Impact of Front-Line Demonstration on Pulses Productivity and Profitability in Farmers Fields

ABSTRACT

Front-Line Demonstration (FLD) is a long-term educational activity carried out systematically by agricultural experts in the field of farmers to demonstrate the value of new practices/technologies in the micro-agriculture situation. The aim of the FLD was to demonstrate improved pulses technologies for production potential. Improved technologies include the use of improved varieties, seed treatment with Rhizobium and PSB culture, sowing methods, balanced fertilizer application and improved pest control techniques. The results of pulses harvested crop in 2021-2022 showed that improved varieties with improved practice packages recorded a higher yield compared to farmers' practices. The improved technologies saw yield increases of 26.33 %, 24.63 %, 23.41 % and 22.83 % yield increase over farmer practices in green gram, chick pea, pigeon pea and black gram respectively. The average percentage yield increased by 24.30 % over farmers' practices. The mean technological yield gap was highest for chickpea (3.47 q/ha), followed by pigeon pea (1.36 q/ha), green gram (1.34 q/ha) and black gram (1.26 q/ha). The maximum mean extension yield gap in the study was recorded in pigeon pea at 11.83 q/ha followed by black gram (5.22 q/ha) and green gram (3.57 q/ha), while the lowest extension yield gap was observed in chickpea (2.44 q/ha). The technology index varied between 7.16 and 17.35% while the lowest (7.16) was recorded for pigeon pea**.** The highest gross return (Rs. 81,654/ha), net return (Rs. 56,370/ha) and benefit-to-cost ratio (3.23) was recorded with chickpea demonstration followed by Black gram and green gram while lowest gross return (Rs. 44,848/ha), net return (Rs.24,634 /ha) and benefit cost ratio (2.22), which was markedly higher than gross return (Rs. 36,342/ha), net return (Rs.16,430/ha) and benefit cost ratio (1.83) in farmers practice. The improved technologies yielded a higher gross return and, net return with a higher benefit-to-cost ratio than farmers' practices.

Keywords: Pulses; yield; technology gap; extension gap; technology index and economic returns and FLDs.

1. INTRODUCTION

India produces the most pulses in the world, in terms of quality and variety. Impoverished and vegetarian individuals comprise the majority of the Indian Population. Pulses are the primary source of proteins. While a pulse crop is almost always included in the traditional cropping pattern, either as a mixed crop or in rotation, the commercialization of agriculture has favored sole cropping. 'India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses worldwide. Although it is the world's largest pulse producer, India is importing 4-6 million tons (MT) and consumer (26-27 MT) of pulses every year to meet its domestic demand' [1]. The use of ancient varieties, greater seed rates, dissemination of sowing methods, and biotic/abiotic challenges in a specific region or area are all factors that contribute to low pulse productivity. As a result, there is a need to raise awareness within the farming community in order to popularize location-specific enhanced varieties to boost pulse crop yield and productivity in a certain region or area. Farmers and agricultural researchers have initiated many initiatives to boost legumes production and productivity. As a result, policymakers, farm scientists, extension officials, and farming communities face a significant challenge in increasing pulse yield and diversifying cropping systems to fulfill national and local pulse requirements.

Front-line demonstration (FLD) of pulses is a unique approach to providing a direct interface between researchers and farmers, as the scientists are directly involved in planning, execution and monitoring of demonstrations for technologies they have developed and receive direct feedback from farmers' field about production in general, and the technology being demonstrated. With the above facts in mind, intensive intervention was carried out, such as front-line demonstrations, to transfer the generated farm technology through FLDs in pulses under trial belt in a specific region or area, with the goals of increasing productivity, profitability and closing the extension yield gaps. In this comprehensive study, technological extension yield gaps under pulses are also discussed to develop a suitable extension plan for effective technology transfer to target farmers in the district of Buldana.

2. METHODOLOGY

The Krishi Vigyan Kendra, Jalgaon Jamod, District Buldana, Maharashtra, considered the front-line demonstration on pulses crop in four villages of the Jalgaon (Ja) tahsil for the studies in 2021-2022, which were put out in adopted villages. Front-line demonstrations were held in four adopted communities with 60 ha area and each with 150 farmers and a 0.4 hectare field (Table 1).

The crop cutting methodology was used to acquire primary data on grain yield farmer practices, which was followed by personal interviews with the beneficiaries. Farmers were educated on the proposed technologies to be demonstrated before receiving the key input through a training session. In front-line demonstrations at various sites, quality seeds of improved varieties, seed treatment, recommended fertilizer doses, Rhizobium, PSB biofertilizer, and plant protection management were exhibited in the farmer's field. In the case of local checks, the standard procedures were followed. All major farm operations were conducted under the supervision of KVK scientists who regularly visited the property. Information was gathered from front-line demonstration fields as well as control fields (farmer practices), and the technology gap, extension gap and technology index were determined using the formula:

Table 1. Details of front line demonstration on pulses

Sr. No.	Crops	Variety	Name of Village	Tahsil and District	Area (ha)	No. of FLD's
1	Black gram	AKU-10-1	Nimgaon	Jalgaon tahsil, Buldana district	10	25
2	Green gram	BM-2003-2	Wadgaon	Jalgaon tahsil, Buldana district	10	25
3	Pigeon pea	PKV-Tara	Bhedwad	Jalgaon tahsil, Buldana district	20	50
4	Chick pea	Phule-Vikram	Asalgaon	Jalgaon tahsil, Buldana district	20	50
Total					60	150

Extension Gap (q/ha) = Demonstration Yield – Check Yield

Technology Gap (q/ha) = Potential Yield – Demonstration Yield

Technology Index (%) = Technology Gap / Potential Yield X 100

3. RESULTS AND DISCUSSION

Table 2 reveals that farmers did not implement a single suggested practice in the pulses crop, despite the technologies used in FLDs and practices adopted by farmers' in control plots.

3.1 Grain Yield

During 2021-2022 frontline demonstrations carried pulses in farmers' fields Table 3 showed that green gram grain yield was increased 26.33 percent over local control plots followed by 24.63 %, 23.41 % and 22.83 % by chickpea, pigeon pea and black gram. An average 24.30 % increase grain yield of pulse crops over local control plots during the study year. The results showed that the front-line demonstration had a good impact on the farming community of Buldana district as it was motivated by the new agricultural technologies applied to the FLD plot. The finding agrees with that of Singh et al [2].

3.2 Extension & Technology Gap

The yield of the demonstration trials and the potential yield of the crop were compared with estimated yield gaps, which were further categorized into technology and extension gaps (Table 4). The technological gap shows between demonstrated yield and the potential yield of black gram and it was the maximum (3.43 q/ha) observed in 2021-2022 for chickpea followed by pigeon pea (1.36 q/ha), green gram (1.34 q/ha) and black gram (1.26 q/ha). 'The overall average technology gap was 1.86 q/ha across all pulse crops. The observed technological gap can be attributed to different soil fertility states, rainfall distribution, disease, pest infestation, and annual changes in the demonstration plot locations' [3].
In addition, the maximum extension gap of 11.83 q/ha was recorded in the 2021-2022 pigeon pea, followed by black gram (5.22 q/ha), green gram (3.57 q/ha) and chickpea (2.44 q/ha). The average total elongation gap was 5.77 q/ha across all pulses. Table 4 also shows that the technology index varied from 7.16 to 17.35 % of black gram, green gram, pigeon pea and chickpea and the average technology index overall was 12.10 % across all pulses. The lower the value of the technology index, the more the feasibility is proven, where as poor field establishment in early vegetative phase due to water stress in rainfed agriculture with uneven distribution of rainfall, long drought and increasing pressure from diseases and insect pests are the possible reasons for poor yields causing higher technology indices [4] [6].

3.3 Economic Return

The economics of improved technologies versus farmer' practices were calculated as a function of the prevailing input and output prices (Table 5). It was found that cost of cultivation of pulse crops varied from Rs. 17,877 to Rs. 25,284/ha with an average of Rs. 20,441/ha of demonstration against the variation cultivation cost of Rs. 16,737 to Rs. 26,114/ha with an average of Rs. 20,032/ha in farmer practice. The cultivation of pulse crops under demonstration gave an average net return Rs. 33,014/ha compared to farmers' practice which recorded Rs. 22,967/ha. The average cost-benefit ratio of 2.57 was found under demonstration compared to 2.11 in farmers' practice. This may be due to higher yields obtained at demonstrations compared to farmers practice [7].

Table 2. Difference between technological intervention and farmers practices for pulses

Crop	Component	Demonstration plots	Farmers plots
Blank gram	Variety	AKU-10-1	Local variety
	Seed rate	10 kg/ha	12 kg/ha
	Seed treatment	seed treatment with Rhizobium culture @ 250 ml/10 kg seed + PSB @ 250 ml/10 kg seed and Trichoderma 1.25kg /10 kg seed	No seed treatment
	Sowing time	Last week of June to First fortnight of July	As per mansoon
	Fertilizer does	On the basis of soil testing report chemical fertilizers used	Overdoses of fertilizers
	Plant protection	Need based application under technical guidance	Indiscriminate use
Green gram	Variety	BM-2003-2	Local variety
	Seed rate	10 kg/ha	12 kg/ha
	Seed treatment	seed treatment with Rhizobium culture @ 250 ml/10 kg seed + PSB @ 250 ml/10 kg seed and Trichoderma 1.25kg /10 kg seed	No seed treatment
	Sowing time	Last week of June to First fortnight of July	As per mansoon
	Fertilizer does	On the basis of soil testing report chemical fertilizers used	Overdoses of fertilizers
	Plant protection	Need based application under technical guidance	Indiscriminate use
	Variety	PKV-Tara	Local variety

Pigeon pea	Seed rate	12 kg/ha	15 kg/ha
	Seed treatment	seed treatment with Rhizobium culture @ 250 ml/10 kg seed + PSB @ 250 ml/10 kg seed and Trichoderma 1.25kg /10 kg seed	No seed treatment
	Sowing time	Last week of June to First fortnight of July	As per mansoon
	Fertilizer does	On the basis of soil testing report chemical fertilizers used	Overdoses of fertilizers
	Plant protection	Need based application under technical guidance	Indiscriminate use
Chick pea	Variety	Phule-Vikram	Local variety
	Seed rate	60 kg/ha	75 kg/ha
	Seed treatment	seed treatment with Rhizobium culture @ 250 ml/10 kg seed + PSB @ 250 ml/10 kg seed and Trichoderma 1.25kg /10 kg seed	No seed treatment
	Sowing time	First fortnight of October	As per soil moisture
	Fertilizer does	On the basis of soil testing report chemical fertilizers used	Overdoses of fertilizers
	Plant protection	Need based application under technical guidance	Indiscriminate use

Table 3. Grain yield analysis of front line demonstration on pulses

Crops	Area (ha)	No. of farmers	Yield qt/ha			% increase over farmer practices
			Potential	FLD plots	Farmer practices	
Black gram	10	25	12	6.78	5.52	22.83
Green gram	10	25	10	6.43	5.09	26.33
Pigeon pea	20	50	19	7.17	5.81	23.41
Chick pea	20	50	20	17.56	14.09	24.63
Mean				9.49	7.63	24.30

Table 4. Gap analysis of front line demonstration on pulses

Crops	Technology gap (qt/ha)	Extension gap (qt/ha)	Technology index (qt/ha)
Black gram	1.26	5.22	10.50
Green gram	1.34	3.57	13.40
Pigeon pea	1.36	11.83	7.16
Chick pea	3.47	2.44	17.35
Mean	1.86	5.77	12.10

Table. 5 Economics analysis of demonstrated plots and farmers practices of pulses

Crops	Av. Cost of cultivation (Rs/ha)		Av. Gross return (Rs/ha)		Average net return (Rs/ha)		B;C ratio	
	Demo. Plots	farmers practices	Demo. Plots	farmers practices	Demo. Plots	farmers practices	Demo. Plots	farmers practices
Black gram	18390	17364	44816	36487	26426	19123	2.44	2.10
Green gram	17877	16737	42502	33645	24625	16908	2.38	2.01
Pigeon pea	20214	19912	44848	36342	24634	16430	2.22	1.83
Chick pea	25284	26114	81654	65519	56370	39405	3.23	2.51
Mean	20441	20032	53455	42998	33014	22967	2.57	2.11

4. CONCLUSION

It is concluded that the FLDs program is an effective tool to increase pulses area, production and productivity and to change farmers' knowledge, attitude and skills in relation to the adoption of improved technologies. The results convincingly showed that the pulse yield can be increased by intervention in recommended practices package. This also improved links between farmers and scientists-built confidence in the adoption of the improved technology. The increase in productivity among FLDs over pulses growing practices created greater awareness, and motivated other non-pulsed growers to adopt improved technologies. These practices can be popularized in this area to fill the extension agencies and bridge the larger extension gaps.

DISCLAIMER

Some part of this manuscript was previously presented in the conference: 3rd International Conference IAAHAS-2023 "Innovative Approaches in Agriculture, Horticulture & Allied Sciences" on March 29-31, 2023 in SGT University, Gurugram, India. Web Link of the proceeding: https://wikifarmer.com/event/iaahas-2023-innovative-approaches-in-agriculture-horticulture-allied-sciences/

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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