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Scaling up of lentil productivity and economic return of farmer's through front line demonstrations of improved technology

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ABSTRACT

Lentil (*Lens culinaris*) is one of the oldest pulse crops and most nutritious among the *rabi* pulses. Front line demonstration was conducted at farmer's field of Gazipur UP, India, involving improved technology. The productivity and economic returns of lentil from improved technologies were calculated and compared with the corresponding farmer's practices (local check). Results revealed that improved scientific lentil production practices recorded higher yield as compared to farmer's practices. The improved technology recorded higher yield of 13.87 q/ha and 14.70 q/ha in the year 2015-16 and 2016-17, respectively over farmer's practice10.90 and 10.67 q/ha. In the economic front too, improved technology gave higher gross return (90155 and 88200 Rs./ha), net return (63336 and 65714 Rs./ha) with higher benefit cost ratio (3.36and 3.92) as compared to farmer's practices. The variation in per cent increase in the yield was attributed by lack of scientific knowledge, and poor socio economic condition. Under sustainable agricultural practices, with this study it is concluded that the FLDs programmes were effective in changing attitude, skill and knowledge of improved package and practices of HYV of lentil adoption.

Keywords: Lentil, FLDs, Economic impact, Adoption, B: C ratio

INTRODUCTION

Lentil (*Lens culinaris*) is one of the oldest pulse crops and most nutritious among the Rabi pulses, Worldwide, India ranks second and first,with respect to production and acreage (Singh *et al*., 2015). In India, it is mainly cultivated in Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, Bihar and West Bengal. These states together contribute 85 per cent of area and 90 per cent production of lentil However, the average productivity is significantly poor being only 714 kg/ha, below the world average of 1008 kg/ha (Singh *et al*., 2018). Annual species of the genus Lens viz., *L. culinaris* Medik has been divided into two sub species of macrosperma and microsperma mainly on the basis of seed size. Lentil originated in Near East and Mediterranean region (Kumar and Srivastava, 2007). Lentil is generally grown in rainfed crop during *Rabi* after rice, maize and pearl millet. In intercropping it is mainly grown with barley and mustard. It is also grown as an inter crop in autumn planted sugarcane. In north-eastern plains, it is also grown as *utera* crop after rice. The seed are broadcast in standing crop of rice just before harvest (Anonymous, 2008). Lentil plays a significant role in human and animal nutrition and in maintenance and improvement of soil fertility (Singh *et al*., 2014). Its cultivation enriches soil nutrient status by adding nitrogen, carbon and organic matter which promotes sustainable cereal based systems of crop production. The primary product of lentil is its seed which has relatively higher contents of protein, carbohydrate and calories compared to other legumes (Singh *et al*., 2013). The lower yields of lentil in Ghazipur district are attributed to the non-availability of improved cultivars that are sensitive to the pest and diseases and crop and land management practices. Among the different agronomic practices, date of sowing, crop geometry (row spacing), seed treatment, plant population and crop management practices play an important role in determining the yield of lentil. The basic objectives of FLD are the speedy spread of new technology of lentil in Ghazipur district.

MATERIALS AND METHODS

The present study was carried out by Krishi Vigyan Kendra (KVK), Ghazipur (Uttar Pradesh) during *Rabi* seasons of 2015-16 and 2016-17 at farmers' fields of cluster demonstration adopted villages. The area under each demonstration was 0.40 ha (1 acre). The total 32 number (40 acre) of demonstration was conducted in these villages. In general soil of the area under study was sandy loam with low to medium fertility status. In the demonstration one control plot was also kept where farmers' practice was carried out. The improved package of practices like use of improved and recommended varieties (HUL-57), seed treatment (Carbendazim @ 3 g/kg seed), seed inoculation (*Rhizobium* and PSB), recommended dose of fertilizer (20:40:20 N:P:S), use of single super phosphate (SSP) fertilizer and plant protection measures (0.03 % Dimehoate) were demonstrated on the farmers' fields through frontline demonstration at different locations. Materials for the present study with respect to FLD and farmers' practices are given in Table 1.

The demonstration farmers were facilitated by KVK scientists in performing field operation likes sowing, spraying and harvesting etc. during the course of training and visits. The collected data were calculated and analyzed to draw the inference. The FLDs were conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under

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Table 1: Gap observed in technological intervention and farmer's practices under FLDs.

Particulars	Technological intervention	Existing practices	Gap
Variety	HUL -57 & PL -8	Narendra Masur	Partial Gap
Land preparation	Three ploughing	Three ploughing	Nil
Seed rate	30 kg/ha	50 kg/ha	Higher seed rate
Spacing	30X10	Broadcasting	Full gap
Seed treatment	Carbendazim @ 3 gram/kg seed	No seed treatment	Full gap
Seed Inoculation	*Rhizobium & PSB* powder@ 5g/kg of seed	No seed inoculant	Full gap
Fertilizer dose	20:40:20 (N:P:S)	Only DAP is used @ 20 kg/ha	Partial Gap
Plant protection	Need based plant protection measure (0.03 % Dimhoeate)	No plant protection	Full gap

existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The technology gap, extension gap and technological index (Samui *et al*., 2000) were calculated by using following formula as given below-

$$\text{Percent increase yield} = \frac{\text{Demonstration yield-farmers yield}}{\text{Farmers yield}} \times 100$$

Technology gap= Potential yield-Demonstrated yield

Extension gap= Demonstrated yield – Yield under existing practice

$$\text{Technology index} = \frac{\text{Potential yield - Demonstrated yield}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

The gap between the existing and recommended technologies of lentil in district Ghazipur was presented in Table1. Full gap was observed in case of use of HYVs, sowing method, seed treatment and weed management and partial gap was observed in fertilizer dose and plant protection measure, which definitely was the reason of not achieving potential yield. Farmers were not aware about recommended technologies. Farmers in general used local or old-age varieties instead of the recommended high yielding resistant varieties. Unavailability of seed in time and lack of awareness were the main reasons. Farmers followed broadcast method of sowing and closer spacing against the recommended line sowing, and proper spacing (30 X 10 cm) and because of this, they applied higher seed rate (50 kg/ha) than the recommended (30 kg/ha).

Yieldgap

During two years of frontier technologies results obtained are presented in Table2. The results revealed that the FLDs on lentil an average yield was recorded 14.29 q/ha under demonstrated plots as compare to farmers practice 10.79 q/ha. The highest yield in the FLDs plot was 14.70 q/ha and in farmers practice 10.90 q/ha. This results clearly indicated that the higher average grain yield in demonstration plots over the years compare to local check due to knowledge and adoption of full package of practices i.e. appropriate varieties such as HUL-57 & PL-8, timely sowing, proper spacing, seed treatment with Rhizobium & PSB @ 5g/kg of seed, use of balanced dose of fertilizer (20:40:20 (N:P:S), method and time of sowing, timely weed management and need based plant protection measures. The average yield of lentil increased 32.51 per cent. The yield of lentil could be increased over the yield obtained under farmers practices (use of non-descriptive local variety, no use of the balanced dose of fertilizer, untimely sowing and no control measure adopted for pest management) in lentil cultivation..

Table 2: Yield and yield attributing character of lentil under FLDs

Year	Variety	Trial No	Area (ha)	Potential yield (q/ha)	Average yield (q/ha)		Percent yield increase	No. of branches/plant	
					Trial	Farmers practice		Trial	Farmer's Practice
2015-16	HUL-57	32	16.0	16.0	13.87	10.90	27.25	6.0	4.0
2016-17	PL-8	51	30.0	18.0	14.70	10.67	37.77	8.0	4.0
Total/Average	-	83	46.0	-	14.29	10.79	-	7.0	4.0

Technology gap

The technology gap, the differences between potential yield and yield of demonstration plots were 2.13 and 3.30 q/ha during 2015-16 and 2016-17 respectively. On an average technology gap under two year FLD programme was 2.72 q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agricultural practices and local climatic situation.

Extension gap

Extension gap of 2.97 and 4.03q/ha was observed during 2015-16 and 2016-17 respectively. On an average extension gap was observed 3.50q/ha which emphasized the need to educate the farmers through various extension means i.e. front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap.

Technology index

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index varied from 13.31 to 18.33 per cent (Table 3).

On an average technology index was observed 15.82 per cent during the both the years of FLDs programme, which shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of lentil. This finding is in corroboration with the findings of Singh *et al.*(2016).

Table 3: Technology and Extension gap and Technological Index observed under FLDs

Year	Variety	Trial No.	Area (ha)	Technology gap (q/ha)	Extension gap (q/ha)	Technological index (%)
2015-16	HUL-57	32	16.0	2.13	2.97	13.31
2016-17	PL-8	51	30.0	3.30	4.03	18.33
Total/Average	-	83	46.0	2.72	3.50	15.82

Economic return

The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating net return and benefit: cost ratio (Table 4). The cultivation of lentil under improved technologies gave higher net return Rs. 63336 and 65714 per ha in 2015-16 and 2016-17 respectively as compared to farmers practices. Similar findings were reported by Singh *et al.,* (2016). The benefit: cost ratio of lentil cultivation under improved cultivation practices were 3.36 and 3.92 as compared to 2.78 and 2.88 under farmer's practice. This may be due to higher yield obtained under improved technologies compared to farmer's practice. This finding is in corroboration with the findings of Mokidue *et al.,* (2011).

Table 4: Economical observations of lentil variety HUL-57 & PL-8 under FLDs.

Year	Variety	Trial No.	Area (ha)	Gross Income (Rs./ha)		Net Return (Rs./ha)		B:C Ratio	
				Trial	Farmers practice	Trial	Farmer's Practice	Trial	Farmer's Practice
2015-16	HUL-57	32	16.0	90155	70850	63336	45382	3.36	2.78
2016-17	PL-8	51	30.0	88200	64920	65714	42434	3.92	2.88

CONCLUSION

The FLD produces a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology (Intervention) under real farming situation, which they have been advocating for long time. This could be circumventing some of the constraints in the existing transfer of technology system in the district, Ghazipur of Uttar Pradesh. The productivity gain under FLD over existing practices of lentil cultivation created greater awareness and motivated to the other farmers to adopt suitable production technology of lentil in the district. The constraints faced by the farmers were different for different technologies. Efforts should, therefore, be made by the extension agencies in their transfer of technology programmes to consider the constraints as perceived by the farmers in this investigations as well as personal. Therefore, for enhancing the production & productivity of lentil crop, strategy should be made for getting the more and more recommended technologies adopted by the farmers.

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