Enhancing field pea (*Pisum sativum* L) production for food security, nutrition and livelihood through technological interventions

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ABSTRACT

Field pea (*Pisum sativum* L) is a popular winter season legume crop largely confined to cooler temperate zones and widely consumed in India. In rainfed production situation where crop often suffers with low and unstable productivity farmers' resources are not adequate and thereby bring nutritional security at stake. Looking at the fact that the productivity of field pea is far below at farmers' fields as compared to potential yield it was essential to demonstrate proven technologies especially for this crop in participatory mode under frontline demonstrations (FLDs) implemented by the Krishi Vigyan Kendra, Azamgarh, Uttar Pradesh. The demonstrations were carried out at 80 farmers' fields in 10 villages for five consecutive years viz 2010-11, 2011-12, 2012-13, 2013-14 and 2014-15. The highest grain yield of 28.4 q/ha was recorded in the year 2010-11 followed by 23.9 q/ha in subsequent year 2011-12 over farmers' practices (19.7 and 16.6 q/ha respectively). In both the years marked increase in yield was recorded to the tune of 44.2 and 44.0 per cent respectively over control and it was also found more profitable on economic parameters with higher benefit-cost ratio (BCR) including incremental benefits of Rs 20880 and 15390 per hectare respectively during both the years of technological intervention. An abrupt increase in BCR (4.36) during year 2010-11 was noticed due to increase in yield as well as sudden hike in prices of pulses in comparison to rest of the years. The variation in the per cent increase in yield was found due to variation in agro-climatic parameters, poor crop management, unseasonal rainfall etc under rainfed condition.

Keywords: FLDs; field pea; farmers' practices; technologies

INTRODUCTION

The significance of pulses in livelihood and nutritional security, sustainable crop production and conservation of natural resources is widely accepted (Joshi et al 2002). In rainfed production situation where crop often suffers with low and unstable productivity farmers' resources are not adequate and thereby bring nutritional security at stake. Under such circumstances pulses have greater mitigating capacity. However the benefits of research outcomes have not been harnessed by farmers from rainfed areas primarily due to their absence or very little involvement in technology development besides the other related factors. For such a fragile situation it is important to redesign the recommended technologies by proper understanding of local situation as highlighted by Swaminathan (1993). Recognizing the significance of pulses production in rainfed areas of India and for meeting the three objectives such as nutritional security, sustainable agricultural and livelihood improvement of rural sectors vis a vis the scope of farmers' participatory approach in this endeavour are implemented by extension agencies. In India the average productivity of field pea is 906 kg/ha. The major field pea growing states are Uttar Pradesh, Madhya Pradesh, Bihar and Maharashtra. Besides these states it is also cultivated in Delhi, West Bengal, Punjab, Haryana and Himachal Pradesh. In Uttar Pradesh it is cultivated in an area of about 479000 ha with production of 502000 MT. Azamgarh district of Uttar Pradesh occupies 7773 hectares of land and 10942 MT production with average productivity of 1409 kg/ha of field pea (hptt/ www.azamgarh.nic.in). Keeping above factors into consideration and decreasing trends of per capita availability of pulses from 60 to 31.2 g is alarming condition to agriculturists working in the country. Therefore the demonstrations were planned under the close supervision of scientists of the Krishi Vigyan Kendra, Azamgarh, Uttar Pradesh with an objective to bridge the productivity gap and keep pulse prices under control along with smooth and speedy spread of the newly introduced high yielding varieties of field pea and acquaint extension functionaries and local farmers with frontline varietal and management technologies.

MATERIAL and METHODS

The on-farm demonstrations on field pea were conducted by Krishi Vigyan Kendra, Azamgarh, Uttar Pradesh with an emphasis to enhance the production potential of field pea during rabi 2010-11, 2011-12, 2012-13, 2013-14 and 2014-15 in ten villages viz Dhanehua, Gopalpur, Awunti, Ekma, Chak Khairulla, Bhagwanpur, Newada, Sikraur, Jagdispur and Pandri covering seven blocks namely Jahanaganj, Palhani, Tahbarpur, Rani Ki Sarai, Sathiyon, Martinganj and Ahiraula of district Azamgarh. A total of 80 farmers were associated under this programme and the selection of farmers was done by using questionnaire on pulses, organizing meetings and group discussions to know their interests, availability of accessible sites for demonstrations etc. For the demonstrations improved variety KPMR 522 of field pea, balanced doses of fertilizers (nitrogen, phosphorus and sulphur @ 20, 60 and 20 kg/ha respectively) through diammonium phosphate and phosphozypsum were used. Whole quantity of fertilizers was applied at the time of final field preparation as basal. The soil of the demonstration fields was also tested. The control of wilt and seasonal weeds during crop period was ensured with the use of *Trichoderma* @ 10 g/kg seed as seed treatment and pre-emergence application of pendimethalin 3.5 l/ha using 1000 litres of water within 48 hours of sowing. A total of 15.0 hectare area was covered in five consecutive years. All these demonstrations were conducted at farmers' fields with local check plots where farmers' practices were carried out for comparative study (Table 1). Similar production and protection technologies other than interventions were applied in demonstrations as well as local checks (Table 2). The other relevant observations along with yield data were collected and statically analyzed by using simple statistical techniques. The technology gap, extension gap and technological index were calculated by using following formulae:

Technology gap= Potential yield – Demonstrated yield

Extension gap= Demonstrated yield – Yield under existing practice

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

Incremental benefit= Net return of demonstration (Rs/ha) – Net return of check (Rs/ha)

RESULTS and DISCISSION

The results presented in Table 3 reveal that all the five years of on-farm technological interventions recorded maximum grain yield and none of the rabi seasons was found poor producer over farmers' practices. The highest yield in the FLD plots as well as farmers' practices was 28.4 and 19.7 q/ha respectively during 2010-11 followed by 2011-12. However the drastic reduction in demonstration yield (16.6 q/ha) was only associated with 2014-15 and this shortfall varied from 7.9 to 11.8 q/ha over rest of the years. The major reason for poor yield of pea during rabi 2014-15 could be due to frequent unseasonal heavy rainfall (mid January to March) observed from flowering to maturity. These results clearly indicate that due to knowledge and adoption of improved variety ie KPMR 522, use of balanced doses of fertilizers (20 kg N and 60 kg P_2O_5 and 20 kg S/ha), seed treatment with *Trichoderma* @10 g/kg seed along with *Rhizobium*, PSB and pre-emergence application of pendimethalin 3.5 l/ha etc enhanced pea yield from 40.7 to 44.2 per cent over the yield obtained under farmers' practices (use of the non-descriptive local variety, no use of the balanced doses of fertilizers and no control measures adopted for wilt and weeds etc). On the basis of yield estimation in respect of productivity of the district it indicates that additional

Table 1. Difference between technological intervention and existing practices under FLDs on field pea

Component	Technological intervention	Existing practice	Gap
Soil sampling	Soil samples from each plot collected and tested	No soil sampling	Total gap
Variety	KPMR 522	Local	Total gap
Seed treatment	*Trichoderma* powder @ 10 g/kg seed, *Rhizobium* and PSB each 20 g/kg seed	No seed treatment	Total gap
Fertilizer dose	NPS @ 20, 60 and 20 kg/ha	Use of under-dose of fertilizers	Total gap
Weed control	Pendimethalin 3.5 l/ha	No use of weedicide	Total gap
Blue bull protection	Use of phenyl sticks and spraying of egg solution around field	No protection measures adopted	Total gap

Table 2. Production and protection technologies applied in the demonstration and control plots (farmers' practices)

Parameter	Application
Seed rate	100 kg/ha
Spacing	Row to row 25 cm, plant to plant 10 cm
Situation	Rainfed
Soil type	Sandy loam
Irrigation	Light irrigation at 40 days after sowing
Weed management	Pre-emergence application of pendimethalin 3.5 l/ha followed by manual weeding once at 30 days after sowing
Plant protection	Need-based chemical fungicide sprayfor powdery mildew control; no use of any control measure for wilt management

production was quite higher 15.5 q/ha during 2010-11 and this yield was more than double when compared to yield obtained under earlier year of study. All the years were found more profitable by gaining higher benefit-cost ratio while seasons rabi 2010-11 and 2011-12 were unique and more congenial years for better returns. The present results are in accoradance with the findings of Singh et al (2002) and Singh et al (2014).

The extension gap showed a decreasing trend from 8.70 to 4.80 q/ha during the period of intervention (2010-11 to 2014-15) that emphasized that farmers were well acquainted and came forward with adoption of improved pea production technology to minimize the extension gap. It is realized that bridging the gap between demonstrations and farmers' practices was a resultant of extension approaches in participatory mode and educating the farmers through various ways. An ascending trend of technology gap (yield ranging from 3.60 to 15.4 q/ha) reflects that the farmers were efficiently cooperating in carrying out technological interventions with encouraging results in subsequent years but frequent attack of wild animals viz blue bull (locally known as Ghar Rose) and wild pig caused severe crop damage from germination to maturity. Hence technology gap observed may be attributed to the heterogeneity in soil fertility status and weather conditions such as heavy unseasonal rainfall, cyclones at flowering and poding stage etc. Technological index shows the feasibility of the evolved technology at the farmers' fields. However the lower value of technology index indicates that more was the feasibility of technology at farmers' fields. As such fluctuation in technology index ranged from 11.3 to 48.1 during the study period in certain regions which may be attributed to the dissimilarity in soil fertility status, weather conditions, improper intercultural operations and pest management etc. Similar findings were also observed by Chauhan (2012) on yield gap analysis of gram cultivation under FLD programme at Tapi, Gujarat.

CONCLUSION

The FLD programme was effective in changing attitude, skill and knowledge of the farmers of recent technology for high yielding varieties, balanced doses of the fertilizers and biological disease management of field pea including their adoption. This also improved the relationship between the farmers and the scientists and built confidence among the

Table 3. Yield, economics and other analytical parameters of demonstrated field pea (pooled data of five years)

Year	Number of farmers	Area (ha)	Yield (q/ha)		Increase in yield (%)	Average productivity of district (kg/ha)	Additional yield over productivity (q/ha)	Technology gap (q/ha)	Extension gap (q/ha)	Technological index (%)	Incremental benefit (Rs/ha)	BCR
			FLD	Farmers' practice								
2010-11	15	3.0	28.4	19.7	44.2	1290	15.5	3.60	8.7	11.3	20880	4.36
2011-12	13	3.0	23.9	16.6	44.0	1270	11.2	8.10	7.3	25.3	15390	4.07
2012-13	13	3.0	22.2	15.7	41.4	1360	8.60	9.80	6.5	30.6	11950	3.36
2013-14	14	3.5	23.1	16.1	43.5	1390	9.20	8.90	7.0	27.8	14700	3.39
2014-15	25	3.0	16.6	11.8	40.7	1030	6.30	15.4	4.8	48.1	8900	2.40
Mean			21.6	16.0	42.8	1270	10.2	9.16	6.86	28.6	14364	3.52

former. The selected farmers of the demonstrations also acted as sources of information and pure seed under keen supervision of scientists for wider dissemination of improved pea seed to the other farmers. The productivity gain under demonstrations over conventional practices of field pea cultivation created greater awareness and motivated the other farmers to adopt appropriate recent production and protection technologies of field pea in the district. The selection of critical inputs and participatory approach in planning and conducting the demonstrations definitely helped in the transfer of technology to the farmers.

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