International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 8, 2020, pp.-9736-9738.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

MAXIMIZING PRODUCTIVITY OF BLACK GRAM THROUGH FRONTLINE DEMONSTRATION (FLD) IN SHIVPURI DISTRICT OF MADHYA PRADESH

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Received: April 04, 2020; Revised: April 16, 2020; Accepted: April 19, 2020; Published: April 30, 2020

Abstract: The present study was carried out by Krishi Vigyan Kendra, Shivpuri district Madhya Pradesh to know the yield gap between improved package and farmers' practice under Front Line Demonstration. Black gram (*Vigna mungo* L.) is one of the most important pulse crops cultivated in Shivpuri district of Madhya Pradesh. It is having lower yield in farmer's field due to multiple constraints. One of the major causes of its lower productivity was non-adoption of improved technologies. Front line demonstrations on Improved Crop Management practices were conducted at 80 framer's fields of Shivpuri district during *Kharif* season from 2011-12 to 2015-16. The improved technologies recorded a mean yield of 12.30 q per ha which was 32.78 percent higher than the yield obtained with farmers practice (9.36 q ha^{-1}). Besides, higher mean net income of Rs. 32247 ha^{-1} with a B: C ratio of 3.23 was realized when compared to farmers practice (Rs. 22097 ha^{-1} and 2.69). The average technological gap, extension gap and technological index noticed were 1.59 q ha^{-1}, 2.94 q ha^{-1} and 11.40 percent respectively. The higher average grain yield was recorded in demonstration plots over the years compared to local check due to increased knowledge and adoption of full package of practices.

Keywords: *Black gram, Front line demonstration (FLD), Productivity, Yield gap, Farmer's field, Net returns, B:C ratio*

Citation: Singh P., *et al*., (2020) Maximizing Productivity of Black Gram through Frontline Demonstration (FLD) in Shivpuri district of Madhya Pradesh. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 8, pp.- 9736-9738.

Academic Editor / Reviewer: Dr Pradeep Mishra, S K Mandi, Gajendra Rana

Introduction

Pulses have great importance in Indian agriculture as they have rich source of protein (17 to 25 percent) as compared to that of cereals (6 to 10 percent), their ability to fix atmospheric nitrogen and improve the soil fertility. Among pulses, black gram is one of the most important crops of India. It is quite helpful for amelioration of protein malnutrition prevalent among men, women and children in India. Pulses contribute 11 percent of the total intake of proteins in India [1]. In India, frequency of pulses consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits. It is important to increase pulses production, due to being the cheapest source of protein, to provide a balanced diet among the socially and economically backward classes. To meet out the domestic demand, about 23 million tons of pulses are imported every year.

The yield of pulses in India is less than the global average. Black gram is second major crop of *Kharif* season and an important pulse crop of Shivpuri district. Adoption levels for several components of the improved technology of the crop were low emphasized resulting in poor dissemination. Several biotic, abiotic and socio-economic constraints inhibit exploitation of the yield potential of black gram and these are needed to be addressed. Crop growth and yield are reduced due to poor plant nutrition and uncertain water availability during the growth cycle. Inappropriate management may further reduce the fertility of soil [2]. The major cause of lower yield of black gram is mainly attributed to use of local varieties, their cultivation on poor soils with inadequate and imbalanced nutrition, use of disease susceptible varieties, lack of seed treatment, lack of Integrated Weed Management (IWM) and lack of Integrated Pest Management (IPM) [3]. Front line demonstration (FLD) is one of the most powerful tools of extension because farmers, in general, are driven by the perception: "believing by seeing". The main objective of front-line demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmer's field. During demonstration in the farmer's field, scientists are required to study the factors contributing higher crop production, field production constraints and there by convince the farmer to adopt the technology for higher yield. Here in front line demonstration farmer's participatory approach is very useful method of owning and continuous interacting with scientists and getting the useful tips for getting higher yield in farmers own field which otherwise get lower yields [4,5]. Keeping this in view Frontline demonstrations (FLDs) on black gram were conducted to demonstrate the production potentials and economic benefits of latest improved technologies of black gram on farmer's fields.

Material and Methods

Front line demonstrations on black gram were conducted on 80 farmers' fields of Shivpuri district during *Kharif* seasons of 2011-12 to 2015-16 on medium black soils with low to medium fertility status under pulse-based cropping system. Based on the problems faced by the farmers, the front-line demonstration was designed and conducted at farmer's field. Each demonstration was conducted on an area of 0.40 ha and the same area adjacent to the demonstration plot was kept as farmer's practices. High yielding and YMV resistant varieties of black gram PU35, JU86 and PU31 were taken in the experimentation. The Integrated Crop Management (ICM) technology comprised the improved variety, proper season, recommended seed rate, seed treatment with fungicide, bio-agents (Rhizobium and PSB), proper nutrient and pest management based on economic threshold level [Table-1].

The data on yield were collected from both the demonstration and farmers practice by random crop cutting method. Qualitative data was converted into quantitative form and expressed in terms of percent increase in yield [6].

Table-1 *Improved production technology and Farmers practices of black gram under FLD*

SN	Technology	Improved practices	Farmers practice	GAP (%)
1	Variety	PU35, JU86 and PU31	Local (Urdi)	Full gap
2	Land preparation	Ploughing and Levelling	Ploughing and Levelling	Nil
3	Post emergence herbicide	Imezathpyr @0.7 l/ha	No herbicide	Full gap
4	Seed rate	15 kg/ha	20-25 kg/ha	Partial gap
5	Seed treatment	Biofertilizers (Rhizobium and PSB)	No seed treatment	Full gap
6	Fertilizer dose	INM	Indiscriminate application	Partial gap
7	Foliar application of nutrient	NPK 19:19:19 @ 2.5 kg/ha	No foliar Spray	Full gap
8	Plant protection	IPM (use of Pheromon traps and need based insecticide and fungicide)	No plant protection measures	Full gap

Table-2 *Impact of improved production technology on productivity of black gram*

Year	Variety	FLD (Nos)	Yield(q/ha)				% increase in yield over local check
			Improved Practice				
			Max.	Min.	Average	Local check	
2011-12	PU35	20	14.5	10.25	12.32	9.15	34.64
2012-13	JU86	16	15.0	11.5	13.94	10.37	34.42
2013-14	JU86	20	12.5	9.2	10.76	8.13	32.34
2014-15	JU86	12	15.5	12.5	13.50	11.65	15.87
2015-16	JU31	12	13.0	9.5	11.00	7.50	46.66
	Total	80	70.5	52.95	61.52	46.8	163.93
	Average	16	14.1	10.59	12.30	9.36	32.78

Table-3 *Indication of potential yield, demonstration yield, farmers yield, technological gap, extension gap and technology index*

Year	Variety	Potential yield (kg/ ha)	Demonstration yield (kg /ha)	Farmers Yield (kg/ ha)	Technological gap (q/ha)	Extension Gap(q/ha)	Techno logy index
2011-12	PU35	15	12.32	9.15	2.68	3.17	17.87
2012-13	JU86	14	13.94	10.37	0.06	3.57	0.43
2013-14	JU86	14	10.76	8.13	3.24	2.63	23.14
2014-15	JU86	14	13.50	11.65	0.50	1.85	3.57
2015-16	PU31	12.5	11.00	7.50	1.50	3.5	12.00
Average		13.90	12.30	9.36	1.59	2.94	11.40

Table-4 *Economics of improved technologies and farmers practice in black gram*

	Total cost of cultivation (Rs.ha^{-1})		Gross Returns (Rs.ha^{-1})		Net Returns (Rs.ha^{-1})		B:C ratio	
Year	Improved technology	Local check	Improved technology	Local check	Improved technology	Local check	Improved technology	Local check
2011-12	9318	8700	36960	27450	27642	18750	3.97	3.16
2012-13	15600	15000	41820	31110	26220	16110	2.68	2.07
2013-14	15088	13544	37660	28455	22572	14911	2.50	2.10
2014-15	18500	17000	67425	55027	48925	38027	3.64	3.24
2015-16	15000	12000	50875	34687	35875	22687	3.39	2.89
Average	14701	13249	46948	35346	32247	22097	3.23	2.69

The data was further analyzed by using simple statistical tools. The extension gap, technological gap and technological index along with the benefit cost ratio were worked out [7] as given below:

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers' yield

Technology index = (Technology gap/potential yield) x 100

Results and discussion

Performance and yield

Frontline demonstrations are effective extension tools in introducing various new technologies to the farmers to boost the farmer's confidence level by comparison of productivity levels between improved production technologies and traditional practices in demonstration trials. The performance of Black gram crop with adoption of improved technologies was assessed over a period of five years and is presented in [Table-2] and [Table-3]. Results from the demonstration revealed that, the integrated crop management practice in black gram recorded 32.78 percent increase in the yield as compared to the farmers practice (9.36 q/ha) as against 12.30 q/ha in ICM practice. However, average highest yield (13.94 q/ha) was recorded during 2012-13 and it was maximum of 15.50 q/ha during the year 2014-15. This may be attributed to suitable climatic conditions during the pod setting to physiological maturity stage and better utilization of applied nutrients [8]. The above findings are in similarity with the findings of [9,10]. The higher yield of black gram under improved technology was due to use of latest high yielding varieties, integrated nutrient management and integrated pest management [11].

Technology Gap

The technology gap means the differences between potential yield and yield of demonstration plot. The technology gap of demonstration plots was 2.68, 0.06, 3.24, 0.50 and 1.50 q/ha during 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16 respectively [Table-3]. On an average technology gap under three years FLD programme was 1.59 q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, crop production, protection practices and local climatic situation.

Extension Gap

Extension gap means the differences between demonstration plot yield and farmers yield. Extension gap were 3.17, 3.57, 2.63, 1.85 and 3.50 q/ha during 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16 respectively [Table-3]. On an average extension gap under threes FLD programmes was 2.94 q/ha which emphasized the need to educate the farmers through various extension programs *i.e.*, front line demonstration for adoption of improved production and protection technologies, to minimize the range 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 and help in improving socio-economic condition of farmers.

Technology Index

Technology Index indicates the feasibility of the evolved technology in the farmers' fields. Lower the value of technology index, higher is the feasibility of the improved technology. The technology index varied from 0.43 to 23.14 percent [Table-3].

On an average, technology index was observed 11.40 percent during the five years of FLD programmes, which shows the efficacy of good performance of technical interventions. This will help increasing the adoption of demonstrated technical intervention to increase the yield performance of black gram in Shivpuri district.

Economic Return

Economic data reveals that the cost involved in the adoption of improved technology in Black gram ICM varied and was more profitable [Table-4]. The cultivation of black gram under improved technologies gave higher net return of Rs. 27642, 26220, 22572, 48925 and 35875 per ha respectively, as compared to farmers practices (Rs 18750, 16110, 1491, 38027 and 22687 per ha in 2011-12, 2012-13, 2013-14 and 2014-15 [Table-4] respectively). An average net return and B:C of demonstration field is 32247 Rs/ha and 3.23 respectively as compared to farmers practice (Rs 22097 per ha and 2.69). Similar findings were reported by Raju Teggelli *et al*., (2015) [9]. The benefit cost ratio of ICM of Black gram under improved cultivation practices higher than farmer's practices in all the years and this may be due to higher yield obtained under improved technologies compared to local check (farmers practice). These finding are in line with the findings of Mokidue *et al*., (2011) [12], and Anuratha *et al*., (2019) [13].

Conclusion

It is concluded from the study that there exists a wide gap between the potential and demonstration yields in Black gram mainly due to technology and extension gaps and also due to the lack of awareness about new technology in black gram cultivation in Shivpuri district of Madhya Pradesh. The FLD produces a significant positive result and provides the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technologies in farmers' field, which they have been advocating for long time. This could be circumventing some of the constraints in the existing transfer of technology system in the Shivpuri district of Madhya Pradesh. The productivity gain and higher returns under FLD over existing practices of black gram cultivation is creating greater awareness and motivation to other farmers to adopt suitable production technology of black gram in the district.

Application of research: Study showed that if farmers adopt the demonstrated technologies, it may fetch better net returns in addition to what they are getting now in traditional practices which may improve their livelihood.

Research Category: Technology extension in pulse crops.

Abbreviations: FLD: Front Line Demonstrations, BC Ratio: Benefit /Cost Ratio

Acknowledgement / Funding: Author are thankful to ICAR-Krishi Vigyan Kendra, Shivpuri, 473551, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002, Madhya Pradesh, India. Authors are also thankful to ICAR-ATARI Zone-IX, Jabalpur, Madhya Pradesh, India

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Research project name or number: Front Line Demonstration on Pulses.

Author Contributions: All authors equally contributed.

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment.

Study area / Sample Collection: Shivpuri district, Madhya Pradesh.

Cultivar / Variety name: *Vigna mungo* L.

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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