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Yield gap and economics of chick pea (*Cicer arietinum* L.) cultivation in low hills of Himachal Pradesh

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Abstract

The popularity of pulse crops remains quite low due to technological gaps in adoption of pulse technologies along with other factors also. To demonstrate pulse production technology, 96 frontline demonstrations (FLDs) were organized by KVK Bilaspur (Himachal Pradesh) on chick pea for four consecutive years from 2006-07 to 2009-10 on the farmers fields with prevailing farmers practice as control. The yield performance, yield gap, technology gap, extension gap and technology index were analyzed for demonstration and control plots. Higher yield of 21.8 to 61.4 percent were recorded in demonstration plots over control. Average technology gap of 2.79 q/ha, average extension gap of 2.94 q/ha with the technology index of 23.21 percent were recorded. The average net return of recommended and farmers' practices were Rs. 22420 and Rs. 15300 with incremental benefit-cost ratio (IBCR) of 1.43 to 2.99, respectively. By conducting FLDs of proven technologies, yield potential and net income from the chick pea cultivation was enhanced to a great extent with increase in farmer's income.

Key words: Frontline demonstrations, technology gap, extension gap, technology index, chickpea, KVK.

Introduction

Chickpea (*Cicer arietinum* L.) with a high amount of good quality stored protein is the most important pulse crop of the world which plays a significant role in the low input agriculture by reducing the dependence on nitrogenous fertilizers. Chick pea seeds on an average contain 23% proteins, 64% total carbohydrates, 5% fat, 6% crude fiber, 3% ash and a high mineral content (Oberoi *et al*., 2010). According to the Food and Agriculture Organization (FAO) statistics, cultivated chickpea is in the first rank, with about 10,671,503 ha cultivated area among cool season food legumes in the world,

Farmers participation in agricultural research is a systematic dialogue between farmers and scientists to solve the problems related to agriculture and ultimately increase the impact of agricultural research. By responding closely to farmers concern and conditions researchers can develop technologies, that are adopted more widely and that respond to important social issues such as equity and sustainability (Das and Willey, 1991; Singh *et al.,* 2008). Technology transfer refers to the spread of new ideas from originating sources to ultimate users. Available agriculture technology does not serve its purpose till it reaches and is adopted by its ultimate users i.e. the farmers (Mishra *et al.*, 2009). The growing demand of about 20 million tonnes of pulses by 2012 and 28 million tonnes by 2025 can be met only by adopting increasingly better production technologies along with sustained developmental efforts and favourable government policies (Singh *et al.,* 2008)

Bilaspur in HP is by far a district, where majority of farmers except those who have taken to commercial vegetable/flower/horticulture cultivation, are still continuing traditional maize-wheat cultivation. The popularity of pulse production has gone down over the years and especially with the introduction of current public distribution system (PDS) where pulses for home consumption are available at subsidized rates.

The objective of frontline demonstrations under study was to demonstrate the various recommended technologies to the farmers on chick pea and to show their worth over farmers' practices in order to motivate them for the adoption of HYVs of chick pea.

Methodology

The study was conducted in Bilaspur district of Himachal Pradesh situated in sub-mountane and low hills sub-tropical agro climatic zone in four different agro ecological situations **(**Govind Sagar's Basin, valley area, changer area and mid hill area) for four years from 2006-07 to 2009-10 consecutively. A total of 96 farmers were selected who undertook the demonstrations on their fields. The FLD data were collected and observations were also taken on farmer's fields. Yield data for the demonstration plots as well as from farmers' practices were recorded at the time of threshing.

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1. Estimation of technology gap, extension gap and technology index

The estimation of technology gap, extension gap and technology index was done using following formula (Kadian *et al*., 1997 and Samui *et al*., 2000)

i) Technology gap (q/ha)= Potential yield (Pi) – Demonstration plot yield (Di)

ii) Extension gap (q/ha) = Demonstration plot yield – Farmer's plot yield

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

Where,

Pi = Potential yield of i^{th} crop

Di = Demonstration yield of i^{th} crop.

2. Economic analysis of FLDs on pulses

Cost of cultivation of chick pea includes cost of inputs - seed, fertilizers, pesticides etc. purchased by the farmers (in farmers practice)/supplied by the KVK (in demonstration plots) as well as hired labour, sowing charges by bullocks/tractor and post harvest operation charges paid by the farmers. The farmers' family labour was not taken into consideration in the present study. The gross and net returns were worked out accordingly by taking cost of cultivation and market price of grain yield. Additional costs in FLDs include expenditure on improved technological inputs in FLDs over farmers' practice. Similarly, the incremental benefit-cost ratio (IBCR) was worked out as a ratio of additional returns to corresponding additional costs (Vedna *et al*., 2007).

Results and Discussion

The results of 96 demonstrations conducted at farmers' field in the rainfed situation during 2006-07 to 2009-10 in district Bilaspur are presented. The details of demonstration package are given in table 1. Data revealed that under demonstration plots the chick pea yield was found substantially higher than that of under farmers' practice during all the years (Table 2) which may be attributed to the adoption of recommended agro-technologies in FLDs during the study period (Sagar and Chandra, 2004). The chick pea demonstration yield ranged between 8.25 to 9.70 q/ha over observation period and was 21.8 to 61.4 percent higher over farmers' practice. In general, in all the years, the yields of demonstration plots were

Table 1. Demonstration package and farmers practice under FLD's in chickpea in Bilaspur district of Himachal Pradesh

S. No.	Operation	Improved practice demonstrated	Farmer Practice
1.	Variety	Himachal Chana-2 (HC-2)	Local (C-235)
2.	Seed rate	45 kg/ha treated with Bavistin	50-60 kg/ha
3.	Sowing method	Line sowing 30 cm apart	Broadcasting
4.	Fertilizer dose	30:60:30 kg NPK/ha	2-4:8-10:4-5 kg NPK/ha
5.	Plant Protection	Need based pesticides and fungicides, seed	Nil
6.	Technical guidance	Time to time	Nil

higher as compared to the control which was due to timely sowing of crops with recommended varieties and optimum seed rate, plant protection practices properly followed and recommended dosage of fertilizer applied to the crop during the season. These results are in conformity with the findings of Tiwari & Sexena (2001), Tiwari *et al.* (2003), Mishra *et al.,* (2007) and Hiremath and Nagaraju (2010) in different pulse crops.

The technology gap is the difference between potential yield and yield of demonstration plots which were 2.30, 2.41, 2.68 and 3.75 q/ha during 2006-07, 2007-08, 2008-09 and 2009-10 respectively. Generally, the technological gap appears even if the FLDs are conducted under the strict supervision of the scientists in the farmers' fields. This may be attributed mainly due to erratic rainfall, variation in the soil fertility status, cultivation on marginal lands and local specific management problems (Sagar and Chandra, 2004 and Vaghasia *et al.,* 2005). This also calls for improvement of farmers' management skills to harness actual potential of the technology. Extension gap of 3.69, 3.48, 3.15 and 1.45 q/ha was observed from 2006-07, 2007-08, 2008-09 and 2009-10, respectively. Average extension gap recorded which emphasized on need to educate the farmers through various extension means like frontline demonstration for successful adoption of improved agricultural technologies, so as to minimize the extension gap.

Technology index indicates the feasibility of the evolved technology at the farmers' fields. Lower the value of technology index, higher the feasibility of improved technology (Mishra *et al.,* 2007). The technology index in chick pea varied between 19.16 to 31.25 percent (Table 2). The technology index in chick pea varied between 19.16 to 31.25 percent (Table 2). The average technology index of 23.21 percent was observed during the four years of FLD which shows that introduction of HYVs and demonstration of improved production technology eventually leads to increase in the yield of chick pea and also higher adoption amongst farmers in the district. From the study it can be inferred that the introduction of HYVs and demonstration of improved technology through FLDs on pulses followed by intensive awareness campaign will eventually lead to adoption of generated technology among farmers of the district to accelerate the crop diversification, pulses intensification and productivity enhancement in the pulses in this hill district.

Economic analysis of FLDs

The gross return and net returns in demonstration plots were the highest in chick pea variety HC-2 during rabi season of 2007-08 while in farmers' practice highest gross and net returns were recorded during the year 2009-10 (Table 3). The additional cost of production varied between Rs. 2385 to Rs. 3180 with average additional cost of Rs.

Table 2. Productivity, technology gap, extension gap and technology index of chickpea (var. HC-2)

Year	No. of FLDs	Yield (q/ha)			% Increase of FLD yield over FP	Technology Gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
		Pot.	FLD	FP				
2006-07	25	12	9.70	6.01	61.4	2.30	3.69	19.16
2007-08	14	12	9.59	6.11	56.9	2.41	3.48	20.08
2008-09	12	12	9.32	6.17	51.1	2.68	3.15	22.33
2009-10	45	12	8.25	6.80	21.8	3.75	1.45	31.25
Total	96							
Mean		12.00	9.22	6.27	47.80	2.79	2.94	23.21

Table 3. Productivity, technology gap, extension gap and technology index of chickpea (var. HC-2)

Year	Cost of cultivation (Rs)		Gross return (Rs)		Net return (Rs)		Additional cost (Rs)	Additional return (Rs)	IBCR
	Demo	FP	Demo.	FP	Demo.	FP			
2006-07	8250	5070	29100	18030	20850	12960	3180	7860	2.47
2007-08	9572	6520	33565	21385	23993	14865	3052	9128	2.99
2008-09	10390	7415	32620	21595	22230	14180	2975	8050	2.71
2009-10	10390	8005	33000	27200	22610	19195	2385	3415	1.43
Average	9650.5	6752.5	32071.3	22052.	22420.8	15300	2898	7113.25	2.40

2898 and additional returns varied between Rs. 3415 to 9128 with average of Rs. 7113 resulting in incremental benefit-cost ratio (IBCR) of 1.43 to 2.99. Maximum additional returns of Rs. 9128 were recorded during 2007-08 followed by Rs. 8050 during the year 2008-09. Better performance during Rabi 2007-08 over other years was due to sufficient pre-sowing moisture and well distributed rainfall received during the season. Highest IBCR of 2.99 was also recorded in Rabi 2007-08 for the reasons explained above. This economic analysis highlighted that use of improved technology in chick pea had substantially increased the farm gains over farmer practice which indicated that use of HYVs of pulses along with recommended farm technology can greatly improve the profitability and livelihood of the farming community of Bilaspur district. Similar findings were reported by Sagar and Chandra (2004) and Vedna *et al.* (2007).

Conclusion

It can be concluded from the study that the FLDs on HYVs of chick pea and improved production technologies could increase the yield (q/ha) over the farmers by 21.8 to 61.4 per cent.

The extension gap emphasizes on need to educate farmers through various means like trainings, FLDs, field days etc. Technology index also shows the feasibility of the technology demonstrated and good performance of intervention made to reduce the yield gap in chick pea.

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