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Productivity Enhancement in Blackgram (*Vigna mungo* L.) through Improved Crop Management Practices on Farmers' Field

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ABSTRACT

Urd bean (*Vigna mungo* L.) or black gram is one of the important pulse crop cultivated over 1000 ha area in Erode district of Tamil Nadu. Attempts were made to reduce the yield gap of black gram by adopting integrated crop management practices through cluster frontline demonstrations during 2016-2020 in 250 farmers' field. The integrated crop management practices comprised of high yielding black gram variety, seed treatment with rhizobium, foliar application of micronutrients, integrated plant protection measures were demonstrated. The results showed that number of pods and seeds per plant were increased by 7.66 and 10.54 per cent respectively over farmers practice. Similarly the average higher grain yield of 7.68 quintal/ha recorded in demonstration plots compared to 6.51 quintal/ha in farmers practice with a yield advantage of 17.99 per cent over the farmer practices. The average extension gap, technology gap and technology index were 1.17 quintal/ha, 0.83 quintal/ha, and 9.75 per cent respectively. About 71.6 per cent farmers were satisfied with the improved crop production technologies. Considering the above facts, Frontline demonstrations were carried out in a systematic and scientific manner on farmer's field to show the worth of improved production management technologies in black gram for further adoption.

INTRODUCTION

Ensuring nutritional security to an ever growing population and sustainable crop production are the priorities of the scientist and extension workers in India. Black gram (*Vigna mungo* L.) popularly known as *Urd* cultivated in most part of the India throughout the year especially the marginal lands and dry tracts. The crop is originated in India and cultivated from the ancient time. Indians consume around 30 per cent of the world's pulses, but domestic production of pulses which became stagnated in recent two decade and has not kept pace with population growth. The net availability of pulses has come down from 60.70 g per day per person in 1951 to 31.6 g per day per person in 2010 but as per recommendation of Indian Council of Medical Research, 65 g pulses are required per day per person.

Black gram is one of the important pulse crops of India. It plays a vital role in soil fertility enhancement through atmospheric nitrogen fixation, root nodulation as well as nutritional security for human beings especially for protein supplement. Black gram is cultivated as pure crop, inter crop and rice fallow in most of the region based on the climatic conditions. It is cultivated mostly on the marginal lands, under rain fed situations. One of the important reason for low productivity is poor fertility levels of the soil. The problem is compounded by the fact that the majority of the farmers in the rain fed regions are lack of awareness on new and high yielding varieties, resource poor with low risk bearing capacity and they generally do not apply recommended practices. Many times pulses are cultivated as a mixed / intercrops and the productivity of black gram is very low in Erode district (731 kg/ha) of Tamil Nadu when compared to the yield potential of the crop. This

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indicates that there is a wide scope for increasing the productivity of black gram by proper management practice.

The productivity of black gram per unit area could be increased by adopting improved practices in a systematic manner along with high yielding varieties (Rai et al., 2015). Frontline demonstration is the new concept of field demonstration evolved by Indian council of Agricultural Research, New Delhi with the main objectives of demonstrating new varieties or technologies and its management practices in the farmers' field. The newly and innovative technology having higher production potential under the specific cropping system can be popularized through FLD programme. The frontline demonstrations were carried out in a scientific way in order to show the worth of the new variety and improved practices for enhancing the black gram productivity.

METHODOLOGY

The study was carried out in Erode District of Tamil Nadu during 2016-17 to 2019–2020 in 6 clusters in 3 blocks of Erode district by covering 100 hectares in 250 farmers' field. The frontline demonstrations were laid out in 75 farmer's field covering 30 ha in both 2016-17 and 2017–18 similarly 50 demonstrations laid out in both 2018-19 and 2019-2020. Each demonstration was conducted in an area of 0.4 ha and adjacent to the farmers' fields in which the crop was cultivated with farmers practice/variety taken as control or check plot. The soil of the demonstration plots are red sandy in nature with the pH range of 6.0-8.2.

The selected progressive farmers were trained on all scientific black gram cultivation aspects like selection of varieties, seed treatment, sowing, integrated nutrient and pest management, harvesting and post harvest management before starting of frontline demonstrations. The improved variety of black gram (VBN 6) was selected for demonstration. The variety VBN 6 released from Tamil Nadu Agricultural University, Coimbatore during the year 2011. The special features of the selected variety are resistant to yellow mosaic virus diseases, synchronized maturity and duration of 65-70 days with the production potential of 850 kg/ha. The seeds were treated with bio-fertilizers and then taken for sowing. Optimum plant populations were maintained in the demonstrations. The demonstrated fields were regularly monitored and periodically observed by the scientists of KVK.

The yield gap analysis is a potent research technique that has been introduced in the 1970s. Developed by the International Rice Research Institute (IRRI), it is extensively used to measure and analyze determinants of the yield gaps. It is also observed that, even though the production level has increased to a great extent in the recent past; still there exists a wide gap between the actual yield obtained by the growers and the production level actually possible with the existing modern technology. To study the impact of frontline demonstrations, data from FLD and farmers practices were analyzed. Other parameters like increasing in yield (%), technology gap (%), extension gap (%) and technology index were worked out as suggested by Kadian et al., (1997). Yield gap refers to the difference between the potential yield and actual farm yield. Potential yield refers to that which is obtained in the experiment station. At the time of harvest yield data were collected from both the demonstrations and farmers practice. Cost of cultivation, net income and benefit cost ratio were worked out. The yield is considered to be the absolute maximum production of the crop possible in the given environment, which is attained by the best available methods and with the maximum inputs in trials on the experiment station in a given season. Demonstration yield is the yield obtained on the demonstration plots on the farmers' fields in the study area. The conditions on demonstration plots closely approximate the conditions on the cultivators' fields with respect to infrastructural facilities and environmental conditions. Actual yield refers to the yield realized by the farmers on their farms under their management practices. The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui et al., (2000).

Extension gap (qtl / ha) = DY (qtl /ha)–LY (qtl/ha)

Technology gap (qtl / ha) = PY (qtl /ha)–DY (qtl/ha)

$$\text{Technology Index (\%)} = \frac{\text{PY (qtl /ha)} - \text{DY (qtl/ ha)}}{\text{PY(qtl /ha)}} \times 100$$

Where, DY = Demonstration Yield, LY = local Check Yield, PY = Potential Yield of variety,

The farmers were personally interviewed with well structured interview schedule. Client satisfaction index was calculated as developed by Kumaran and Vijayaragavan (2005). The individual obtained scores were calculated by the formula as:

$$\text{Client Satisfaction Index (\%)} = \frac{\text{The individual obtained score}}{\text{Maximum score possible}}$$

RESULTS AND DISCUSSION

The result indicates that the frontline demonstration has given a good impact over the farming community as they were motivated for adoption of new agricultural technology applied in the FLD plots. The yield attributing factors like number of pods per plant and number of seeds per pod was recorded and the observations were presented in Table 1. It indicates that the maximum of number 28.2 pods plant was recorded in 2018-19 and 26.8 pods recorded in 2017-18 with the average of 27.5 pods were produced in the demonstrated plot which was superior to the local practices (25.6 pods / plant). This indicated that 7.66 percent more pods produced in the improved crop management practices adopted field. Similarly on an average 5.75 seeds produced the demonstrated plot compared to local practices which recorded 4.93 seeds per pod. Though the production of a number of pods/plant may be a genetic character, environmental conditions such as soil, climatic condition, etc. also decides the pod's number. Bhowaland and Bhowmik (2014) reported a variation of the number of pods earlier.

New variety with improved crop management practices registered significantly higher yield than the local practices. The yield of demonstrations and local practices were presented in Table 2. The farmers harvested an average bean yield of 7.68 q ha^{-1} with the highest bean yield of 8.22 q ha^{-1} and the lowest grain yield of 6.93 q ha^{-1} with a yield advantage of 17.99 per cent over the existing farmer practices. An average additional yield of 1.17 q ha^{-1} was harvested in the demonstrated plot over the farmers practice. This could be achieved due to the adoption of improved production

Table 1. Yield attributing characters of black gram under demonstration

Year	Sowing Time	Number of demonstrations	Number of pods/ plant			Number of seeds / pod		
			Improved practices	Local check	Percent increased	Improved practices	Local check	Percent increased
2016-17	First fortnight of May	75	27.4	25.8	6.20	5.9	4.9	20.41
2017-18	First fortnight of May	75	26.8	25.4	5.51	5.6	4.6	21.74
2018 -19	Second fortnight of May	50	28.2	26.2	7.63	5.5	5.0	10.00
2019-2020	First fortnight of May	50	27.6	24.8	11.29	6.0	5.2	15.38
Total		250	110	102.2	30.63	23	19.7	42.15
Average		50	27.5	25.6	7.66	5.75	4.93	10.54

Table 2. Grain yield of black gram as influenced by improved and local practices

Year	Grain Yield (qtl / ha)				Additional yield (qtl / ha) over local check	Percent yield increase over local practices
	Improved practices			Local practices		
	Maximum	Minimum	Average	Average		
2016-17	8.56	7.38	8.08	6.82	1.26	18.48
2017-18	7.12	6.28	6.84	5.80	1.04	17.93
2018 -19	8.50	7.42	7.99	6.90	1.09	15.80
2019-2020	8.70	6.65	7.79	6.50	1.29	19.85
Average	8.22	6.93	7.68	6.51	1.17	17.99

technologies along with new variety of black gram. These results indicated that the frontline demonstrations gave good impact on farming community in Erode district as they were motivated by the improved production technologies applied in the demonstration plots. The findings of the present study are in line with Singh et al., (2018); Jyothiswaroopa et al., (2016) and Rai et al., (2015).

The economic feasibility of the scientific adoption of technologies over farmers practice was calculated depending on the prevailing prices of inputs and output costs (Table 3). The average highest of cultivation was recorded during 2016-17 as Rs. 22,750.00 and the lower of Rs. 20158.00 during 2018–19. It was found that the average cost of cultivation of black gram under improved crop production technology was recorded with an average of Rs. 21767.80 over the farmers practice and it was recorded as Rs. 22,557.50 / ha. Frontline demonstrated fields recorded the higher mean gross return of Rs. 45547.50/ ha and net return Rs. 23134.50/ha with high benefit cost ratio of 2.03. These results are in line with the findings of Sreelakshmi et al., (2012) and Hiremath and Nagaraju (2009). These results are clearly indicated that the adoption of scientific technologies was enhancing the black gram production and economic returns from the demonstrated regions.

The technology gap shows the gap between the potential yields of the crop over demonstrated yield. The technology gap was recorded as 0.83 qtl / ha (Table 5). The extension gap shows the gap between the demonstration yield and local yield and it was 1.17 qtl/ha. The observed extension gap and technology gap may be attributed due to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers in this region (Mukherjee, 2003). More and more use of latest production technologies will subsequently change this alarming trend. The new technologies will eventually lead to discontinue the old technologies and to adoption of new technologies by the farmers. Technology index shows the feasibility of the technologies at the farmers' field. The lower the value of the technology index more is the feasibility. Table 4 revealed that the technology index value was 9.75 per cent.

Table 5. Extent of farmer's satisfaction on extension services rendered during demonstrations

Satisfaction level	Percentage
Low	9.6
Medium	18.8
High	71.6

Table 3. Cost of cultivation, Gross return, Net return Benefit cost ratio as influenced by improved and local practices

Year	Cost of cultivation		Gross Return		Net Return		BCR	
	Improved practices	Local check	Improved practices	Local check	Improved practices	Local check	Improved practices	Local check
2016-17	22750	23500	50904	42966	28154	19466	2.24	1.83
2017-18	21750	22100	38304	32480	16554	10380	1.76	1.47
2018 -19	20158	21156	41862	36168	21704	15012	2.08	1.71
2019-2020	22413	23474	45547.5	38620.1	23134.5	15146.1	2.03	1.65
Total	87071	90230	176618	150234	89546.5	60004.1	8.11	6.65
Average	21767.8	22557.5	44154.4	37558.5	22386.6	15001	2.03	1.66

Table 4. Yield, Extension gap, Technology gap and Technology index of the demonstration

Variables	Yield (qtl/ha)	Extension gap (qtl/ha)	Technology gap (qtl/ha)	Technology Index (%)
Local check	6.51	-	-	-
Improved practices	7.68	1.17	0.83	9.75

The findings of the present study are in line with the findings of Rai et al., (2015) and Hiremath and Nagaraju (2009). The extent of satisfaction level of the respondent farmers over extension services and performance of demonstrated variety was measured by Client Satisfaction Index (CSI) and the results presented in Table 5. The data depicted in the table shows that the majority of the farmers expressed high (71.6%) to medium (18.8%) level of satisfaction for performance of technology and extension services where as very few (9.6%) farmers expressed the lower level of satisfactions. The similar type of findings reported by Kumaran and Vijayaragavan (2005) on mustard and gram crops, Meena et al., (2014) on maize crops and Rai et al., (2015) on vegetable pigeon pea crops. This shows the relevance of frontline demonstrations.

CONCLUSION

Based on the findings, it is concluded that the scientific adoption of integrated crop management technologies along with new black gram variety VBN 6 performed superior than the existing farmers practice in all the demonstrations. Yield potential of the black gram variety is increased 17.99 per cent over farmers practice. It is also suggested that conducting large scale adoption demonstrations and ensuring the critical inputs in time for adoption of technologies play a critical role in enhancing black gram production. The findings also concluded that the adoption of integrated crop management practices along with new variety paved the way for improving the productivity of black gram per unit area.

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