micronutrients viz. Fe, Mn, Cu and Zn are essentially required in plant growth. Their contents are required in small quantities. Their build up in soils is considered as desirable feature unless or until they do not reach beyond the toxic range and affect the plant growth. Addition of organics regulate the availability of micronutrients by way of chelating them and releasing them slowly in synchronization with plant growth. The higher contents of micronutrients in surface and subsurface soil layers under sewage-irrigated conditions were probably due to higher content of micronutrients in sewage water. Bhupal Raj *et al.,* (1997) reported similar trends in trace element contents in the sewage-irrigated soils of Ludhiana, Varanasi and Hyderabad respectively. Krishna *et al.,* (2004) reported that the level of the metals in soils around the

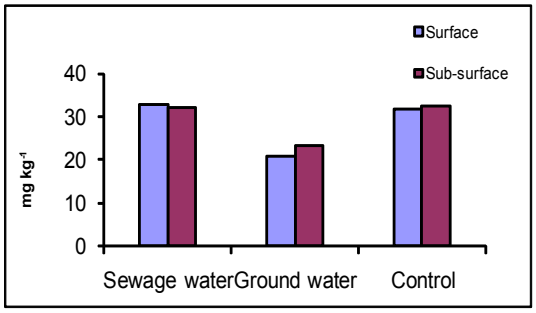

Fig. 4 DTPA extractable Fe content of surface and subsurface soils as affected by sewage, ground water irrigation and control

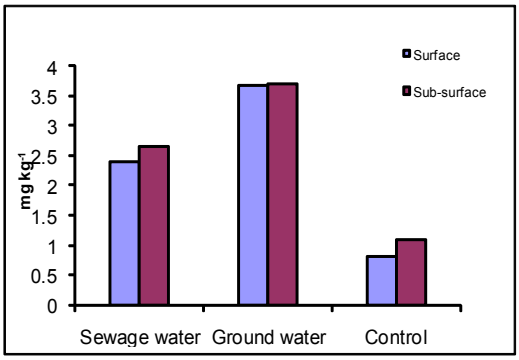

Fig.5: DTPA extractable Cd content of surface and subsurface soils as affected by sewage, ground water irrigation and control

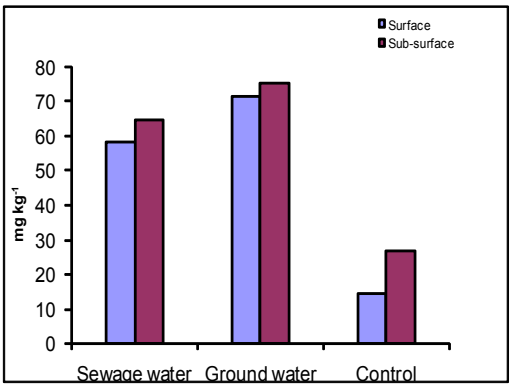

Fig. 6: DTPA extractable Pb content of surface and sub-surface soils as affected by sewage, ground water irrigation and control

industrial area of Pali, Rajasthan, India were found to be significantly higher than their normal distribution in soil. Patel *et al.*, (2004) observed that the soils continuously irrigated with effluents showed the highest Cu availability. Rattan *et al.,* (2005) concluded that the sewage irrigation for 20 years resulted into significant build up of DTPA- extractable Zn (208%), Cu (170%), Iron (170%), Ni (63%) and Pb (29%) in

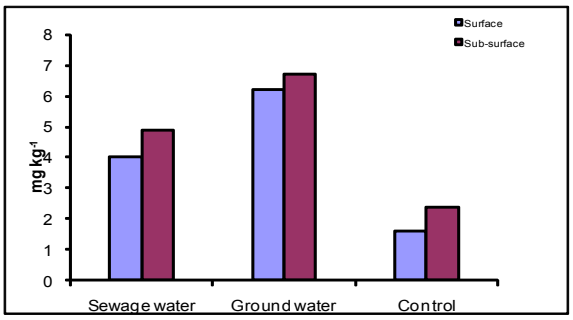

Fig.7: DTPA extractable Ni content of surface and subsurface soils as affected by sewage, ground water irrigation and control

sewage irrigated soils over adjacent tubewell water-irrigated soils. Perusal of village wise data on distribution of trace elements /micronutrients under sewage and ground water irrigated conditions and under control (unirrigated) conditions.

In the present study, the DTPA extractable heavy metals (Pb, Ni, Cd) contents were considerably higher in sewage and ground water treated soil profiles than in control soils. The mean Cd contents of sewage and ground water irrigated soils in surface and subsurface layers were 2.39 and 2.60 mg kg^{1} and 2.23 and 2.10 mg kg^{-1} respectively. Whereas, in control conditions, the corresponding values were 0.64 and 0.97 mg kg^{-1} respectively. These values of Cd in soil were found to be slightly lower than the critical levels suggested for safety by FAO (1983) (3.0 mg kg^{-1}). However, the order of contamination of soils with respect to Cd was: Sewage treated soil > ground water treated soils > control. The increase in Cd content in sewage-irrigated soils over control soils may be attributed to relatively higher content of Cd in sewage water (mean value 2.14 mg L^{-1}). In the ground water treated soils, the detection of Cd is attributed to more concentration of Cd in ground water (mean value 2.35 mg L^{-1}). This presence of Cd in the ground water is possibly due to contamination occurred on account of lateral flow and seepage from the contaminated river.

The mean nickel contents in sewage and ground water irrigated surface and subsurface soils were 4.03 and 4.88 mg kg^{-1} and 3.98 and 3.86 mg kg^{-1} respectively, whereas, in control soils, the corresponding values were 1.59 and 2.39 mg kg^{-1}. These values were quite lower than the safe critical limits of Ni suggested for soil by FAO (1983) (50 mg kg-1) and German standards (Pescod *et al.*, 1985) (50 mg kg^{-1}).

The mean Pb contents of sewage and ground water irrigated soils in surface and subsurface layers were 68.08 and 72.47 mg kg^{-1} and 65.08 and 62.71 mg kg^{-1}, whereas in control soils, these values were 14.38 and 26.96 mg kg^{-1} respectively. Some of these values were found to be higher than the safe limits suggested

for soil by FAO (1983) (50 mg kg^{-1}) and were lower than the German standards (Pescode *et al.,* (1985) (100 mg kg^{-1}). The relatively higher content of accumulation of Pb in sewage irrigated and ground water irrigated soils could be ascribed due to higher content of Pb in sewage (29.50 mg L^{-1}) and ground water (37.40 mg L^{-1}).

Earlier studies revealed that the relative availability of Pb was highest near Ahmedabad and Ankleshwar soils irrigated with sewage mixed with industrial effluent (Patel *et al.,* 2004).

Continuous application of sewage effluents to arable lands will go on increasing the concentration of these heavy metals in the feeding zone of plant roots, which may not only become toxic to plants but would also create critical problems in animals and human beings because of entry of heavy metals into the food chain. Hence, these aspects are important from the view point of safety of human beings and animals. The results of the present study are eye openers to the agriculturists, environmentalist, policy makers and inhabitants of peri-urban areas. Necessary steps are essential to safely use the sewage water after appropriate treatments.

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Effect of Phosphorus, Sulphus and Zinc on Grain Yield and Oil Content in Mustard (Brassica Juncea L)

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Abstract

A field experiment was conducted during rabi seasons at the Agronomy research farm of Raja Balwant Singh College Bichpuri (Agra) to find out the effect of Phosphorus, sulphur and Zinc on the performance of mustard crop variety 'Rohini' results revealed that the application of 40 kg S and 60 kg phosphorus per ha-^{1} significant increase in the yield and oil content. The present experiment was conducted in split plot design with three replication. Three levels of phosphorus (0.30.60 kg ha-^{1}). Three levels sulphur (0.20.40 kg ha^{-1}). Three levels of zinc (0.5.10 kg ha^{-1}) 27 treatment combinations and 81 plots were used to conduct this study.

Key words: Phosphorus, sulphur, Zinc, oil content

Introduction

Mustard is the main crop in northern India grown in rabi season. The rapeseed mustard being second important oil seed crop only after groundnut in India. Can play an important role in enhancing the total oil production in the country. In India, UP is the major state of rapeseed mustard cultivation.

Mustard production can also be increased either by putting more area under this crop or by increasing its productivity level, Area increase is not possible because of shortage of cultivated land and increasing population pressure which forced us to keep more area in food grain crops. Therefore, only alternative is to increase productivity level of mustard crop. It can only be possible by providing all necessary inputs at optimum to the crop. Out of these inputs sowing of crop at optimum time and proper nutrient management are much importance.

Sulphur is one of the sixteen nutrient elements which all plants must have for normal growth and development plants deficient in an essential nutrient have poor growth give low yield and the produce is also of inferior quality.

Sulphur is increasingly being recognized as the fourth major plant nutrient after nitrogen, phosphorus and potassium. It is important for protein production by virtue of its being a constituent of amino acid, methionine, cystine and cystein, which are the building blocks of protein sulphur is considered as a quality element, Besides, a constituent of protein it is needed in formation of vitamin B_1 and thiamine. Oil content can be termed as the most attractive quality character with respect to sulphur fertilization because it leads to the enhanced oil percentage hence more profit to formers.

Keeping above aspects experiment was conducted to study the effect of phosphorus, sulphur and zinc on the performance of mustard crop.

Methods and Materials

A field experiment was conducted at agronomy research farm of Raja Balwant Singh College Bichpuri Agra to find the effect of phosphorus, sulphur and zinc on the performance of mustard crop. An experiment was conducted during the year 2002-03 and 2003-04. In rabi seasons on that field whose soil was sandy loan. The pH value of soil 0-25 cm deep was found 8.10 Organic Carbon 0.42% and 0.44%, available nitrogen 171.20 kg ha^{-1} and 174.40 kg ha^{-1} available phosphorus 18.9 kg ha^{-1} and 19.40 kg ha^{-1} available sulphur 8.10 kg ha^{-1} and 8.30 kg ha^{-1} available potash 212.20 kg ha^{-1} and 220.70 kg ha^{-1} , available Znic (Mg ha^{-1}) 0.52 and 0.56 was during the year 2002-2003 and 2003-2004 respectively.

The experiment was conducted in split plot design with three replications. Three levels of phosphorous (0. 30. 60) Three levels of sulphur (0. 20. 40) and There levels of zinc (0.5. 10) kg ha^{-1}. Number of treatment combination is 27 total number of plot 81 were used to conduct this study. The mustard crop fertilized as per recommended dose the half dose of nitrogen and full dose of phosphorous, potash, sulphur and zinc was applied at sowing time in 4 cm depth from seed and remaining nitrogen was topdressing after first irrigation in sufficient moisture condition. The mustard seed at the rate of 5 kg ha^{-1} and now to row distance was 45 cm and depth of seed was 5 cm. The distance in row between plant to plant was mentioned 10-12 cm after 15 days of sowing.

Result and Discussion

(a) Yield Studies

(i) Phosphorus

It is evident from the data given in Table that

phosphorus application affected seed yield during both years significantly. Each increase in phosphorus level caused significant increase in seed yield ha^{-1} and thus P_2 level (60kg P_2O_5ha^{-1}) produced significantly maximum and P_0 (control) minimum seed yield ha-1 during both years. The rate of increment from P_0 was calculated to be 1.89 q ha^{-1} (13.32%) and 1.59 q ha^{-1} (9.8%) from P_1 and P_2 levels of phosphorus application on mean level basis. Kamat et al (1986) states that the seed yield was increased due to 25 and 50 kg $P_2$05 ha^{-1} respectively.

Table1: Effect of phosphorus, sulphur and zinc on grain yield and oil content (per cent)

Treatment	Seed Yield (q/ ha^{-1})			Oil content (%)		
	02-03	03-04	Mean	02-03	03-04	Mean
Phosphorus Level (kg ha^{-1}):						
P_0(0)	13.89	14.49	14.19	38.57	38.58	38.58
P_1(30)	15.79	16.37	16.08	39.43	39.57	39.50
P_2(60)	17.38	17.97	17.67	39.93	40.13	40.03
C D 5%	1.373	1.410	-	0.373	0.270	-
Sulphur Levels (kg ha^{-1}):						
S_0(0)	13.93	14.53	14.23	37.05	37.02	37.04
S_1(20)	15.77	16.38	16.07	38.34	38.49	38.42
S_2(40)	17.37	17.96	17.66	40.22	40.39	40.30
C D 5%	1.366	1.400	-	0.373	0.273	-
Level of zinc (kg ha^{-1}):						
Zn_0(0)	15.38	15.95	15.66	39.57	39.64	39.60
Zn_1(5)	15.69	16.27	15.98	39.45	39.60	39.53
Zn_2(10)	15.99	16.58	16.28	39.02	39.03	39.03
C D 5%	NS	NS	-	NS	NS	-

(ii) Sulphur

The data given in the Table indicates that sulphur application had significant effect on seed yield q ha^{-1} and the trend remained almost similar in both the years of experimentation. The seed yield increased significantly with every increase in the dose of sulphur application up to the dose of (S_2). On mean basis of two years, 40kg S ha^{-1} (S_2) produced 3.43 q ha^{-1} (24.10%) and 1.59 qha^{-1} (9.89%) higher seed yield that S_0 (control) and S_1 (20kg ha^{-1}) respectively. There results may be supported by Bishwas and Teotia (1991) that sulphur application resulted in superior quality, higher yields. Tandon (1986) reported that suphur application increase in seed yields. Sulphur 20 and 40 kg ha^{-1} improve the seed yield significantly indication the increase over the control singh et al (2002) singh and Prakash (2000) reported that Sulphur application increase in seed yield.

(iii) Zinc

Effect of zinc application was not found to be significant on seed yield qha^{-1} during any of the experimental year. However, Zn_2 dose showed higher yield closely followed by Zn_1 and control (Zn0) respectively. The margin of difference between the yield of three levels of zinc application remained very nominal. There results may be supported by Dutta and Bairs (1960) who did not find significant effect of zinc application on seed yield of mustard.

(b) Oil Content in grain of mustard

(i) Phosphorus

It is clear from Table that increase in phosphorous application increased seed oil content significantly which was maximum at highest (P_2) 60kg P_2O_5 ha^{-1} level of phosphorus application in both years. On an average, P1 over P0 and P2 over P_1 had increased seed oil content by 0.92 and 0.53 units. Kamat et al (1986) states that the oil persent in seed was increased due to 25 and 50 kg p_2 O_5 ha^{-1} respectively.

(ii) Sulphur

The increasing levels of sulphur had significantly positive linear increase in seed oil content. Thus, increase in seed oil content was almost at similar rate with increase in each dose of sulphur . On mean basis over years, S_1 and S_2 of sulphur showed 1.38 and 1.89 unit increase in seed oil content over their lower levels, respectively . Tandon (1986) reported that sulphur application increase in oil per cent in seed. The performance of Indian mustard in relation to sulphur 0.20.40 and 60kg ha^{-1} at the rate of 20 kg and 40 kg ha^{-1} improve the oil per cent in seed significantly indication the increase over the control singh et al (2002).

(iii) Zinc

Application of zinc had not significant effect on seed oil content , however seed oil reduced numerically by a very narrow margin with increasing levels of zinc. The results remained identical during both years of experimentation.

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Prevalence of Indigenous Technical Practices for Treatment and Prevention of Reproductive Disorders of Dairy Animals among Livestock Farmers of Mathura District

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Abstract

*India has a very rich heritage of local indigenous knowledge – knowledge that is unique of a given culture or society. Indigenous knowledge is acquired by various local healers of rural areas by performing a series of informal experiments and such knowledge were percolated from one generation to another. Such indigenous knowledge was not well documented and ends with the death of the local healers. This paper reveals several indigenous practices commonly used by livestock owners for treatment of various livestock ailments, viz., anoeatrus, repeat breeding, prolapse of uterus, retention of placenta and induce heat in their animals in Mathura district of Uttar Pradesh. Six villages of Mathura district were surveyed to identify the indigenous techniques prevalent to treat and prevent various reproductive disorders in dairy animals. Livestock owners reported that feeding of eggs, common salt, mahua (*Madhuca indica*) or papaya (*Carica papaya*) can treat anoestrous, whereas feeding of mahua, burnt leaves of ber (Zyzyphus mauritiana) or primordial of banyan tree (Ficus benghalensis) can treat retention of placenta. Feeding of onion, water chestnut flour or cactus stem were used to prevent uterine prolapse. Reduced feeding, feeding of barley flour, mustard oil, ghee, sugar, mehandi powder and sugarcane juice has been adopted by certain respondents to treat repeat breeders.*

Key words: Knowledge, livestock, mustard oil, respondents

Introduction

India has very rich heritage of traditional health control and treatment system which has been used for animals since generations. Many of these practices are not properly documented, thereby hindering their scientific understanding and application (Reijntjes *et al.,* 1993). Reproductive health is one of the important aspects of dairy animal husbandry and poses a major challenge to livestock owners, veterinarians and scientists alike. Since ancient times, livestock owners are using various indigenous techniques to treat or prevent reproductive disorders in dairy animals (Khandelwal, 1995). Indigenous knowledge is acquired by performing a series of informal experiments and such accumulated experiences were percolated from one generation to another. In rural context such knowledge is considered to be the holistic approach for livestock management methodologies adopted by non-literate cultures. The bearers of indigenous knowledge may be farmer, rural artistan, landless labourer, rural women, animal husbandry practitioner, etc, who earn their livelihood through their capacity of having systematic knowledge as well as knowing the mechanism of how indigenous practices work for various ailments of animal husbandry (Mc Corkle, 1986).

Today many indigenous practices are at risk of becoming extinct due to introduction of modern scientific medicines, which provides short-term gains but long-term adverse effects on health and production of livestock leading to the initiation of several projects to document such indigenous knowledge and practices adopted widely in rural India in order to accelerate research, planning and development (Yadav, 1998 and Vivekanandan, 1993). Several non-government organizations, viz., BAIF, Pune; Jagaran Vikas Kendra, Udaipur; ANTHRA, Pune; SALIHOTRA, M.P.; Appropriate Technology of India, Ahemdabad; Women's organization for rural development (WORD), Ahemdabad and Grass Roots Innovation Augmentation Network (GIAN), Gujrat are also involved in documentation as well as validation of indigenous knowledge system (Dwivedi, 1998).

This research study presents the documentation of various indigenous practices and techniques commonly practiced among livestock owners of Mathura district of Uttar Pradesh for various

livestock ailments, viz., anoeatrus, repeat breeding, prolapse of uterus, retention of placenta and induce heat in their animals.

Methodology

This study was conducted purposively in the six villages namely, Goverdhan, Raya, Sureer, Ading, Maat and Gokul in Mathura district of Uttar Pradesh. Mathura district is inhabited by about nearly 1.27 percent of the state's population is a semiarid and resource poor region, where rainfed extensive agriculture is commonly practiced. Thirty respondents from each village were purposively selected by using nomination method and RRA technique depending upon the concentration of livestock species as well as known to use indigenous knowledge for various reproductive disorders among animals. Hence in total 180 respondents were identified, which were interviewed and documentation of indigenous knowledge was performed. These respondents may be either the livestock owners of the villages, village officials, agriculture officials, diversified agriculture support project (world bank aided project) officials, bank officials, animal husbandry staff, etc. The indigenous practices were notified in the form of dose amount, dose period, dose rate, alteration in the ingredients used.

Results and Discussion

This study presents several indigenous practices used by livestock owners for various livestock ailments, viz., anoeatrus, repeat breeding, prolapse of uterus, retention of placenta and induce heat. The documented indigenous practices for various livestock ailments are summarized as hereunder –

Indigenous techniques for treatment of Anoestrous

It was a common belief among respondents that if the cow is not coming to heat, despite being otherwise normal, then something which can produce heat inside the body can help in bringing animal to heat. Substances credited to this effect by the respondents were eggs, common salt, mahua (*Madhuca indica*), papaya (*Carica papaya*) and wheat. Many respondents communicate that feeding of 5-6 eggs' shell mixed with concentrate brings the cow into heat. A respondent communicate that feeding of about 100 g of common salt/day for a week brings the animal into heat. Another respondent, however, reported that amount of salt should be about a handful and has to feed along with 500 g of wheat and 250 g of mahua green. Another farmer communicated that feeding papaya fruit, about 2 kg/day to the affected animal for a week bring the animal to heat.

Indigenous techniques for treatment of Retention of Placenta (ROP)

Feeding of Mahua flowers and its supplementation by cooked or uncooked rice in the 1:6 ratio. Feeding of 1 kg paddy straw smeared with groundnut oil 4-5 hrs after calving was also claimed to be effective in bringing about normal expulsion of placenta. Respondents reported that feeding ash of burnt leaves of ber (*Zyzyphus mauritiana*) or growing primordial of banyan tree (*Ficus bengalensis*) helps in treating severe cases of ROP. Some respondents communicated that 50 g of turmeric, 200-250 g raw rice and equal amount of jaggery, mixed and fed once to the animal can be used as a mild treatment for ROP. Similar indigenous technique for ROP treatment has been reported earlier by Balasundram (1998). Another respondent reported that if 500 gms of ajawain, 100 gms of bamboo sticks and 500 gms of gur are boiled in 2.0 liters of water, till the extract remains one-fourth of the original. The prepared extract is further mixed in 2 liters of water and provided to the animal @50ml for 2-3 days.

Several livestock owners reported that if 100 gms of arjuna bark, 500 gms of jaggery and 100 gms of kneep are boiled in 1 liters of water and its extract may be provided to the animal. However several respondents found feeding the paste of 100 gms each of Fig fruits, ajawain, chick pea, castor oil and 1 kg of gur to the animal is also highly effective. Few respondents also reported that application of a paste of 100 gms each of Mango leaves, fig fruits, jaiphal leaves, kaiphal leaves and sesame leaves on the vagina of the animal. Feeding a paste prepared from sowa, Ber, maize cobs, bamboo, gokhru and pearl millet is fed @50 gm BID for 5-7 days atleast fifteen days before parturition.

Indigenous techniques for treatment of Uterine Prolapse

Uterine prolapse is treated by the farmers of this region by applying ice or sugar on the prolapsed mass and then inserting it back. Respondents communicate that recurrence can be prevented by supplementing 0.5-1.0 kg barley or singhara (water chestnut) flour to the concentrate mixture. Few respondents feed about 10 kg onion to non-carrying animals as a preventive method for uterine prolapse. Similar practice has been reported earlier by Rathod (1999). Two respondents reported that crushed stem of cactus mixed with buttermilk given orally prevents recurrence of prolapse of uterus/vagina. Many respondents communicate that various items e.g., ghee, haldi, opium, mentha, mustard oil, soap individually or as a mixture can be used as lubricant/disinfectant before replacing the prolapsed uterus.

Several farmers provide mustard oil and castor oil in ratio of 1:1 in order to prevent prolapse of uterus, while other livestock owners feed 250 gms each of lajwanti herb and gur to the animal at the time of

parturition. However few livestock owners feed 250 gms each of methi, opium/aphim and gur making a paste in mustard oil, which is then applied on the protruded part of the animal. Several livestock owners feed 500 gms of water soaked barley flour in the morning to the animal.

Indigenous techniques for treatment of Repeat Breeding

Indigenous techniques reported by the respondents for treatment of repeat breeder females were primarily oriented towards application of some kind of stress to the animal and are not very different from those reported previously by Meena and Malik (2002) and Dohare (1996). These include step-wise reduction in feed to even abruptly reduced feeding to half of the normal intake. Certain respondents communicated that feeding of barley flour, mustard oil, ghee, sugar, mehandi powder and sugarcane juice have efficacy in causing conception in repeat breeders. These edibles are thought to be effective as they are considered to produce cooling effect inside the body.

Indigenous techniques for treatment of Induce Heat

Few livestock owners feed paste of nearly 400 gms of germinated oat to the large animals cattle and buffalo for 5-7 days and nearly one-tenth quantity in case of small animals, i.e., sheep and goat. It was also reported by several livestock owners that a paste prepared from grinding 100 gms of garlic, 50 gms of harad, 100 gms mustard cake and 10 gms of badam also induce heat in the small as well as large animals. Some respondents treat induce heat by feeding a paste of 100 gms of fresh mustard leaves, 50 gms garlic, 50 gms onion and 100 gms of badam to the small and large animals.

Conclusion

Indigenous techniques to treat/prevent reproductive disorders of farm animals is still an unexplored area. These techniques offer unique advantage as they can be applied using things normally available in village households, require little technical expertise, but highly cost effective. Inspite of a wide network of modern scientific medicines the livestock owners of the Mathura District region are still using local indigenous preparations for treating the reproductive disorders of their animals in emergency situations. Such study reveals that Mathura district of Uttar Pradesh is very rich in indigenous knowledge and traditional healing practice, which is the basic heritage of our society and shall not be made extinct. Hence it is necessary that similar studies shall be undertaken covering the whole state of Uttar Pradesh and several other parts of the country to prepare a detailed documentary of this authentic indigenous knowledge base. Experimental trials with systematic research and scientific validation must be conducted on such documented indigenous practices in order to identify the cost-effectiveness, accessibility, compatibility and their sustainability among livestock owners in comparison to modern scientific technologies.

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Factors affecting sustainability in agriculture as perceived by the small farmers

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Abstract

Present day living demands quality of life which can only be maintained by keeping intact of the ecology. To preserve and maintain the ecology, not only the technology but the minds of the people particularly small farmers perceiving sustainability is more important. A study has been undertaken with 80 small farmers from eight villages of Pipli block in Puri district of Orissa during 2008 It is observed that good soil condition, fertility status, use of chemicals, enterprise diversification, cost effective technology, common use of resources, energy use in farm operation, regular flow of information, credit and finance, easy marketing, cost effective technology with consumer preference and its accommodation in govt. policy system as well as humanness were the important considerations of the small farmers for their sustainability in Agriculture. At the same time, the small farmers not considering much towards ecological soundness and economic viability as the factors of sustainability in Agriculture.

Key words: Small farmers, Sustainability, Agriculture

Introduction

With increasing advancement in science and Technology, we have manipulated our environment without paying adequate attention to consequences. Now all the countries of the world are trying to actualize the meaning and concept of sustainability. It is more so in case of agriculture as it is the core base of life supporting system. Orissa comprises 4.47% of Indian land mass accounting 3.58% of the population. About 85% population living in rural areas depending upon Agriculture for livelihood. Out of 39.66 lakh operational land holdings, the small and marginal farmers are 52.79% with 55.52% of the operational holdings. The present day, livings demands quality of life which can only be maintained to keep intact of the surroundings. To preserve and maintain the ecology, not only the technology but also the mind of the people perceiving sustainability is more important. Since small and marginal farmers constitute the major population in India, a study has been designed to assess the perception of small farmers towards their sustainability in Agriculture.

Methodology

The study was undertaken in Pipli block of Puri districts in Orissa during 2008. A sample size of 80 small farmers covering eight villages was randomly selected as the respondents. Ecological soundness, economic viability, social accessibility, humanness and adaptability of technology were selected as the variables of the study. Information were collected personally through a semi-structured schedule pretested earlier. Responses received on three point continum i.e. strongly agree, agree and disagree were analysed by putting weightage 3, 2 & 1 respectively.

Results and Discussion

Conservation and maintenance of ecosystem is the important aspects of sustainability due to degradation of natural resources directly or indirectly. Mixed responses were obtained from the respondents about different ecological condition for sustainability in Agriculture as revealed in Table 1. However, good soil condition, fertility status and use of chemicals were the favoured conditions of the small farmers towards their sustainability in agriculture. Since, the small farmers have less farm land; they did not agreed for the use of organic fertilizer and crop rotation which are the major recommendations for maintaining ecological soundness, rather preferred for use of chemicals with good soil condition having better fertility status for getting more production.

Optimum utilization of available resources increased the production, productivity and farm income particularly for the resource poor farmers. The natural resources must be properly used without which development cannot be sustained. There is the tendency to manipulate and use natural resources for immediate benefit without thinking future. The perception of the small farmers towards economic viability (Table 2) revealed that neither the respondents.

Respondents agreed or disagreed over the suggested factors as mentioned in the table. But,

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Table 1: Perception on ecological soundness towards sustainability

S.No.	Factor	Strongly Agree	Agree	Disagree	Mean score	Rank
1	Soil condition	35(43.75)	1518.75	30(37-50)	2.06	II
2	Residual moisture	-	42.0(52.50)	38(47.50)	1.53	IV
3	Fertility status	20(25.0)	45(56.25)	15(18.75)	2.06	II
4	Crop rotation	16(20.0)	34(42.50)	30(37.50)	1.83	III
5	Organic fertilizer	-	22(27.50)	58(72.50)	1.28	V
6	Use of chemicals	38(47.50)	22.0(27.50)	20(25.00)	2.23	I

(Figures in parenthesis indicate percentage)

Table 2: Perception on economic viability towards sustainability

S.No.	Factor	Strongly Agree	Agree	Disagree	Mean score	Rank
1	Stability in production	13(16.25)	28(35.00)	39(48.75)	1.68	VI
2	Conservation of natural resources	27(33.75)	15(18.75)	38(47.50)	1.86	IV
3	Profitability	12(15.0)	31(38.75	37(46.25)	1.69	V
4	Enterprise diversification	48(60.00)	25(31.25)	7(8.75)	2.51	I
5	Cost effective technology	30(37.50)	25(31.25)	25(31.25)	2.06	II
6	More income	18(22.50)	35(43.75)	27(33.75)	1.89	III

(Figures in parenthesis indicate percentage)

Table 3: Perception on social accessibility towards sustainability

S.No.	Factor	Strongly Agree	Agree	Disagree	Mean score	Rank
1	Use of village resources	33(41.25)	24(30.00)	23(28.75	2.13	IV
2	Use of energy in farm operation	37(46.25)	28(35.00)	15(18.75)	2.28	I
3	Source of technological information	42(52.50)	17(21.25)	21(26.25)	2.26	II
4	Credit and finance	29(36.25)	30(37.50)	21(26.25)	2.10	V
5	Marketing of the farm produce	35(43.75)	25(31.25)	20(25.00)	2.19	III
6	Participatory decision making in use of common resources	27(33.75)	34(42.50)	19(23.75)	2.10	V

(Figures in parenthesis indicate percentage)

Table 4: Perception towards humanness in sustainability

S.No.	Factor	Strongly Agree	Agree	Disagree	Mean score	Rank
1	Respect for honesty and value system	28(35.0)	31(38.75)	21(26.25)	2.09	III
2	Cordial relationships among communities	37(46.25)	23(28.75)	20(25.00)	2.21	I
3	Respect for honourabale living	29(36.25)	35(43.75)	16(20.0)	2.16	II
4	Climate of trust worthiness	23(28.75)	37(46.25)	20(25.0)	2.04	V
5	Opportunity for compassion	23(28.75)	28(35.0)	29(36.25)	1.93	VI
6	Social solidarity	24(30.0)	36(45.0)	20(25.0)	2.05	IV

(Figures in parenthesis indicate percentage)

enterprise diversification and cost effective technologies were the preferred perceptions. Since small farmers have less farm area, they required various feasible enterprises for their livelihood. Similarly, they require cost effective technologies as they can not invest more for commercial cultivation. Hence, the small farmers perceived these two important economic factors for their sustenance in Agriculture.

Each individual wants easy accessibility to common resources. This is more required for resource poor farmers due to scarce resources. Attempt made to assess their perception on social accessibility for their sustainability in agriculture revealed that (Table 3) the respondents had given more emphasis on the

Table 5: Perception towards factors of adaptability

S.No.	Factor	Strongly Agree	Agree	Disagree	Mean score	Rank
1	Trend towards progressiveness	31(38.75)	29(36.25)	20(25.0)	2.14	III
2	Accommodation of policy and technological change	33(41.25)	27(33.75)	20(25.0)	2.16	II
3	Widened market demand	38(47.5)	23(28.75)	19(23.75)	2.24	I
4	Consumer preference	27(33.75)	35(43.75)	28(22.50)	2.11	IV
5	Conflict resolution	23(28.75)	25(31.25)	32(40.0)	1.89	V
6	Disaster management	22(27.50)	18(22.50)	40(50.0)	1.78	VI

(Figures in parenthesis indicate parentage)

use of energy in farm operation, regular contact with the experts for technological information on farm activities, easy marketing of the produce with remunerative price, use of common resources with participatory decision making and credit/finance in order of importance. Small farm holders have to produce more for their sustainability. These are the essential factors for which the small farmers perceived better accessibility to these social factors for their sustainability in Agriculture.

Table 6: Comparative analysis of the factor of sustainability

S. No.	Factor	Mean score	Rank
1	Ecological found ness	1.83	V
2	Economic viability	1.95	IV
3	Social accessibility	2.18	I
4	Humanness	2.08	II
5	Adaptability	2.05	III

The development ultimately aims at humanness in the society. With change of time, the concept of development centers around humanness consisting of honesty, value system, cordial relationship, respect for honourable living, trustworthiness etc. The perception of the small farmers towards humanness was also studied. It is observed from the Table 4 that majority of the respondents favoured all the criteria of humanness for their sustainability in Agriculture. The small farmers definitely desires for honesty, cordial relationship, honourable living, trustworthiness and social solidarity for their sustainability in Agriculture and the study also revealed that technologies are to be adopted with refinement to arrest degradation of natural resources. Emphasis has been laid both in research and extension system to achieve sustainability in Agriculture as it is the major component of the life supporting system. It is observed from the Table 5 that the trend towards progressiveness emphasis for accommodation of Govt. policy and technological change, making market demand widened and consumer preference technologies were the suggested factors of adaptability towards sustainability in Agriculture. These are the usual criteria for stability and sustainability for any technologies particularly in small farm production system and the respondents also adhered to. Comparative analysis of the factors of sustainability revealed that that (Table 6) the respondents laid more emphasis on the respondents laid more emphasis on social accessibility followed by humanness and adaptability in comparison to economic viability for sustainability in small farm production system. The small farmers are always in need of utilization of village resources, regular flow of information, participatory decision making for the use of common resources, availability of credit and finance, cordial relationship trustworthiness, social solidarity, honesty, honourable living, trend towards progressiveness, market demand, consumer preference technology and accommodation of the suggested technologies in Govt. policy so that they can produce sufficiently for generating income and sustained with Agriculture. Due to small holdings, they are not giving much importance towards ecological soundness and economic viability as the factors of sustainability in Agriculture.

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Impact of Crop Residue Management on nutrient balance in rice-wheat cropping system in an Aquic hapludoll

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Abstract

An experiment conducted on rice-wheat cropping system under the Mollisol order of Pantnagar to study the effect of crop residue management practices on nutrient balance during 2005-2006. Three crop residue management practices; crop residue incorporation, crop residue remove and crop residue burnt and two levels of nitrogen (100 kg/ha, 150 kg/ha) and three levels of potassium (0 kg/ha, 30 kg/ha, 60 kg/ha) was applied. The results revealed that NPK uptake were highest in crop residue incorporation as compare to crop residue remove and burnt. Nitrogen balance was negative in all the treatments, and potassium balance also fallows same as nitrogen except potassium application with crop residue incorporation. Rice–wheat yield and nutrient uptake were significantly higher in case of crop residue incorporation with nitrogen and potassium application.

Key words: Crop Residue Management, Rice-Wheat Cropping System, Nutrient balance

Introduction

Rice-wheat system is the widely practiced cropping system in India and cover about 9.5% m ha, about 90% of this is under Indo-Gangatic plain (Gupta *et al.* 2004) . Rice wheat cropping system is a highly nutrient feeder crop it depletion soil nutrients is increasingly regarded as a major constraint to sustainable food production in Indo-Gangatic plain. The quantification of changes in soil nutrient stocks is crucial to identify problem areas and better nutrient balance among the fertility component. Comprehensive nutrient balance is crucial to achieve sustainable high productivity and better soil health under intensive cropping system. Crop residue management practices are the most important approach among the nutrient balance approaches. Both rice and wheat are exhaustive feeders and the double cropping system is heavily depleting the soil of its nutrient content. A rice wheat sequence that yield 7 tons/ha of rice and 4 tons/ha wheat removes more then 300 kg N, 30 kg P and 300 kg K/ha from the soil (Singh, 2003). Singh (2003) reviewed that the crop residue are a good source of plant nutrients and are imported components for the stability of the agricultural ecosystem. About 25% of N and P, 50% S and 75% of K uptake by cereal crops are retained in crop residue, making them viable nutrient sources.

Materials and method

The field experiment was conducted during *kharif-rabi* season of the year 2005-06 at the Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar, India. The soil have 1.15% organic matter content, 7.63 pH (1:2.5 soil water suspension) , 227, 32, 230 kg/ha available N, P (Bray's P), K respectively. The experiment was laid out in Split Plot Design (SPD) with three crop residue management practice i.e crop residue incorporation, residue burning and residue removal. And two levels of nitrogen i.e 100 kg/ha, 150 kg/ha and three levels of potassium K_0, K_{30}, K_{60} as 0 kg/ha, 30 kg/ha, 60 kg/ha so that fertilizer combination with crop residue made 18 treatments in a random manner. Rice variety Pant Dhan-4 and in wheat crop variety PBW -343 was practiced. Soil and plant samples analyzed according to standard procedure of analysis.

Nutrient Balance

Annual apparent N, P and K balances were estimated for total crop residue management practices using different inputs and outputs measured during the present experiment. Average crop yields were considered for apparent balance estimations. N, P and K balances were calculated as:

N balance = $\sum$(fertilizer N + manure N + rain N + biologically fixed N + irrigation-water N + N in seedling and seeds)- $\sum$ (N uptake + losses of N) [1]

P balance = $\sum$ (fertilizer P + manure P + rain P + irrigation-water P + P in seedling and seeds)- P uptake [2]

K balance = $\sum$ (fertilizer K + manure K + rain K + irrigation-water K + K in seedling and seeds)- $\sum$ (K uptake + losses of K) [3]

Among inputs, N, P, and K contents in mineral fertilizers, crop residue and irrigation water were measured in the present study. The N, P, and K

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contribution of 3.4, 0.2 and 5 kg ha^{-1} yr^{-1} with rainfall were based on the data of Brown *et al.* (1999). Nitrogen input from biological N_2 fixation was considered at the rate of 10 kg ha^{-1} during rice and 5 kg ha^{-1} during wheat (Brown *et al.,* 1999). The quantities of N, P and K added to the soil with rice seedling and wheat seed were obtained by considering N, P and K contents as 41.0, 4.0 and 30.0 g kg^{-1} seedling (dry weight) and 20.0, 3.6 and 4.0 g kg^{-1} in seed respectively.

Total loss (volatilization, denitrification, and leaching) of fertilizer N was taken to be 600 g kg^{-1} for rice (Brown *et al.*, 1999). Losses of soil N and manure N were estimated based on data reported by Kundu and Ladha (1997). It was assumed that there would be no loss of P and K through leaching or otherwise from the soil system.

Table 1: Annual N, P and K balance in rice-wheat cropping system

Treatment	N Balance (kg ha^{-1})	P Balance (kg ha^{-1})	K Balance (kg ha^{-1})
$R_1N_1K_0$	-60.9	17.6	-214.1
$R_1N_1K_1$	-75.9	15.9	-175.8
$R_1N_1K_2$	-80.3	14.6	-136.8
$R_1N_2K_0$	-75.6	8.7	-226.5
$R_1N_2K_1$	-84.5	8.1	-205.8
$R_1N_2K_2$	-99.9	8.2	-172.0
$R_2N_1K_0$	-76.5	15.6	-203.5
$R_2N_1K_1$	-86.7	11.6	-170.9
$R_2N_1K_2$	-103.5	10.7	-138.9
$R_2N_2K_0$	-88.1	10.5	-233.5
$R_2N_2K_1$	-108.7	10.2	-205.8
$R_2N_2K_2$	-102.8	5.0	-171.2
$R_3N_1K_0$	-21.3	31.2	-31.2
$R_3N_1K_1$	-32.6	27.5	10.9
$R_3N_1K_2$	-38.0	29.0	58.0
$R_3N_2K_0$	-4.1	29.8	-34.9
$R_3N_2K_1$	-9.4	27.9	7.1
$R_3N_2K_2$	-13.7	26.4	55.4

Results and discussion

Nutrient (NPK) uptake by rice as well as wheat was estimated by crop yield and nutrient content in plants. The balance of nitrogen in soil was negative (Table 1). The net loss of 60.9 kg N ha^{-1} yr^{-1} was estimated for the control treatment. Annual balance of N in rice-wheat was lowest where residue incorporation technique was adopted followed by removal and burning. Lower balance was observed with higher doses of N, along with residue incorporation treatment. Pathak *et al* .(2006) predicted a negative newt N balance varying from -19 to -71 kg N ha^{-1} for the rice- wheat cropping system in Indo-Gangetic Plains of India. The present study could show that the negative N balance in rice-wheat cropping system can be changed into a positive balance by mixed incorporation of Sesbania and wheat residues. Thus, a mixer of N-rich and N-poor crop residues can provide a balanced N supply required for high yield and agronomic N efficiency (Sharma and Prasad, 2008).

Phosphorus balance was positive in all the treatments. However, the residue incorporation treatments recorded highest P balance (Table 1). Data regarding P balance postulates that current fertilizer recommendation for P seems to be satisfactory as it shows a gradual build up of P in soil over year.

In all the residue incorporation treatments positive K balance was observed except two treatments where K was not applied. The K balance in residue removal and burning plots was negative because K applied was only 30 and 60 kg K ha^{-1} whereas crop removal was greater (243 kg K ha^{-1}) and (254 kg K ha^{-1}) leaving a negative balance of -175.8 and -136.8 kg K ha^{-1}, respectively (Table 1).

Annual nutrient balance in respect to N in rice-wheat system in this study was negative in all treatments, through the negative values for crop residue incorporation treatments were very low (-4.1 to -32.6 kg/ha/yr). P balance was positive in all treatments due to uniform P application all plots. K balance was negative in all plots except two in which crop residue was incorporated with application of K @ 30 and 60 kg K_2O/ha. This highlights the importance of crop residue incorporation and K application in rice-wheat system for maintaining the nutrient balance which is so crucial for sustainable agriculture.

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