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Enhancing black gram profitability in Bharuch district of South Gujarat: Constraints and approach

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Abstract
The present study was conducted by BAIF Krishi Vigyan Kendra, Bharuch during 2016, 2017 and 2018 in the monsoon seasons with field surveys and one hundred fifty cluster frontline demonstrations (CFLDs) on black gram across twelve villages of Bharuch district of Gujarat. The results of survey showed that cultivation of VYM susceptible local varieties is the major cause of low yield. The data on demonstrations revealed that farmers could enhance the black gram productivity remarkably by switching over to YVM resistance variety 'GU-1'. Postponing date of sowing helped farmers to overcome the problem of early maturity in 'GU-1' variety. From the CFLDs, it was observed that the black gram variety 'GU-1' recorded the higher yield (905 kg/ha) compared to the farmers' practices variety (704 kg/ha). The increase in the demonstration yield over farmer's practices was 28.55 %. Technology gap and the technology index values were 295 kg/ha and 24.58, respectively.

Keywords: VYM, black gram, FLD, yield, economics

Introduction
Black gram is one of the favored crops of the tribal farmers of a Netrang, Valia and Jhagadia block of Bharuch district particularly for less fertile hilly upland and marginal soil. The soils and topographical situation of entire tribal belt of South Gujarat are almost similar where black gram is cultivated with same practices. The productivity of black gram in Bharuch district (734 kg/ha) is lower than most of the major black gram producing district in Gujarat. In Bharuch, black gram was cultivated in an area of 1396 ha with production 1025 MT (DAO, 2017) [3].
The decline in overall yield and area under cultivation of black gram and green gram in Bharuch district was reported in last few years. In India, Black gram production accounts for about 10 per cent of total pulse production (Sahu *et al.*, 2018) [8]. It is therefore, essential to assess the technological gap in production and also to know the constraints faced by farmers in black gram production technologies.

Materials and Methods
The present study was conducted by Krishi Vigyan Kendra, Bharuch during 2016, 2017 and 2018 in the monsoon seasons with field surveys and one hundred fifty cluster frontline demonstrations across twelve villages of Bharuch district of Gujarat. The survey was conducted to gather information on constraints faced by black gram growers across twelve villages with total sample size of 100 respondents selected randomly.

Quantification of data in terms of "Rank Based Quotient" (RBQ) estimation

$$RBQ = \frac{\sum fi\ (n + 1 - ith)}{N \times n} \times 100$$

Where
fi = Frequency of farmers/key informants for the ITH rank of the problem.
N = Number of farmers/Number of respondents
n = Number of problems identified by all the contacted farmers

Gaps Assessment in Technology and its Dissemination
Based on the problems faced by the farmers, the frontline demonstrations were designed and conducted at farmers' field. Each demonstration was conducted in an area of 0.4 ha.

To estimate the technology gap, extension gap and technology index following formulae used by Samui et al. (2000) [9] have been used:

Technology gap = Pi (Potential yield) - Di (Demonstration yield)

$$\text{Technology index} = \frac{\text{Technology gap X 100}}{\text{Potential yield}}$$

Results and Discussions

Constraints faced by Black gram growers

Eight constraints were reported by farmers during survey, they usually faced in black gram cultivation. Based on the ranks given by the farmers, different constraints and the calculated Rank Based Quotient (RBQ) for each problem are listed in the Table 1. The RBQ value varies from 93.00 to 48.88. The data presented in table revealed that the incidence of YMV is the major constraints faced by black gram growers in the district which is followed by lack of technical know-how and improved varieties. The major cause of wide spread of VYM in black gram is due to cultivation of local varieties year after year. Gupta and Pathak (2009) [5] reported that in epidemic year, 100 per cent yield loss was observed from MYMV infested black gram in Bundelkhand agroclimatic zone. Srivastava and Prajapati (2012) [11] revealed that the lowest yield of black gram was obtained due to cultivation of unsuitable cultivar for the area by farmers and disease incidence at pod bearing stage.

Table 1: Constraints faced by farmers

S.N.	Constraints	RBQ	Rank
1	Incidence of Yellow Mosaic Virus	93.00	I
2	Lack of Technical Knowledge	84.75	II
3	Lack of Improved Varieties	82.88	III
4	Infestation of Sucking Pest	65.25	IV
5	Low Soil Fertility Status	61.50	V
6	Improper Use of Fertilizers	59.63	VI
7	Drought at Critical Crop Stages	53.75	VII
8	Weed Problem	48.88	VII

Plan to overcome constraints in black gram cultivation

To manage the problem, KVK Bharuch decided to go for demonstration of Gujarat Urad-1, a high yielding YVM resistant variety with other demonstration packages during 2016, 2017 and 2018 in the monsoon seasons under Cluster FLDs sponsored by National Food Security Mission (NFSM).

Results and Discussion

Differentiation in farmers' practices and demonstration package in black gram crop

The major differences were found between demonstration package and farmer's practices are regarding varieties, seed treatment, time of sowing, fertilizer dose and plant protection measures as shown in Table 2. Under farmers' practice, they generally sow seed of local varieties of black gram at higher seed rate without treatment.

The key difference between 'GU-1' and local varieties is VYM resistance characters of 'GU-1' but apart from this another difference is duration to mature. 'GU-1', as a short duration matures in 75-85 days, incompatible for farmers as harvesting falls in post monsoon periods. On the contrary, local varieties mature at 115-120 days and can escape from damage due to rains. To overcome on both these problems of VYM and early maturity, KVK team has demonstrated sowing of 'GU-1' during last week of July to first week of August. Postponing the date of sowing helped farmers to overcome the problem of early maturity in 'GU-1' and realized higher crop yield.

Table 2: Differences between farmers' practices and technological intervention for black gram crop

Particular	Farmers' Practice	Demonstration Package
Variety	Local	Gujarat Urd -1 ('GU-1')
Seed Treatment	No seed treatment	Thiram @ 3g/kg seed + *Rhizobium* and PSB culture 20 ml/kg seed
Sowing Period	Onset of Monsoon	Last week of July to First Week of August
Fertilizer dose	No use of Chemical fertilizers	Urea @ 43 kg/ha and SSP@ 266 kg/ha

Performance of intervention on production and economics of black gram

Yield Performance: A comparison of yield performance between demonstrated practices and local checks is shown in Table-3. It was observed that in front line demonstrations, the improved yellow vein mosaic resistance black gram variety 'GU-1' recorded the higher seed yield (905 kg/ha) when compared to farmers practices (704 kg/ha). The increase in the yield over local check was 28.66 %. It is apparent from the results that the yield of demonstrated variety was found better than the local check under same environment conditions.

Table 3: Yield Performance of Black gram under Farmers' Practice and Front Line Demonstration.

Variables	Yield (kg/ha)	% increase over local check	Technology gap (kg/ha)	Technology Index
Farmers Practices	704	-	-	-
Demonstration (Cv. 'GU-1')	905	28.55	295	24.58

The technology gap is the difference between the demonstration yield and potential yield and it was 295 kg/ha. This gap exists due to variation in the soil nutrient status and climatic factors. These findings are similar to the findings of

Saravanakumar (2018) [10].

Technology index shows the feasibility of the technology at the farmer's field. The lower the value of technology index more is the feasibility. Result of present study depicted in Table- 3, revealed that the technology index values were 24.58. The results of the present study are in recurrence with the findings of Kothyari *et al*. (2018) [6], Bar and Das (2015) [2] and Islam *et al*. (2011)

Economics of frontline demonstrations: The economics of black gram production under front line demonstrations have been presented in Table- 4. The Results of economic analysis of black gram production revealed that the gross expenditure in recommended practices was higher than the farmer's practices by about 13.85 %. But, front line demonstrations recorded higher gross returns (Rs. 39,756/ha) and net return (Rs. 23,302/ha). The similar finding was also reported by Bairwa *et al.* (2013) [1].

Table 4: Economics of frontline demonstrations

Variables	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit: Cost ratio
Farmer's Practices (Local check)	14452	30772	16320	2.13
Demonstration	16454	39756	23302	2.41
Additional in demonstration	2002	8984	6982	

Exploitable yield reservoir in Black gram

The results obtained from FLDs during the last three years have conclusively proves the beneficial impact of the production technology over the farmers' practices. The existing average productivity of black gram in Gujarat is 624 kg/ha however the total annual production is 0.64 Lakh MT (DPD, 2016-17). The estimates derived from the FLD's showed that there exists a commercially exploitable yield reservoir, which can be achieved through adoption of advocated improved crop production technology for black gram. Thus, it is clear that with full adoption of the presently available production technologies, 0.93 Lakh MT of black gram production could be achieved, which is almost adequate to meet the requirement of black gram in the state.

Table 5: Exploitable yield reservoir in black gram in Gujarat.

Average Demonstration yield under FLD (kg/ha)	Gujarat State Average Productivity (kg/ha)	Gujarat State Average Production (Lakh MT)	Expected production (Lakh MT) if yield gap is bridged through complete adoption of improved practices
904	624	0.64	0.93

Conclusion

The field study of constraints faced by farmers will give a ground level strategy for input supply and interventions in technology management for adoption. There is need to apply appropriate technologies to overcome these emerging constraints for enhancement of productivity and farm profitability on a sustainable basis. Farmers were motivated by results of demonstrated agro technologies applied in the FLDs and it is anticipated that they would adopt these technologies in future. Promotion of a suitable variety 'GU-1' by KVK Bharuch has been proved useful for black gram cultivators.

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