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Technology Development, Assessment and Transfer-A Case of Frontline Demonstration in Himachal Pradesh

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ABSTRACT

Background: Pulses are distinctive leguminous crops that enhance and renew soil fertility by means of biological nitrogen fixing. Pulses may be generated with little resource utilization and are mostly farmed in rainfed environments. The current study aims to investigate the influence of KVK on the promotion and its effects on the production of pulses in Himachal Pradesh.

Methods: A representative sample of 75 farmers (50 FLDs and 25 non-FLDs farmers) was selected at random from the villages included in the FLD program.

Result: The disparity between the suggested methodologies in frontline demonstration and the actual practices of farmers regarding blackgram and chickpea cultivation indicates that farmers typically do not employ the recommended technology. The technological disparities between FLD farms and cultural behaviors were minimal. Therefore, it is recommended that further field level demonstrations (FLDs) focused on pulses should be implemented in locations with the potential for pulse production.

Key words: Frontline demonstration, KVK, Pulses, Regression analysis.

INTRODUCTION

Pulses are the most important part of our diet, richest and cheap source of proteins, vitamins, minerals and amino acids besides high nutritional value. Hence, the economic value of these crops is very high. Pulses can be produced with a minimum use of resources and are mostly cultivated under rainfed conditions and do not require intensive irrigation (Sood *et al.,* 2018; Sood *et al*., 2020). Keeping in view large benefits of pulses for human health; the United Nations has proclaimed 2016 as the International Year of Pulses (Sahruzaini *et al*., 2020). Thus, due attention is required to enhance the production of pulses not only to meet the dietary requirement of proteins but also to raise the awareness about pulses for achieving nutritional, food security and environmental sustainability (Sood *et al.,* 2024). The Government of India through Indian Council of Agricultural Research (ICAR) has established a wide network of Krishi Vigyan Kendras (KVKs) in all the rural districts of the country. These KVKs under the aegis of the National Agricultural Research and Education System are the real carriers of frontline technologies and impart knowledge and critical input support for the famers. The frontline demonstration programme (FLDs) in pulses is a unique programme by Ministry of Agriculture, Govt. of India, conducted under close supervision of farm scientists (Jha *et al*., 2012). Main objective of FLDs in pulses is to demonstrate and popularize the improved agro-technology on farmer's fields under varied farming situations for effective transfer of generated technology and fill the gap between improved technology and adopted/indigenous technology to enhance pulse productivity and farms gains for sustaining the production systems especially under rainfed farming (Choudhary *et al.,* 2009). The field demonstrations conducted under the close supervision of scientists of the National Agriculture Research System is called front-line demonstrations. The main objective of frontline demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmers' field under different agro-climatic regions and farming situations.

In Himachal Pradesh, pulses are grown on an area of 31.38 thousand hectares with an annual production of thousand 63.34 MT. The important pulses grown in the state include gram, moong, urd, lentil, rajmash, moth, pea, cowpea, horsegram and lathyrus (Choudhary and Suri, 2014). However, the farmers in the state are getting high income from pulse production by following modern techniques and recommended package of practices. The soaring prices of pulses in the recent years have also

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incentivized the farmers to include pulses in their crop production programme. The Krishi Vigyan Kendra of CSK HPKV, located at Berthin in Bilaspur district has a mandate of promoting pulses. The KVK, Berthin has various programmes and demonstrations on pulses. As a result, the farmers' efforts to produce different pulse crops are increasing, leading to higher production and income. Even with the best efforts, pulse acreage and productivity has been stagnant in Himachal Pradesh (Kumar and Prasher, 2012). The productivity of pulses in the state is quite low compared to national and global acreage, mainly due to their cultivation under rainfed and marginal lands besides poor crop management practices (Choudhary, 2013; Choudhary *et al*., 2009). Besides this, Himachal soils are acidic in reaction with low phosphorous availability, thus adequate supply of phosphorous through fertilizers becomes more critical for pulses which is lacking in the farm practices of resource poor hill farmers generally supplying sub-optimal doses of chemical fertilizers especially phosphorous. Thus, keeping in view the above mentioned facts, the present study was undertaken in Bilaspur district of Himachal Pradesh. It was relevant to take up a study entitled, "Impact of Frontline Demonstration on production and economics of pulses in Himachal Pradesh" with following specific objectives.

Objective

1. To examine the impact of Frontline Demonstrations on production of pulses.
2. To examine the technological gaps in production, management practices and input use pattern of pulses between FLDs and Non-FLDs farmers.

MATERIALS AND METHODS

The present study was based on both primary as well as secondary data. The study was conducted in CSKHPKV, Palampur in the year 2022-23. The secondary data were collected from different reports of KVK, reports of the Department of Agriculture and Directorate of Economics and Statistics. The primary data were collected through well designed and pre-tested schedule by personal interview method. Simple random sampling technique was employed for the selection of farmers covered under FLDs. A manageable sample of 75 farmers (50 FLDs and 25 non-FLDs farmers) was randomly drawn from the villages covered under FLDs.

The technological gap was computed on the basis of difference between the management practices and input usage on progressive/frontier farm and actual management practices and input usage on an average farm. This was computed by using following algorithm:

$$Tg = \frac{(Yf - Ya)}{Yf} \times 100$$

Where,

Tg = Technological gap (%) in input usage.

Yf = Input usage by frontier farmer.

Ya = Actual input usage by average farmer.

Table 1: Frontline demonstrations on pulses.

Crop	Variety	No. of demonstration			Yield (q/ha)					
					2019-20		2020-21		2021-22	
		2019-20	2020-21	2021-22	Demonstration	Check	Demonstration	Check	Demonstration	Check
Blackgram	Him Mash-1	50	60	50	6.10	4.70	6.40	5.30	10.10	9.20
Chickpea	HPG-17	39	50	3	6.10	5.30	8.80	5.90	10.60	8.50
	Himachal Chana-2	4	25	38	6.10	5.10	7.90	5.70	11.20	7.56
	GPF-2	7	33	7	6.10	5.40	9.20	6.50	11.90	8.60
Total		100	168	98						

RESULTS AND DISCUSSION

Frontline demonstration on pulses

The number of frontline demonstration laid down in different villages from year 2019-2022 have been given in Table 1. In demonstration fields pulses were grown according to the package of practices. It can be seen from the table that during the year 2019-20 a total of 100 FLDs were laid down on farmers field. The number of FLDs increased to 168 in 2020-21 and in the year 2021-22 the number of FLDs conducted were 98 only. In 2020-21 and 2021-22 the maximum yield of 9.20 q/ha and 11.90 q/ha, respectively, was recorded in chickpea (GPF-2) whereas in 2019-20 stagnant yield of 6.10 q/ha was recorded under all varieties of pulses (blackgram and chickpea).

Table 2 reveals that transfer of improved farm technology under frontline demonstrations (FLDs) in pulses resulted in invariably higher grain yield of pulses under demonstration plots than farmers plot yield, which may be attributed to the adoption of recommended agro-technologies in FLDs during study period. Choudhary *et al*. (2009) has also reported yield enhancement by the use of recommended agro-technologies in FLDs. The table further reveals that the maximum per cent increase in yield over check was recorded to be 51.10 and 49.20 per cent under chickpea (HPG-17) in 2019-20 and 2020-21, respectively. On the other hand, in 2021-22 the maximum per cent increase in yield over check (48.10%) was recorded in Himachal Chana-2. It also reveals that lowest per cent increase over check in yield was reported in chickpea (GPF-2) in 2019-20, in 2020-21 and 2021-22 lowest per cent increase was reported in blackgram (Him Mash-1).

Extension yield gaps

Extension gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the farmers. The extension gaps in yield of pulses are given in Table 3. Maximum extension gap of 1.40 q/ha was observed in blackgram (Him Mash-1) during 2019-20, 2.10 q/ha gap was observed in chickpea (HPG-17) and 3.64 q/ha in chickpea (Himachal chana-2) during 2021-22. During 2020-21, maximum extension gap of 2.90 q/ha was observed in chickpea (HPG-17) followed by 2.70 q/ha in chickpea (GPF-2). The higher extension yield gaps indicate that there is still a strong need to aware and motivate the farmers for adoption of improved farm technologies in pulses over existing local practices. Refinement in the local farmers practices for higher adoption of location specific generated farm technology for sustaining crop productivity is another option open for the research scientists (Choudhary *et al*., 2009).

Pulses production technological gaps

The gap between the recommended practices in frontline demonstrations and farmers' practices of black gram and chickpea in study area are presented in Table 4, 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. Similar observations in seed treatment gap were also reported by Kumar and Elamathi (2007). Partial gap in time of sowing of black gram was also observed. Farmers had sown the black gram in between June 15th 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. These tables further revealed that farmers did not apply any 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

Table 2: Per cent increase in yield over check.

Crop	Variety	Per cent increase in yield over check		
		2019-20	2020-21	2021-22
Blackgram	Him Mash-1	29.80	20.80	9.80
Chickpea	HPG-17	51.10	49.20	24.70
	Himachal Chana-2	19.60	38.60	48.10
	GPF-2	13.00	41.50	38.40

Table 3: Extension gaps in yield of pulses.

Crops	Variety	Extension gap (q/ha)		
		2019-20	2020-21	2021-22
Blackgram	Him Mash-1	1.40	1.10	0.90
Chickpea	HPG-17	0.80	2.90	2.10
	Himachal Chana-2	1.00	2.20	3.64
	GPF-2	0.70	2.70	3.30

Table 4: Comparison between demonstration package of practices and existing farmer's practices of blackgram and chickpea.

Crop operations	Blackgram			Chickpea		
	Recommended practices demonstrated	Farmers' practice	Gap	Recommended practices demonstrated	Farmers' practice	Gap
Variety	UG-218 and Him mash-1	Local	Full	HPG-17, Himachal channa-2 and GPF-2	Local	Full
Land preparation	Two ploughing	One or two ploughings	Nil	Two ploughing	One or two ploughings	Nil
Seed rate	20 kg/ha	22-25 kg/ha	Higher	40 kg/ha	50-52 kg/ha	Higher
Seed treatment	Rhizobium culture	Nil	Full	Rhizobium culture	Nil	Full
Method of sowing	Line sowing at 30 cm row spacing	Broadcasting	Full	Line sowing at 30 cm row spacing	Broadcasting	Full
Time of sowing	June end to July beginning	June15th to June 30th	Partial	Mid October	Mid October	Nil
Fertilizer dose	20:40:20 kg NPK per ha	No fertilizer or urea only	Full	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	Kera	Broadcast at the time of sowing	Full
Weed management	Pendimethalin application @ 1.5 l ai/ha	No or one hand weeding	Full	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	Need based pesticide and fungicide application	No pesticide and fungicide application	Full
Irrigation	Rain fed	Rain fed	Nil	Rain fed	Rain fed	Nil

in improved technologies and farmer's practices were also observed by Burman *et al*. (2010) in different crops.

Production and productivity of major crops

The quantum of various types of crops raised on the farm highlights the economic prosperity and soundness of the farming as occupation. Therefore, the production of major crops on per farm basis has been worked out and displayed in Table 5. It was noticed from the table that among FLD farmer's maize gave the maximum production of 7.12 quintal per farm on an average farm followed by wheat (6.48 q/farm) and vegetables (2.61 q/farm). The per farm production of pulses was recorded to be quite low. The table further reveals that in case of Non-FLD farms production of maize was 2.92 q/farm and that wheat (2.52 q/farm). Among pulse crops in case of FLD farmers the per farm production was highest in case of chickpea (1.99 q) followed by blackgram (1.69 q), lentil (1.54 q), respectively. Whereas, in case of Non-FLD farmers per farm production was maximum in case of blackgram (0.30 q) followed by chickpea (0.27 q), lentil (0.20 q), respectively.

Technological gap in production of pulses

Technological gap with respect to management practices in the process of production and existing practices of a particular crop indicates the per cent difference in the recommended and existing practices. The technological gap in respect of utilization of various inputs and performing of various cultural practices in the cultivation of pulses has been worked out and is given in Table 6 and Table 7. An overview of the table reveals that on FLD farms the highest technological gap was observed with respect to method of sowing on FLD farms and on Non-FLD farms technological gap was observed to be highest with respect to seed rate. The seed treatment was another practice where significantly high gap was observed on Non-FLD farms. No gap was observed in FLD farms with respect to the use of improved varieties they used seeds of hybrid varieties whereas the gap was recorded to be high (76%) in opting for hybrid seed varieties in Non-FLD farms. Around 24 per cent of gap was observed in case of seed treatment on FLD farms as against of 72 per cent in Non-FLD farms, respectively. Lack of knowledge and ignorance among farmers may be the major reason for this gap. A significantly high gap to the extent was observed for seed rate, land preparation method of fertilizers application, fertilizers doses on Non-FLD farms. It can, therefore, be concluded from the table that the technological gaps with respect to all the cultural practices were lower on Non-FLD farms, as the FLD farmers were having the deep practical knowledge regarding latest cultural and management practices of pulses production and were found to be comparatively more cautious regarding the raising crops in their farms.

Technological gap can be defined as the per cent difference in the recommended and existing practices in the process of crop production. Here an attempt has been

Table 5: Production and productivity of major crops.

Crops	FLD farmers		Non-FLD farmers	
	Production (q/farm)	Productivity (q/ha)	Production (q/farm)	Productivity (q/ha)
Maize	7.12	29.32	2.92	17.00
Wheat	6.48	21.92	2.52	18.75
Fodder	2.09	20.34	1.10	13.88
Vegetables	2.61	28.63	2.40	21.92
Pulses				
Blackgram	1.69	4.22	0.30	2.44
Chickpea	1.99	5.24	0.27	2.54
Lentil	1.54	4.49	0.20	2.35

Table 6: Technological gap in management practices of pulses.

Recommended practices	Per cent of farmers following recommended practices		Technological gap (%)	
	FLD	Non-FLD	FLD	Non-FLD
Improved variety	100	24	Nil	76
Land preparation	70	40	30	60
Seed rate	84	20	16	80
Seed treatment	76	28	24	72
Method of sowing	62	36	38	64
Time of sowing	90	60	10	40
Fertilizer dose	64	40	36	60
Method of fertilizer application	86	32	14	689
Weed management	78	52	22	48
Plant protection	94	60	6	40

Table 7: Technological gap in input use under FLD and Non-FLD farmers.

Particulars	Units	Recommended			Existing use/application			Technological gaps (%)		
		Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil
FLD farmers										
Seed	kg/ha	25	50	40	20.00	42.10	32.43	20.00	16.00	20.00
FYM	q/ha	50	50	50	33.00	25.79	27.30	34.00	48.00	46.00
Fertilizers	kg/ha	140	140	140	99.25	104.74	101.35	29.10	25.00	27.85
Fungicides	No.	2	2	2	1.46	1.72	1.32	27.00	14.00	34.00
Insecticides	No.	2	2	2	1.41	1.68	1.23	29.50	16.00	38.50
Non-FLD farmers										
Seed	kg/ha	25	50	40	17.66	23.72	26.22	32.00	52.00	35.00
FYM	q/ha	50	50	50	20.83	22.00	21.77	58.00	56.00	56.46
Fertilizers	kg/ha	140	140	140	88.54	94.58	95.24	38.57	32.44	31.97
Fungicides	No.	2	2	2	1.12	1.02	1.21	44.00	49.00	39.50
Insecticides	No.	2	2	2	1.23	1.41	1.36	38.50	29.50	32.00

made to study the technological gap with respect to different agronomic practices *viz*., seed rate, farm yard manure, fertilizer application, plant protection measures and irrigation. The technological gaps in pulses cultivation on FLD and Non-FLD farms were computed to know the extent of adoption of technology and deviation from the recommended level.

The technological gap in respect of use of inputs such as seeds, farm yard manure, fertilizers doses and application of plant protection measures for FLD and Non-FLD farms is given in Table 7. It is observed that the technological gap in use of seeds was highest in Non-FLD farms and in FLD farms it was less than the Non-FLD farms. This infers that the FLD farmers were comparatively closer to the recommended practice with respect to seed rate. Again the technological gaps were positive in both the cases which show that both the farm groups were using lesser seed as compared to the recommended. Similarly, a positive and very high technological gap was observed in case of FYM use on both the farms. The farmers used FYM in different crops on the basis of availability of FYM and the quantity of FYM used in the previous crop. They did not keep the recommendations in mind. In case of the fertilizers, higher technological gaps were recorded in FLD farmers than Non-FLD farmers. So far as the plant protection measures were concerned very less technological gaps were observed with respect to the number of sprays of insecticides and fungicides on FLD farmers under study however significantly high gaps were found on Non-FLD farmers. It can be concluded from the table that all the inputs were below their recommended levels more on Non-FLD farmers which indicated that there lies sufficient scope to enhance yields by increasing the use of these inputs.

CONCLUSION

The potential of pulses to help and address the future food security, nutritional and environmental sustainability needs has been acknowledged through UN declaration 2016 as international year of pulses. The findings of the study reveals that pulses are also the integral part of farmers; cropping pattern. Therefore, it is required that more number of FLDs on pulses must be laid down in the areas having potential of pulse production. There is an urgent need of narrowing down the technological gaps in pulses production in seed rate, method of sowing and plant protection measures in pulse production by bringing more number of farmers under the ambient trainings under required pulse production technologies. More area under production of pulse must be brought by providing incentives to the farmers such as improved seeds and other extension advisory services on weed/pest control and nutrient management. Policymakers should strengthen extension services, ensure timely availability of quality seeds and promote improved agronomic practices through training programs. Financial support, including input subsidies and low-interest credit, can encourage technology adoption. Investing in post-harvest infrastructure and market linkages will enhance profitability and sustainability, bridging technological gaps and improving yields.

Conflict of interest

Authors declare no conflict of interest.

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