Assessment of Gaps in Pulse Production in Hamirpur District of Himachal Pradesh

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ABSTRACT

Though substantial progress has been made in evolving techniques to obtain high yields of pulses, their production per hectare has remained the same for the last few decades. Acreage and productivity of pulse crop is declining in Himachal Pradesh in general and Hamirpur district in particular. To boost the production and productivity of pulse crops Krishi Vigyan Kendras are conducting frontline demonstrations on pulse crops. The main objective of frontline demonstrations on pulses is to demonstrate and popularize the improved technologies on farmers' fields for effective transfer of generated technology and fill the gap between recommended practices and farmers' practices. Frontline demonstrations in blackgram during Kharif and Chickpea during Rabi season were studied for five years (Kharif 2007 to 2011 and rabi 2007-08 to 2011-12) in Hamirpur district of Himachal Pradesh. There was a wide yield gap between the potential and demonstration yields in both pulse crops mainly due to technology and extension gaps. The frontline demonstrations on black gram crop indicated that per cent increase in yield over farmers practice ranged from 31.1 to 76.6 per cent where as in case of chickpea the range was 39.4 to 63.6 per cent over five years. It was further observed that in terms of economics, both black gram and chickpea crops recorded higher net returns per hectare compared to farmer's practice during all the years. The benefit cost ratio of demonstration plots ranged from 1.30 to 2.99 in black gram and 0.42 to 3.00 in chickpea. The per cent technology index varied from 26 to 56 per cent in black gram and 27 to 62 per cent in chickpea indicating the urgent need to motivate the farmers to adopt economical viable technologies for increasing production, productivity and profitability of pulse crops.

Key words: *Pulses; Black gram; Chickpea; Yield gap; Frontline demonstrations;*

Pulses are the basic ingredient in the diets of a majority of peoples of India, as they provide a perfect mix of vegetarian protein component of high biological value when supplemented with the cereals. Even with the best efforts, pulse acreage and productivity has been stagnant in Himachal Pradesh (*Kumar and Prasher, 2012)*. In Himachal Pradesh, pulses are grown on an area of 32.42 thousands hectare with an annual production of 34.59 thousand MT (*Anonymous, 2010-11*). The productivity of pulses in Himachal Pradesh continues to be quite low over the years because of their cultivation under rainfed conditions on less productive lands with no or little inputs compared to those used for cereals.

Hamirpur district of Himachal Pradesh is situated between 76018' to 76044'East longitude and 31051' and 31052' North latitude with an elevation varying from 400 meters to 1100 meters. Black gram during *kharif* and chickpea during *rabi* seasons are the two major pulse crops grown by the farmers of the district. There exists a wide yield gaps in between the experimental plots, frontline demonstrations plots and farmers fields. Considering the importance of pulses in human diet and food security Krishi Vigyan Kendra, Hamirpur conducted frontline demonstrations on black gram and chickpea with the objective to identify and fill these gaps between farmers' practice and recommended practices followed under frontline demonstrations.

METHODOLOGY

Frontline demonstrations on pulse crops viz. black gram and chickpea were conducted by KVK, Hamirpur of Himachal Pradesh during *Kharif* 2007 to 2011 and *Rabi* 2007-08 to 2010-11 for consecutive five years. A total of 35.68 ha area was covered under frontline demonstrations on black gram and chickpea under

rainfed conditions in 26 villages on 258 farmers' fields during all the years under study. In frontline demonstrations full package of practices were adopted whereas in the farmers' practice, existing practices being used by the farmers of the area were followed. The primary data on yield and farmers' practice was collected from the beneficiary farmers. The yield increase in demonstrations over farmers' practice was calculated by using the following formula:

$$\% \text{ YIOFP} = \frac{\text{Demo. yield} - \text{farmers' plot yield}}{\text{Farmers' plot yield}} \times 100$$

%YIOFP= % increase in yield over farmers' practice

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

$$\text{Tech. gap} = \text{Potential yield} - \text{Demo. plot yield}$$

$$\text{Ext. gap} = \text{Demo. plot yield} - \text{Farmer's plot yield}$$

$$\text{Tech. Index} = \frac{Pi - Di}{Pi} \times 100$$

Where,

Pi = Potential yield of ith crop

Di = Demonstration yield of ith crop.

Economic analysis of FLD's on oilseeds: Cost of cultivation of black gram and chickpea crops include cost of inputs like seed, fertilizers, pesticides etc. not available with the farmers and purchased by the farmers (in farmers practice)/supplied by the KVK (in recommended practice) as well as hired labour (if any), sowing charges by bullocks/tractor (if any) and post harvest operation charges (if any) 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 price of grain yield of respective crop into consideration. Additional costs in frontline demonstrations include expenditure on improved technological inputs in frontline demonstrations over farmers' practice. Similarly, benefit-cost ratio was worked out as a ratio of returns and corresponding costs.

RESULTS AND DISCUSSION

Comparison of production technologies: The gap between the recommended practices in frontline demonstration and farmers' practice of black gram and chickpea in Hamirpur district of Himachal Pradesh are presented in Table 1 and 2, respectively. The perusal of the tables revealed that farmers generally did not use recommended and improved technologies. There was a wide gap in use of improved varieties seed in both the crops due to its non availability. In farmers' practice broadcast method of sowing black gram and chickpea against the recommended line sowing was followed and higher seed rate was used. Farmers did not practice seed treatment with *rhizobium* culture, an important component in increasing the yield and yield attributes of pulse crops (*Kumar and Elamathi, 2007*). Partial gap in time of sowing of black gram was also observed. Farmers had sown the black gram in between June15th to June 30th, compared to recommended time of sowing i.e. June end to July beginning. However, no gap in sowing of chickpea crop was observed. Tables 1 and 2, further revealed that farmers did not apply any

Table 1. Comparison of recommended practices demonstrated and farmers' practice in black gram crop in Hamirpur district of Himachal Pradesh.

Crop operation	Recommended practices demonstrated	Farmers' practice	Gap
Variety	UG-218 and Him Mash-1	Local	Full
Land preparation	Two ploughings	One or two ploughings	Nil
Seed rate	20 kg/ha	22-25 Kg/ha	Higher
Seed treatment	*Rhizobium* culture	Nil	Full
Method of sowing	Line sowing at 30cm row spacing	Broadcasting	Full
Time of sowing	June end to July beginning	June15th to June 30th.	Partial
Fertilizer dose	20:40:20 Kg NPK per ha	No fertilizer or urea only.	Full
Method of fertilizer application	Kera	Broadcast at the time of sowing	Full
Weed management	Pendimethalin application @ 1.5 l ai/ha.	No or one hand weeding	Full
Plant protection	Need based pesticide and fungicide application	No pesticide and fungicide application	Full
Irrigation	Rain fed	Rain fed	Nil

Table 2. Comparison of recommended practices demonstrated and farmers' practice in chickpea technologies in Hamirpur district of Himachal Pradesh.

Crop operation	Recommended practices demonstrated	Farmers' practice	Gap
Variety	Himachal Channa-1 and GPF-2	Local	Full
Land preparation	Two ploughings	One or two ploughings	Nil
Seed rate	40 kg/ha	50-52 Kg/ha	Higher
Seed treatment	*Rhizobium* culture	Nil	Full
Method of sowing	Line sowing at 30 cm row spacing	Broadcasting	Full
Time of sowing	Mid October	Mid October	Nil
Fertilizer dose	30:60:30 Kg NPK per ha	No fertilizer or urea only.	Full
Method of fertilizer application	*Kera*	Broadcast at the time of sowing	Full
Weed management	Pendimethalin application@1.5 l ai/ha.	No or one hand weeding	Full
Plant protection	Need based pesticide and fungicide application	No pesticide and fungicide application	Full
Irrigation	Rain fed	Rain fed	Nil

recommended fertilizer, if applied only urea was given to the crop at the time of sowing. Partial or full gap in adoption of weed control and plant protection measures was observed in farmers' practice over recommended practice in frontline demonstrations. Similar observations for gap in improved technologies and farmers practices were also observed by *Burman et al. (2010)* in different crops.

Yield: Perusal of the data in Table 3 reveled that with the adoption of recommended practices in frontline demonstration of pulse crops, the yield can be raised by 32.2 to 35.2 per cent (UG-218), 31.1 to 76.6 per cent (Him Mash-1) in black gram, 39.4 to 60.2 per cent (Himachal Channa1) and 63.6% (GPF-2) in chickpea over the farmers' practice. This superiority of recommended practices in frontline demonstration over farmers' practice was also reported by *Sagar and Chandra (2004), Vaghasia et al. (2005), Mitra and Samajdar (2010) and Balai et al. (2012).* The year to year fluctuation in yield and cost of cultivation can be explained on the basis of variation in prevailing social, economical and microclimatic conditions of that particular village.

Technology gap, extension gap and technology index: The technological gap shows the gap in the recommended practices frontline demonstrations yield

Table 3. Technology gap, extension gap and technology index in pulse crop in Hamirpur district of Himachal Pradesh.

Crop/Variety	1	2	3	4	5	6	7	8	9	10
Blackgram										
UG-218	*Kharif* 2007	4.0	17	2	7.80	5.90	32.2	4.20	1.90	35
UG-218	*Kharif* 2008	4.0	11	2	8.10	6.00	35.2	3.90	2.10	32
Hima Mash-1	*Kharif* 2009	4.0	14	2	8.92	6.80	31.1	6.08	2.12	40
Him Mash-1	*Kharif* 2010	4.0	57	4	10.60	6.00	76.6	1.40	4.60	9
Him Mash-1	*Kharif* 2011	6.0	78	4	10.60	6.40	65.6	1.40	4.20	9
Chickpea										
Himachal Channa No.1	Rabi 2007-08	1.2	6	1	10.25	6.80	50.7	1.75	3.45	14
Himachal Channa No.1	Rabi 2008-09	1.0	16	3	5.30	3.80	39.4	6.70	1.50	55
Himachal Channa No.1	Rabi 2009-10	2.7	12	2	7.05	4.90	43.8	4.95	1.50	41
Himachal Channa No.1	Rabi 2010-11	2.0	12	3	10.9	6.80	60.2	1.10	4.10	9
GPF-2	Rabi 2011-12	4.0	35	3	9.98	6.10	63.6	5.02	3.88	33

1. Season/Year 2. Area(ha) 3. No. of farmers 4. No. of villages 5. Yield(q/ha) DP*, 6. Yield(q/ha) FP*, 7. %YIOFP 8. Technology gap(q/ha) 9. Extension gap(q/ha) 10.Technology index (%)

DP* Front line demonstration plots. FP* Farmers practice plots.

Table 4. Economic analysis of FLD's on pulse crops in Hamirpur district of Himachal Pradesh.

Crop/Variety	Season/ Year	COC (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		ACOC	AR (Rs/ha)	B:C Ratio (Rs/ha)	
		DP*	FP*	DP*	FP*	DP*	FP*			DP*	FP*
Blackgram											
UG-218	*Kharif* 2007	6050	4500	24180	17700	18130	13200	1550	4930	2.99	2.93
UG-218	*Kharif* 2008	6700	4900	24300	16800	17600	11900	1800	5700	2.62	2.42
Hima Mash-1	*Kharif* 2009	13280	11100	35680	27200	22400	16100	2180	6300	1.69	1.45
Him Mash-1	*Kharif* 2010	14125	8950	34090	21000	19965	12050	5175	7915	1.41	1.35
Him Mash-1	*Kharif* 2011	14854	8587	34200	24800	19346	16213	6267	3133	1.30	1.89
Chickpea											
Himachal Chana No.1	Rabi 2007-08	10250	8000	41000	23800	30750	15800	2250	14950	3.00	1.97
Himachal Chana No.1	Rabi 2008-09	12364	9400	17500	13300	5136	3900	2964	1236	0.42	0.41
Himachal Chana No.1	Rabi 2009-10	11974	11114	28200	19600	16226	8486	860	7740	1.36	0.76
Himachal Chana No.2	Rabi 2010-11	12511	11623	43600	27200	31089	15577	888	15512	2.48	1.34
GPF-2	Rabi 2011-12	13316	12733	39920	24400	26604	11667	583	14937	1.99	0.91

DP* Frontline demonstration plots. COC=Cost of cultivation(Rs/ha) AR=Additional returns over local (Rs/ha)
FP* Farmers practice plots. ACOC=Additional cost of cultivation over local (Rs/ha)

over potential yield and it ranged from 3900 to 4200 kg/ha in UG-218,1900 to 6080 Kg/ha in Him Mash-1 in black gram. In chickpea, the technological gap ranged from 1750 to 6700 kg/ha in Himachal Channa-1and 5020 Kg/ha in GPF-2. The observed technology gap may be attributed to dissimilarity in soil fertility status and weather conditions. Similar findings were documented by *Hiremath and Nagaraj (2009)*. Hence to narrow down the gap between the yield of recommended practices and farmers' practice location specific recommendation appears to be necessary.

The highest extension gaps which ranged from 1900 to 4600 kg/ha in black gram and 1500 to 4100 kg/ha in chickpea during the period of study emphasized the need to educate the farmers through various means for the adoption of recommended and improved agricultural production technologies to reverse this trend of wide extension gap. The feasibility of the evolved technology in the farmer's fields is indicated by the technology index. The lower the technology index more is the feasibility of the technology (*Mishra et al. 2007*). In black gram crop technology index varied from 9 to 40% and in chickpea 9 to 55%. As both the crops are grown under rain fed conditions, lack of irrigation facilities particularly in *rabi* season when very little rains occur in the district leads to higher technology index during *rabi* season chickpea crop. Moreover, reduction of technology index in general in both the pulse crops over the year of study clearly exhibited the feasibility of technologies demonstrated in frontline demonstrations.

Economic analysis: The economic analysis of the data for the study period for black gram and chickpea clearly revealed that in both the said crops, the gross return, net returns and benefit: cost ratio were higher in frontline demonstrations where recommended practices were followed compared to farmers' practice indicating higher profitability. The benefit cost ratio of demonstration plots ranged from 1.30 to 2.99 in black gram and 0.42 to 3.00 in chickpea. Similar findings were also reported by *Vedna et al. (2007)*

CONCLUSION

The yields of pulse crop can be increased to a greater extent even under rain fed situations by adopting the recommended practices and improved technology in Hamirpur district of Himachal Pradesh. Favourable benefit: cost ratio is self explanatory of economic viability of the frontline demonstrations and encouraged the farmers for adoption of interventions imparted. It is also observed that higher extension gap emphasized that there is further need to educate the farmers for adoption of improved technologies so that poor farmer with limited resources could improve their livelihood and diversify their farming situation.

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