REFINEMENT OF NUTRIENT MANAGEMENT IN LENTIL UNDER LIMITED FARMERS' RESOURCES THROUGH FARMERS' PARTICIPATORY APPROACH

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In view of the limited applicability of extension approach through "Package Transfer" to meet the emerging challenges confronting Indian Agriculture, which includes improvement in productivity, profitability and sustainability, two important paradigms have been controlling. First, the technological have to be assessed and rainfed before the transfer and second, a programme approach involving various technological components relevant to the farmers in varying agro-ecological conditions will be required for a perceptible change. Rainfed agricultural development is resource capability and management centered. It is therefore being increasingly recognized that alignment of research objectives with local agricultural land resource management practices through participatory approach is the sound format for generating location specific technologies. Till now, technologies generated at the research station were thrust upon the farmers in the technology transfe programmes without understanding their existing situation. It is therefore, required a complete reversal of Transfer of Technology (TOT) approach where farmers are fully involved at all the stages of technology development process. Utter Pradesh contribute significant area (651730 ha) and production (408052 metric ton.) of lentil crop. In Uttar Pradesh, Hamirpur district has tremendous potential in pulses production. This is predominantly a pulse-growing district. In Hamirpur, lentil is grown in about 58208 ha area during rabi season. Out of this, only 270 ha area comes under irrigated situation. Total production of lentil is 21537 metric ton (2000-2001) and productivity is 8.7 q/ha which is higher than the state average (6.26 q/ha). Both the area and production has been reduced in the district due to severe incidence of wilt, attack of insect-pest at flowering stage increasing the facility of irrigation in the dominant lentil growing areas.

Still lentil is known as low input crop among farming communities, hence it find an important place in the farming system which is generally grown at residual moisture after kharif fallow either in submerged/low input area or after kharif crop in rainfed situation at marginal field. It is fast growing and blooms approximately 60 days after crop emergence. It matures at about 125 - 130 days after sowing or earlier.

Technology Assessment and Refinement Pulse Based Rainfed Agro-Ecosystem through Institution Village Linkage Programme under production system research mode funded through NATP is being implemented in Vidokhar village of Hamirpur district by IIPR, Kanpur. Since August 2000. It is a holistic approach based project in which maximum emphasis being in field crops followed in order by livestock vegetable and fruit crop etc. Most of the farm families in the village depend upon farming and about 70% farmers grow lentil in rabi season. Clay (Mar) and clay loam

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(Kabar) type of soils are suitable of lentil cultivation in the village. During time line analysis most of the farmers opined that lentil was the most important crop of this village during 1990s. But the area under lentil was gone down drastically during the last 10 year due to reduction of productivity and inclusion of area under wheat crop due to the increase of irrigation potential in the village. At the start of investigation area under lentil was only 117 ha. The farmers rated this crop first in the profitability point of view. Farmers did not apply any plant nutrient to the lentil crop. Hence present investigation is to find out plant nutrient doses in lentil crop under pulse based production system and to assess the impact on adoption of plant nutrient application among farmers' communities.

METHODOLOGY

The present study was conducted at Vidokhar village of Hamirpur district in Uttar Pradesh as a part of NATP funded project on Technology Assessment and Refinement through Institution Village Linkage Programme. Before laying out the trial in rabi 2001-2002, Agro-Ecosystem Analysis through PRA was done in the month of January 2000 at Vidokhar village of Hamirpur district with active and full participation of farming communities residing in the village, which accounts 1000 farm families. During problem-cause analysis, the residents of the village have identified the different micro-farming situation of the village and the major problems in crop production. Farmers have identified and prioritized low yield of lentil as one of the most serious problem. The farmers identified poor nutrient management as the most important cause for low yield of lentil. Lentil is predominantly grown in heavy clay and clay soil with residual moisture in submerged/ low-lying areas, which remain fallow in kharif season. It is mostly grown as low input crop. The lentil fields prior to sowing in kharif are submerged with rainfall water. When rainfall logged water are drained, then crop in the month of Oct is sown. Before sowing of lentil, thirty (30) soils samples of dominating lentil area were taken and soils analysis was done in laboratory of the Indian Institute of Pulses Research, Kanpur (UP). The soils have neutral in soil reaction, Low in nitrogen, medium in available phosphorus and sulphur and high in potassium. All tools and techniques used for collecting above-mentioned information could conveniently be grouped into three categories viz. visualized analysis, interviewing and sampling methods and group and dynamics methods.

Table 1. Details of technological intervention

Particular	Description
Title	Refinement of nutrient dose in lentil
Problem	Poor Yield of lentil due to no application of fertilizer
Thematic Area	Integrated plant nutrient management
Nature of intervention	OFT (On Farm Trial)
No of trials Year 2001-2002	18
2002-2003	15
Micro-Farming Situation	Clay and clay loam soil in Kharif fallow rainfed condition
Crop Rotation	Kharif fallow-lentil/ chickpea

Layout of On Farm Trial :

During the Rabi 2001-02 and 2002-2003 years, 18 and 15 On Farm Trials were laid out in the Vidokhar village of Hamirpur district (UP). The farmers were not using any plant nutrients in lentil, while recommended dose of plant nutrient for Bundelkhand region was 15 Kg N, 40 Kg P2O5 and 20 Kg S/ha. Soils test values as also indicating the needs of supplying the recommended doses of plant nutrients. For the assessment of plant nutrient in the lentil crop, sub-optimal dose of fertilizer were taken into consideration. Henceforth along the farmer's practices and recommended plant

nutrients, third treatments was taken as 50 per cent of recommended Nitrogen, Phosphorus and Sulphur. Although, in the third treatment there was inclusion of rhizobium inoculation because of very low nitrogen content in the soils and might be low abandoned rhizobium strain due to continuous cultivation of lentil crop in the village area. The treatments are summarized below:

T_1–Farmers' practice (No application of any plant nutrient)

T_2–Recommended dose of plant nutrient (15 Kg N/ha + 20 Kg S/ha)

T_3–50 % of T2 + Inoculation with rhizobium culture.

Total 18 and 15 farmers were chosen randomly for the study in the year 2000-2001 and 2001-2002, respectively. More emphasis is being laid on active participation of farmers as an active partner in terms of problem solving, management and decision-making. Farmers have been fully involved in collection of technical observations. Following technical observations have been visualized in participation mode.

Technical Observation :

Plant Growth Parameters–The plant growth parameters such as initial plant population, plant height, number of nodule per plant and number of primary and secondary branches were taken during crop growth stages.

Grain Yield–The grain yield of lentil crop is noted separately of each treatment from each farmers and average is calculated.

Economic Analysis–The economic analysis has been worked out for the estimating the net return and B/C ratio. For calculating the economic analysis, the seeding rate was 50 kg per ha. Seed cost was assumed to Rs. 20.00 per kg. The market-selling price was calculated Rs. 1500 per quintal.

Impact Analysis–In impact analysis, the adoption of the technology in the IVLP village and nearby villages has been studied. The number of farmers adopted the technology in the IVLP village has also been studied.

RESULTS AND DISCUSSION

The response of fertilizer dose in lentil was assessed under rainfed farming. The improved varieties viz. DPL 62 and JL 1 were used in all three treatments. The initial plant stand, plant height, number of nodules and branches were higher in sub-optimal does of fertilizer treatment followed by optimal dose and then no application of fertilizer treatment.

Table 2 Plant growth parameters affected by different doses of fertilizer.

Growth Parameter		Year	Treatment		
			T_1	T_2	T_3
Initial Plant stand		2001-2002	31.3	29.3	30.4
		2002-2003	29.4	30.2	30.8
Plant Height (cm)	At 45 DAS	2001-2002	26.3	27.1	27.8
		2002-2003	25.4	27.5	27.8
	At 90 DAS	2001-2002	33.1	34.5	36.2
		2002-2003	34.2	35.4	36.0
No. of Nodules/plant	At 45 DAS	2001-2002	3.6	4.3	6.1
		2002-2003	3.4	4.5	5.5
	At 90 DAS	2001-2002	7.4	6.3	10.5
		2002-2003	7.0	7.1	9.5
No. of Primary branch	At 45 DAS	2001-2002	4.3	5.2	5.6
		2002-2003	4.0	4.8	5.5
	At 90 DAS	2001-2002	7.1	9.4	10.2
		2002-2003	6.8	9.5	10.4
No. of Secondary Branch	At 90 DAS	2001-2002	14.2	16.1	16.3

The number of root nodule per plant in T3 treatment (sub-optimal dose) is 6.1 and 10.5 in the year 2001-2002; 5.5 and 9.5 in year the 2002-2003 at 45 DAS and 90 DAS respectively. While in T2 (optimum dose), it is 4.3 and 6.3 in the year 2001-2002; 4.5 and 7.1 in year the 2002-2003 at 45 DAS and 90 DAS respectively. The nodule no is less might be due to fact that lentil crop does not fix atmospheric nitrogen if excess nitrogen is available in the soil. Also, excess nitrogen causes excessive vegetative growth, reducing seed yield.

Table 3. Grain yield and economic analysis of fertilizer response

Economic Factor	Year	Treatment		
		T_1	T_2	T_3
Grain yield (q/ha)	2001-2002	14.1	15.3	16.2
	2002-2003	13.3	15.8	16.9
Percent increase in grain yield	2001-2002	—	16.8	23.7
	2002-2003	—	18.7	26.5
Additional cost (Rs./ha)	2001-2002	—	1035.00	592.50
	2002-2003	—	1035.00	592.50
Additional output (Rs./ha)	2001-2002	—	1800.00	3150.00
	2002-2003	—	3750.00	5400.00
Net Return (Rs./ha)	2001-2002	14885.00	15650.00	17442.50
	2002-2003	13685.00	16400.00	18492.50
B/c ratio	2001-2002	3.38	3.14	3.54
	2002-2003	3.18	3.25	3.70

Lentil yields at IVLP village in Hamirpur district, averaged across varieties, have ranged from 13.3 to 16.9 q per ha. The yield of lentil variety is higher under sub-optimal dose with rhizobium fertilizer and obtained 23.7% and 26.54 % in year the 2001-2002 and 2002-2003, respectively higher yield followed by optimal dose fertilizer (16.8 % in year the 2001-2002 and 18.74 % in year the 2002-2003). Thus from sub-optimal dose with rhizobium fertilizer, farmers get higher net return of Rs. 17442.50 in year 2001-2002 and Rs. 18492.50 in the year 2002-2003 and higher B/C ratio of 3.54 in year 2001-2002 and 3.70 in year 2002-2003.

Table 4. Farmers' view regarding the fertilizer response

Description	Treatment		
	T_1	T_2	T_3
Plant Vigour	Moderate appearance	Good appearance	Good appearance
Number of branch	Less	More	More
Nodules	Less in number and small in shape	Good in number and large in shape	Highest, large in shape and more branched
Brightness in seed	Dull in appearance	Bright	Less bright
Seed shape	Mostly shriveled	Round and filled	Round and filled

Impact :

S. No.	Technology Adopted	1st Year		2nd Year	
(a)	Continuance of adoption by the farmers covered under IVLP	5	3	10	8
(b)	Adoption in the IVLP village	11	6	14	10
(c)	Adoption in nearby non IVLP village	1	1	3	4

Farmers' Reaction–The reaction of the farmers regarding the nutrient management is very positive. The farmers have liked rhizobium culture has been inoculated with half of the recommended dose of inorganic fertilizer. This has reduced the cost of cultivation as well as increased the net income and accepted the result of sub-optimal dose of NPS along with rhizobium culture inoculation. Farmers collectively wanted the help from Government/Private Agencies/Agril. Universities for providing good quality bio-fertilizers. There is no element of risk in the adoption of this technology as expressed by all categories of farmers. Unavailability of sulphur containing fertilizers in the nearby market is another important constraint being faced by most of the farmers of the locality. The farmers' response in this regard has been depicted in the following table.

CONCLUSION

It showed that sub-optimal dose of fertilizer is best and economical for the production as well as net return point of view. Lentils may represent a good opportunity for Bundelkhand farmers to diversify their farm income and crop rotations. Farmers who may be interested in producing lentils on their farm need to investigate profitability and cash flow of this alternative crop. Thus farmer participatory approach could develop appropriate, location specific and demand driven technologies through active and full participation of all categories of farmers.

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