Original Research Article

Boosting summer moong production through frontline demonstration in Tarn Taran district of Punjab

ABSTRACT

The present study was conducted to boost summer moong crop during summer season of 2017and 2018 with 130 front line demonstration (FLD's) covering an area of 50 hectare (ha) in Tarn Taran district of Punjab to aware the farmers about improved agricultural technology in real farm situations. The results were compared between FLD and control plots. Latest crop production and protection technologies with improved summer moong varieties (SML 668 and SML 832 during 2017 and 2018, respectively) resulted in average increase in the yield of 23 per cent of summer moong. Technology gaps, extension gaps and technology indices were calculated to analyze the performance of these FLDs at farmers' fields. The average extension gap and technology gap recorded were 2.05 q ha^{-1} and 1.4 q ha^{-1}, respectively. Between both varieties of summer moong, lower technology index of 6.92 per cent in SML 668 in 2017 indicates the feasibility of this variety in existing farming situation in the district over SML 832. This proved that SML 668 performed better than SML 832. Sowing of high yielding varieties along with improved package of practices resulted in higher benefit-cost ratio (1.61) over farmers' practice (1.35) during both years of study.

Keywords: *Summer moong, Frontline demonstrations, Technology index, yield, B:C ratio.*

1. INTRODUCTION

Mungbean (*Vigna radiata* L.), also known as green gram, has been grown in India since ancient times. In addition to be grown as *kharif* crop, green gram is also cultivated as summer crop and is a good fit in wheat-rice crop rotation because of its short duration of 55-60 days after wheat harvest and before sowing of rice. Although large area covers cereal crops but shortage of pulses, oilseed and vegetable is the main reason of low returns from the pulses and other crops [1,2]. The nutritional dimension is said to be integral to concept of food security, therefore, it is required to increase the production and productivity of pulse crops in the current scenario. The current per capita availability of pulses is 41.7 g/capita/day which are much below the recommendations of ICMR of 51 g/capita/day. Hence, to accomplish the target of 32 million tones of pulses by the year 2030, an average annual growth of 4.2% is required [3].

In Tarn Taran district of Punjab, large area is under rice-wheat cropping system, hence, it is required to incorporate summer moong after wheat harvesting to get additional income as well as to enrich the soil with leguminous crop accompanied with organic biomass and nitrogen. Summer moong is one of the conventional pulse crops among grain legumes [4]. Several biotic and abiotic constrains in the region are prevailing that restrict the full yield potential of crop to be achieved which needs to be addressed with implementation of recommended practices at farmers' field [5]. Keeping this view in fact, the frontline demonstration on summer moong was conducted in the district by Krishi Vigyan Kendra (KVK), Tarn Taran at different locations at farmers' field to aware the farmers about adoption of improved production technology.

2. MATERIAL AND METHODS

The frontline demonstrations were conducted in district Tarn Taran of Punjab during the year of 2017 and 2018 to demonstrate the impact of improved production technology on summer moong according to recommended package of practices. It lies between 31° 7′ and 32° 3′ North latitude and 74° 29′ and 75° 23′ in the East longitude. The net sown area in the district is about 2.17 lakh ha, which is almost 100 % double cropped. However, in some areas of the district, farmers' takes more than two crops in a year involving summer moong in cropping system. Tube wells are the main source of irrigation. Total 130 front line demonstration (FLD's) on 50 ha area were conducted by KVK during the study period. Materials and recommendation were followed in the present study is presented in Table 1. The SML 668 and SML 832 varieties of summer moong were sown with seed rate of 37.5 and 30 kg ha^{-1}, respectively during the month of March in rows 22.5 cm apart with plant-to-plant distance about 7 cm and 4 to 6 cm deep during study years. All N, P and K were applied according to soil test basis. Seed was treated with fungicide captan (3 g kg^{-1} seed) and biofertiliser (*Rhizobium* sp LSMR-1 and *Rhizobacterium* RB 3). Recommended weed control measure was adopted and irrigation was given according to the requirement of the crop. The demonstration fields were regularly visited by KVK scientists to supervise and to collect feedback from farmers. To seek the benefits of demonstrated technology by other farmers, field days and group meetings were also organized at the demonstration sites. Demonstrated plot yield was obtained from front line demonstrations conducted at the farmer's field in different locations of the district. The traditional practices were practiced by farmers in case of local checks for comparative study and the data were collected from both frontline demonstration plots as well as check plots (farmers' practices). Gross returns were estimated based on the prevailing market prices and the yield obtained by the farmers during both the years. For obtaining input cost, the sum of expenditure on land preparation, planting method, fertilizer, fungicide, insecticide, herbicide, irrigation, labour and harvesting cost, etc. were calculated from each plot. Benefit:Cost was calculated as ratio of net return over cost of cultivation. The extension yield gap, technology yield gap and technology index were worked out [6,7]. Extension gap is the difference between demonstrated plot yield and farmers practice plot yield. Technology gap is the difference between potential yield and demonstrated plot yield. The technology index shows the feasibility of evolved technology at the farmers' fields:

$$\text{Percent yield increase} = \frac{\text{Demonstration yield (q ha}^{-1}\text{) - farmers practice yield (q ha}^{-1}\text{)}\times 100}{\text{Farmers practice yield (q ha}^{-1}\text{)}}$$

$$\text{Technology gap (q ha}^{-1}\text{)} = \text{Potential yield (q ha}^{-1}\text{) - Demonstration yield (q ha}^{-1}\text{)}$$

$$\text{Extension gap (q ha}^{-1}\text{)} = \text{Demonstration yield (q ha}^{-1}\text{) - Farmers practice yield (q ha}^{-1}\text{)}$$

$$\text{Technology Index} = \frac{\text{Potential yield (q ha}^{-1}\text{) - Demonstration yield (q ha}^{-1}\text{)}\times 100}{\text{Potential yield (q ha}^{-1}\text{)}}$$

3. RESULTS AND DISCUSSION

Comparative analyses of the recommended package of practices and farmers practices have been presented in Table 1. It was reported that in the frontline demonstrations with recommended production technology such as improved variety of summer moong, seed treatment with fungicides and inoculation with consortium biofertilizer, recommended seed rate, balanced nutrient application and insect pest management was followed by the farmers which led to the overall better performance of the crop. In comparison to demonstration plots, farmers usually delayed the sowing and used broadcast method of sowing under check plots. They did not prefer to treat the seeds with bioferilizer and used imbalanced fertilizer application and its dose. In addition to this, farmers were not willing to adopt the recommended use of herbicides and pesticides for controlling the weeds and insect pest in the planted crop.

Table1: Comparison between demonstration and existing farmers practices of summer moong crop in Tarn Taran district of Punjab

S. No.	Particulars	Demonstration	Farmers Practice
1.	Farming situation	Irrigated	Irrigated
2.	Variety	Recommended variety of PAU (SML-668, SML 832)	Local varieties
3.	Time of sowing	20 March to 10 April	2nd fortnight of April
4.	Seed rate	37.5 kg ha^{-1} for SML-668 and 30 kg ha^{-1} for SML 832	20-30 kg ha^{-1}
5.	Method of sowing	Line sowing	Broadcasting
6.	Seed treatment	Captan (3 g kg^{-1} seed)	No seed treatment
7.	Use of Bio-fertilizer	(Rhizobium sp LSMR-1 and Rhizobacterium RB 3)	No biofertilizer treatment
8.	Fertilizer dose	Urea @ 27.5 kg ha^{-1} and SSP @ 250 kg ha^{-1}	Irrational use of nitrogenous fertilizer and no application of SSP
9.	Weeding	Stomp 30 EC @ 2.5 lit /ha	Not used
10.	Plant protection measures	Need based spray of insecticides and fungicides	No application or with unrecommended insecticides/fungicides

Grain yield: Data furnished in Table 2 and Figure 1 indicated that yield of summer moong was found to be substantially higher in demonstration plot than that of farmers practice during 2017and 2018. During year 2017, variety of summer moong SML 668 yielded 12.1 q ha^{-1} as compared to yield of farmers' practice (9.2 q ha^{-1}). There was an additional increment of 31.5% for the seed yield under demonstration plots than local check. Similarly, during year 2018, summer moong variety SML 832 recorded 9.6 q ha^{-1} yield under demonstration in comparison to local check *i.e.*8.4 q ha^{-1}. The increase in yield was to the tune of 14.3 % in demonstration plots during second year of study. It was due to use of high yielding improved varieties, improved agronomic practices, timely weed management, balanced application of fertilizer and timely control of pest and diseases at economic threshold level. Singh *et al.* [8] also observed that improved package of practices of summer moong varieties resulted in average increase in yield of 15.7 per cent over the check plots in Moga district of Punjab. Similar findings have also been supported by Suryavanshi *et al.* [9] and Bhargav *et al.* [10] in summer moong who reported that the yield of demonstration plots exceeds that of farmer's plots in all demonstrated plots in real farm situation. Such enhancement in yield might be attributed to adoption of newly released high yielding varieties, improved agro-techniques which resulted in higher yield [11, 15].

Table2: Grain yield of summer moong trial conducted during 2017 and 2018 in district Tarn Taran

Season	Variety	No. of trials conducted	Total area (ha)	Average yield under Demonstration plots (q ha^{-1})	Average yield under Local check plots (q ha^{-1})	Per cent increase (%)

2017	SML 668	100	40	12.1	9.2	31.5
2018	SML 832	30	10	9.6	8.4	14.3

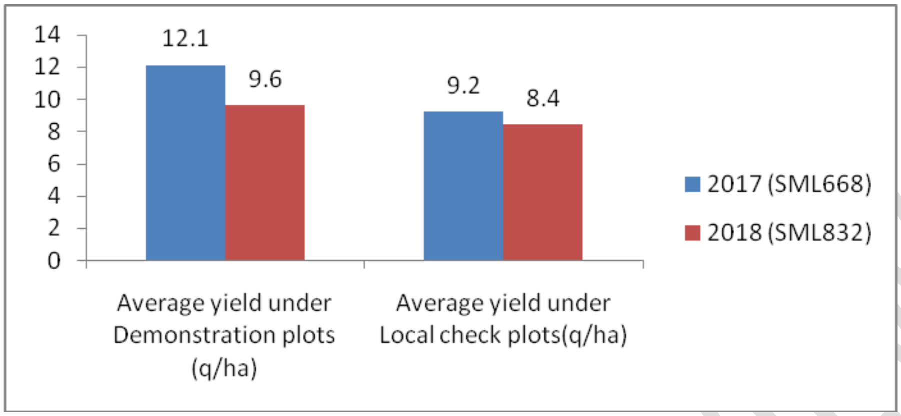

Fig. 1: Comparison in average yield of summer moong between demonstration and local check plots during 2017 and 2018 in Tarn Taran district of Punjab

Technology and Extension gap: Technology gap was found to be 0.9 q $ha^{-1}$and 1.9 q ha^{-1} during the study years of 2017and 2018, respectively (Table 3). The average value of technology gap during both years was recorded as 1.4 q ha^{-1}. The benefits of improved practices are quite visible from the extension gap that was to the tune of 2.9 q ha^{-1} in the year 2017 and 1.2 q ha^{-1}in 2018. The average extension gap was 2.05 q ha^{-1} in district Tarn Taran. Technology Index shows the feasibility of improved technology at farmer's field. Technology index indicated wide variation from 6.92 % in 2017 to 16.5 % in year 2018 that might be due to difference in soil fertility status, weather conditions and insect-pest attack on crop. The average technology index was found to be 11.71% during both years of study that proclaims the possibility of new technology adoption in district. The results are concordant with the findings of Kaur and Kumar [12].

Table3: Yield, technology gap, extension gap and technology Index of summer moong demonstrations in district Tarn Taran

Year	Variety	Yield (q ha^{-1})			Technology gap (q ha^{-1})	Extension gap (q ha^{-1})	Technology index (%)
		Potential	Demonstration	Check			
2017	SML 668	13.00	12.1	9.2	0.9	2.9	6.92
2018	SML 832	11.50	9.6	8.4	1.9	1.2	16.5
Average		-	10.85	8.8	1.4	2.05	11.71

Economics of front line demonstration: The economic analysis of front line demonstrations on summer moong is presented in Table 4. The data revealed that during 2017, cost of cultivation of summer moong SML 668 was Rs. 30573/- (Rs. ha^{-1}) over 38180/- (Rs. ha^{-1}) in case of local check (farmers' practice). Gross return was recorded Rs. 50215/- (Rs. ha^{-1}) from the demonstration plots under variety SML 668 over Rs. 38180/- (Rs. ha^{-1}) under local check during 2017. The highest gross returns were during second year of study under summer moong variety SML 832. The value was 50880/- (Rs. ha^{-1}) from the demonstration plots under variety SML 832 as compared to 44520/- (Rs. ha^{-1}) of local check during 2018.

It is clear from the table 4 that with improved technology, summer moong variety SML 668 gave highest net returns of Rs. 19642/- per ha with benefit cost ratio of 1.64 as compared to local check (Rs. 9122/- per ha with benefit cost ratio of 1.31). Due to improved production and protection techniques, higher additional return was obtained (Rs. 10520/-) during year 2017 as compared to year 2018 (Rs.6203/-). The additional return is calculated as the difference between net returns of demonstration and local check plots. The benefit-cost ratio (B:C ratio) was calculated during both years of study in summer moong. It was on higher side in demonstration plots *i.e.* 1.64 and 1.58 as compared to 1.31 and 1.39 in local check during the year 2017 and 2018, respectively. The average additional returns during both years was reported Rs. 8361/- per ha. These results are in agreement with the finding of Matharu and Tanwar [13] and Singh *et al.* [14].

Table 4: Economics of summer moong front line demonstrations and local check in District Tarn Taran

Year	Variety	Demonstration Plot				Local check Plots				Additional returns (Rs. ha^{-1})
		Cost of cultivation (Rs. ha^{-1})	Gross Returns (Rs. ha^{-1})	Net Returns (Rs. ha^{-1})	B:C ratio	Cost of cultivation (Rs. ha^{-1})	Gross Return (Rs. ha^{-1})	Net Returns (Rs. ha^{-1})	B:C ratio	
2017	SML 668	30573	50215	19642	1.64	29058	38180	9122	1.31	10520
2018	SML 832	32282	50880	18598	1.58	32125	44520	12395	1.39	6203
Average	-	31428	50548	19120	1.61	30592	41350	10759	1.35	8361

4. CONCLUSION

It is concluded from this study that summer moong variety SML 668 gave higher grain yield than SML 832 in district Tarn Taran of Punjab. Whereas, performance of both varieties were better under demonstration plots over local check (farmers' practice). It was also reported that the yield gaps between demonstration and farmers plots are due to technology and extension gaps and farmers could achieve benefits of approved techniques with decrease in extension gap with the support of extension scientists. This loophole can be filled with collaboration of farmers, extension workers, KVK team and agriculture department to reap the full benefits of new innovations and technologies. The results of the front line demonstration clearly indicated the positive effects of improved production technology on grain yield and benefit cost ratio over traditional farmers practice. Farmers can get additional net income and summer moong crop can be a good fit as short duration variety in wheat-rice crop rotation which certainly will improve the soil quality as well.

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