RESEARCH ARTICLE

YIELD AND ECONOMICS OF URDBEAN (*VIGNA MUNGO* L. *HEPPER*) AS INFLUENCED BY FRONT LINE DEMONSTRATIONS IN BUDAUN DISTRICT OF UTTAR PRADESH

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Abstract: Front Line Demonstrations (FLDs) were conducted during *Kharif* seasons from 2011 to 2017 (07 years) at the farmers' fields of different villages of Budaun district of Uttar Pradesh by scientists of Krishi Vigyan Kendra, Ujhani (Budaun) under Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.). Total 128 front line demonstrations in 50 ha area were conducted to evaluate the effect of front-line demonstrations on yield and economics of urdbean crop. Results of FLDs indicated that the cultivation practices comprised under FLDs *viz.*, use of improved variety (PU-31), balanced application of fertilizers, line sowing, timely weed management and control of insect pests through fungicide & insecticide, produced on an average 910 kg/ha urdbean grain yield, which was 20.6 per cent higher compared to prevailing farmers practice (754 kg/ha). The extension gaps ranged from 86 to 220 kg/ha during the period of demonstration with average 157 kg/ha. The technology gap was maximum (619 kg/ha) in the year 2015 and minimum (336 kg/ha) in the years of 2013 with average value of 490 kg/ha. The data revealed that minimum technology index value 24.0 per cent was noticed in the year 2013 followed by 25.7 per cent in 2012 whereas, maximum value of technology index of 44.2 per cent in the year 2015. The FLDs recorded higher average gross returns (Rs. 41807/ha) and net return (Rs. 26369/ha) and B: C ratio (2.78) with slightly higher investment on cost of cultivation (Rs. 1339/ha) as compared to farmers' practice. It is observed that majority of the respondent farmers expressed high (52.34%) to the medium (31.25%) level of satisfaction regarding the performance of urdbean under demonstrations. Whereas, very few (16.41%) of respondents expressed lower level of satisfaction. The higher to medium level of satisfaction with respect to performance of demonstrated technology indicate stronger conviction, physical and mental involvement of in the frontline demonstration which in turn would lead to higher adoption.

Keywords: Client Satisfaction Index, Front line demonstration, Integrated crop management, Productivity, Profitability

INTRODUCTION

India is the largest producer, consumer, importer and processor of pulses in the world. Ironically, the country's pulse production has been hovering around 14–15 million tonnes, coming from a near-stagnated area of 22–23 million hectare, since 1990–91. For meeting the demand of the growing population, the country is importing pulses to the tune of 2.5–3.5 million tonnes every year. Strong upward trend in the import of pulses is a cause of concern, since an increase in demand from India has shown to have cascading effect on international prices, thus draining the precious foreign exchange. By 2050, the domestic requirements would be 26.50 million tonnes, necessitating stepping up production by 81.50%, i.e., 11.9 million tonnes additional produce at 1.86% annual growth rate (Ali and Gupta, 2012). This uphill task has to be accomplished under more severe production constraints, especially abiotic stresses, abrupt climatic changes, emergence of new species/ strains of insect-pests and diseases, and increasing deficiency of secondary and micronutrients in the soil. This requires a two-pronged proactive strategy, i.e., improving per unit productivity and reducing cost of production. The growing demand of about 20 million tonnes of pulses by 2012 and 28 million tonnes by 2025 can be realized only by adopting increasingly more productive technologies along with sustained developmental efforts and favourable Government policies.

In terms of agricultural importance, pulses are next to cereal crops and are also known as excellent option for agriculture diversification and intensification in sustainable farming. Pulses are an important group of food crops that can play a vital role to address national food and nutritional security and also tackle environmental challenges. The share of pulses to total food grain basket is around 9-10 per cent and is a critical and inexpensive source of plant-based proteins, vitamins and minerals. Pulses are critical in food basket (dal-roti, dal-chawal), are a rich source of protein (@20-25 per cent, it is double the protein content of wheat and thrice that of rice) and help address obesity, diabetes malnutrition etc.

In addition to their nutritive value, by virtue of broad genetic diversity in food legumes and climate resilience to sustain well in adverse weather situations, the Government of India is also targeting to address agrarian challenges by adopting income-based agriculture. The goal is to double farmers' income by 2022. In India food grains occupy 65 per cent of total gross cropped area comprising cereals in 50% and pulses in about 15%. Within pulses, gram occupies 5% area followed by urdbean 3%, arhar 2%

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and mungbean 2%. Other pulses cover about 3% of gross cropped area. Under individual crop category, gram with 46 per cent production share in total pulses is the highest contributor followed by arhar (17%), urdbean (13%) and mungbean (8%).

Urdbean is the third most important pulse crop of India after chickpea and pigeon pea, which is grown in various agro-ecological conditions under diverse cropping systems. It is grown throughout the country and during 2017-18 the crop was cultivated over an area of 50 lakh ha. The success of this crop was released with a harvest of about 35 lakh tonnes at an ever-highest yield levels of 352 kg/ha. More than 90 per cent of urdbean production comes from 09 states of Madhya Pradesh, Rajasthan, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Maharashtra, Jharkhand, Gujarat and West Bengal. However, in Uttar Pradesh it occupied an area of 6.14 lakh ha with production of 3.15 lakh tonnes and average productivity was 653 kg/ha (Anonymous, 2018-19). Though, urdbean has been cultivation since long time but its productivity is not achieved up to its genetic potential of 1400 kg/ha. However, improved varieties of urdbean crop with ICM practices hold promise to increase productivity by 20–25 % yield advantage over the farmers' practices in a large number of frontline demonstrations conducted across the country (Ali and Gupta, 2012).

Hence, improved production technology with full package of practices was demonstrated at farmers' field to augment the urdbean productivity. Therefore, newly released resistant to biotic stress variety was evaluated at farmers' field to match the appropriate variety for agro-climatic condition. Keeping these facts in view, demonstrations were conducted to assess the impact of front-line demonstrations on productivity and profitability of urdbean in Mid Western Plain Zone of Uttar Pradesh under famers' conditions.

MATERIALS AND METHODS

The present study was carried out by the Krishi Vigyan Kendra, Ujhani (Budaun) under Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) during *Kharif* seasons from 2011 to 2017 (07 years) at the farmers' fields of different villages of Budaun district in Mid Western Plain Zone of Uttar Pradesh. In total 128 frontline demonstrations in 50 ha area in different villages were conducted. Materials for the demonstrations with respect to FLDs and farmers' practices were given in Table 1. In case of farmers practice plots, existing practices being used by farmers were followed. In general, the soils of this region are light in texture, with slightly alkaline in reaction (pH 7.7) and was low in organic carbon (0.30%) and medium in phosphorus (39 kg P_2O_5 ha^{-1}) and low in potassium (143 kg ha^{-1}) and suitable for cultivation of pearl millet, urdbean, mungbean, mustard, potato, wheat etc. The temperature ranges from 4.5 ^{0}C to 45.4 ^{0}C with annual average rainfall 861 mm.

The FLDs were conducted with the objective to transfer the improved technology for increase the productivity of urdbean through demonstrations with full package of practices including improved variety, seed treatment, use of biofertilizers, recommended dose of FYM & fertilizers, timely weed, water & pest management and compared with farmers practice in the area. All the partner farmers were trained on improved production technology of urdbean. The details of inputs and package of practices used in FLDs are given in Table-1.

Table 1. Details of package of practices followed in the Front-Line Demonstrations

S. No.	Inputs/particulars	Quantity per hectare	
		Demonstration	Farmers practice
1	Variety	PU-31	Type-9
2	Seed rate	20 kg	20 kg
3	Single Super Phosphate (SSP)	250 kg	-
4	Di-ammonium phosphate (DAP)	-	100 kg
5	Urea	45kg	-
6	Muriate of potash	65 kg	-
7	Zinc Sulphate (21%)	15 kg	-
8	Rhizobium culture	500 gm	-
9	Carbendazim	2 gm/kg seed	-
10	Metasystox	1.25 litre	1.00 litre
11	Pendimethalin	3.3 litres	-
12	Weeding	Use of Pendimethalin	Manual weeding

The crop was sown after the onset of monsoon in the month of July. The inputs for demonstrations were supplied to the farmers. Farmers were advised to timely sowing by using optimum seed rate with proper seed treatment by Carbendazim @ 2 gm/kg seed along with recommended package of practices for cultivation of urdbean.

Full dose of phosphorus, potash and zinc sulphate through fertilizers (SSP & DAP for N & P, muriate of potash for K and zinc sulphate hepta hydrate for Zn) were applied as basal at the time of sowing. To control weeds, Pendimethalin @ 3.3 litres per hectare was sprayed with the volume of 650 litres of water just after sowing of crop in all demonstrated plots and farmers done one manual weeding in farmers practice plots. Plant protection measures were under taken as per need of the crop.

Finally yield data of demonstrations and farmers practices were collected on the equal area. The data collected were tabulated and statistically analyzed to interpret the results. The economic-parameters (gross return, net return and B: C ratio) were worked out on the basis of prevailing market prices of inputs and Minimum Support Prices of outputs.

The technology gap, extension gap and technology index were calculated using the following formulae given by (Samui *et al*., 2000).

Extension gap = Demonstration yield - Yield under existing farmers' practice

Technology gap = Potential yield - Demonstration yield

Technology index = {(Potential yield - Demonstration yield)/Potential yield} x 100

The satisfaction level of beneficiaries' as well as neighboring farmers for the performance of front-line demonstrations was also assessed. In all, 128 participating farmers' were selected to measure satisfaction level of farmers' for the performance of the technology demonstrated. The selected respondents were interviewed personally with the help of a pre-tested and well-structured interview schedule. The farmer's satisfaction level was calculated with following formulae.

Client satisfaction index = (Individual score obtained/ Maximum score possible) x 100

RESULTS AND DISCUSSION

Effect on yield:

The data (Table 2) indicated that the frontline demonstration has given a good impact over the farming community of Budaun district as they were motivated by the new agricultural technologies applied in the demonstrations. Results of 128 frontline demonstrations indicated that the cultivation practices comprised under FLDs *viz*., use of improved variety (PU-31), balanced application of fertilizers, line sowing, timely weed management and control of insect pests through fungicide & insecticide, produced on an average 910 kg/ha urdbean grain yield, which was 20.6 per cent higher compared to prevailing farmers practice (754 kg/ha).

Ali and Gupta (2012) also reported that improved varieties of urdbean under front line demonstrations were conducted during the years of 2006-2009 across the country and found yield advantage of 21.9 % over local checks. From these results it is evident that the performance of urdbean was found better when crop was grown under integrated crop management practices including good quality seed of improved variety than the prevailing farmers practice under real farm situations. Farmers were motivated by results of demonstrations of integrated crop management practices in urdbean and they would adopt these technologies in the coming years.

Similarly, Kumar *et al*. (2019) also reported 0.83 to 14 q/ha grain yield of different pulse crops under demonstrations as compared to 0.72 to 8.40 q/ha in farmer's practices. The per cent yield increase of chickpea crop was 28.57 to 30.28% in the similar dry areas was also reported by Kumar *et al*. 2018.

Table 2. Yield of urdbean under FLDs at farmers' fields

Year	Yield (kg/ha)		Yield increase over FP (%)	Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index (%)
	Demonstration	Farmers practice				
2011	980	780	25.6	200	420	30.0
2012	1040	820	26.8	220	360	25.7
2013	1064	868	22.6	196	336	24.0
2014	876	754	16.2	122	524	37.4
2015	781	662	18.0	119	619	44.2
2016	797	711	12.1	86	603	43.1
2017	834	680	22.6	154	566	40.4
Average	**910**	**754**	**20.6**	**157**	**490**	**35.0**

Effect on Extension gap, Technology gap and Technology index:

The extension yield gap was the difference observed between demonstrations technology and farmers practices in the respective crop (Table 2). The extension gaps ranged from 86 to 220 kg/ha during the period of demonstration with average 157 kg/ha, which emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinuance of old varieties with the new

technology. According to Parihar *et al*. (2018), the average extension yield gap in lentil crop was 1.83q/ha under demonstrations which resulted in higher grain yield as compared to farmers practices.

The results (Table 2) further indicated that of front-line demonstrations and potential yield of PU-31 were compared to estimate the yield gaps which were further categorized into technology gap and technology index. The technology gap shows the wide gap in the demonstration yield over potential yield of urdbean. The technology gap was maximum (619 kg/ha) in the year 2015 and minimum (336 kg/ha) in the years of 2013 with average value of 490 kg/ha. The observed technology gap may be attributed to dissimilarities in their soil fertility, uneven & erratic rainfall and vagaries of weather conditions in the area as well as management of the farmers.

Technology index shows the feasibility of the technological package at the farmer's field. The lower the value of technology index more is the feasibility. The data (Table 2) revealed that minimum technology index value 24.0 per cent was noticed in the year 2013 followed by 25.7 per cent in 2012 whereas, maximum value of technology index of 44.2 per cent in the year 2015. The variation in technology index may be due to uneven & erratic rainfall and vagaries of weather conditions in the area.

The hypothesis proposed by Ram *et al*. (2014) and Dayanand *et al*. (2014) are in conformity with the present findings.

Effect on Economics:

The economics (Cost of cultivation, gross & net return and B: C ratio) of urdbean under front line demonstrations were estimated and the results have been presented in Table- 3. Economic analysis of the yield performance revealed that besides higher production, FLD partner farmers fetched better price of their produce as compared to the prevailing farmers practice in all the years. This is so because of better quality of the produce. The front-line demonstrations recorded higher average gross returns (Rs. 41807/ha) and net return (Rs. 26369/ha) and B: C ratio (2.78) with slightly higher cost of cultivation (Rs. 15439/ha) as compared to farmers' practice. The average increase in gross return, net return, B: C ratio and cost of cultivation was 20.3, 27.7, 9.9 and 9.5 per cent, respectively over farmers practice.

Similarly, increasing in monetary returns and benefit: cost ratio in pulses crops have been also reported by earlier workers (Ram *et al*., 2014; Dayanand *et al*., 2014; Lathwal, 2010).

Table 3. Economics of urdbean under FLDs at farmers' fields

Year	Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)	
	Demonstration	Farmers practice	Demonstration	Farmers practice	Demonstration	Farmers practice
2011	11290	10118	32340	25740	21050	15622
2012	12680	11200	44720	35260	32040	24060
2013	13350	11780	46284	37758	32934	25978
2014	15150	14625	40515	34873	25365	20248
2015	17400	15750	39050	33100	21650	17350
2016	18350	16925	43038	38394	24688	21469
2017	19850	18300	46704	38080	26854	19780
Average	**15439**	**14100**	**41807**	**34744**	**26369**	**20644**

Further, data (Table 4) shows that the average additional cost of cultivation (Rs. 1339/ha) under integrated crop management demonstrations and has yielded additional net returns of Rs. 5725 per hectare with incremental benefit cost ratio of 0.25. The results suggest that higher profitability and economic viability of urdbean demonstrations under local agro-ecological situation. Similar results were also reported by Islam *et al*. (2011).

Table 4. Additional economic performance of urdbean under FLDs at farmers' field

Year	Additional Cost of cultivation (Rs./ha) in Demonstration	Additional Return (Rs./ha) in Demonstration	B : C Ratio	
			Demonstration	Farmers practice
2011	1172	5428	2.86	2.54
2012	1480	7980	3.53	3.15
2013	1570	6956	3.47	3.21
2014	525	5118	2.67	2.38
2015	1650	4300	2.24	2.10
2016	1425	3219	2.35	2.27

2017	1550	7074	2.35	2.08
Average	**1339**	**5725**	**2.78**	**2.53**

Farmer's satisfaction:

The extent of satisfaction level of respondent farmers over performance of demonstrated technology was measured by Client Satisfaction Index (CSI) and results presented in Table 5. It is observed that majority of the respondent farmers expressed high (52.34%) to the medium (31.25%) level of satisfaction regarding the performance of urdbean under demonstrations. Whereas, very few (16.41%) of respondents expressed lower level of satisfaction. The higher to medium level of satisfaction with respect to performance of demonstrated technology indicate stronger conviction, physical and mental involvement of in the frontline demonstration which in turn would lead to higher adoption.

According to Islam *et al*. (2011) the variation in agro-climatic parameters as well as locations of FLD programme was effective in changing the attitude, skill and knowledge of the farmers for adoption of improved technology/HYV of urdbean and further wide scale diffusion to the other farmers. It also improved the relationship between the farmers and scientist and built confidence between them.

Table 5. Extent of farmer's satisfaction over performance of demonstrated technology

Satisfaction level	Number	Per cent
High	67	52.34
Medium	40	31.25
Low	21	16.41

*****(n=128)

CONCLUSION

It may be concluded that integrated crop management technology in urdbean has found more productive, profitable and feasible in Mid Western Plain Zone of Uttar Pradesh as compared to prevailing farmers' practice. Farmers were motivated by results of demonstrations of integrated crop management practices in urdbean and they would adopt these technologies in the coming years. This should be brought to the access of farmers through transfer of technology centres like KVKs.

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