Factors affecting productivity of black gram in Mohali district of Punjab

Harmeet Kaur, Priyanka Suryavanshi and Yashwant Singh

Abstract
The cluster frontline demonstrations on black gram variety Mash 114 were conducted on 20 ha area by Krishi Vigyan Kendra, S.A.S. Nagar (Mohali) in three blocks of district Mohali namely Kharar, Majri and Dera Bassi during kharif season of 2018-19. The results revealed that use of yellow vein mosaic virus tolerant variety + seed treatment with rhizobium culture + line sowing + plant protection measures (mechanical control + insecticide) recorded higher average yield (9.5 q/ha) over control plots (7.92 q/ha). Benefit cost ratio for demonstration and control plots was 1.57 and 1.37, respectively. The yield increase of demonstration plots over control plot was observed 19.94%. Thus, it can be concluded that the black gram productivity could be enhanced by encouraging the farmers through adoption of recommended technologies which were followed under demonstration plots.

Keywords: Black gram, cluster frontline demonstrations, productivity, yellow vein mosaic virus, yield

Introduction
Pulses play an important role in Indian agriculture by providing proteinaceous grains and nutritive fodder. These also increase soil fertility for obtaining high yield in succeeding crops. Pulses contribute 11 per cent of the total intake of proteins in India (Reddy, 2010) [9]. These are referred to as poor man’s meat and rich man’s vegetable (Singh and Singh 1992) [10]. Black gram is native to India (Vavilov, 1926) [12]. Among the various pulses, black gram contains approximately 25-28% protein, 4.5-5.5% ash, 0.5-1.5% oil, 3.5-4.5% fibre and 62-65% carbohydrate on dry weight basis (Kaul, 1982) [7]. It is valued for its high digestibility and freedom from flatulence effect (Fary, 2002). Like other pulse crops, black gram plays a vital role in maintaining nitrogen balance in the soil. It possesses nodules on its roots, containing Rhizobium sp (nitrogen fixing bacteria), which fixes nitrogen in symbiotic association with the plant and release a significant amount for plant growth and development. India is the largest producer as well as consumer of black gram. In India black gram is presently cultivated over an area of 5.44 Mha (kharif + rabi) and recorded an average production of 3.56 Mt at a productivity level of 655 kg/ha (Anonymous 2019) [1]. In Punjab state, black gram was grown on 2.1 thousand hectare area with production of 1.1 thousand tones and average yield of 5.01q/ha during 2016-17 (Anonymous, 2018) [2]. To improve crop yield, indiscriminate use of pesticides by the farmers leads to phytotoxicity and destruction of beneficial organisms such as predators, parasitoids, microorganisms and pollinators (Luckman and Metcalf, 1978) [8]. Integrated pest management (IPM) approach is the best alternative to overcome such problems. To promote crop diversification, efforts were made by KVK (Krishi Vigyan Kendra), Mohali to enhance productivity of black gram by conducting cluster frontline demonstrations (CFLDs) at the farmer’s field with adoption of IPM strategy in district Mohali. FLD is the major tool to disseminate new technology at farmer’s field which is designed to overcome the problems faced by farmers at field level in order to show the worth of improved package of practices for enhancing the crop productivity.

Materials and Methods
The CFLDs were conducted over 20 ha area, divided into three clusters under the project “Cluster Frontline Demonstration on Pulses” during kharif season 2018.
The yield of control plots of farmers was affected by various constraints faced by farmers. The results were compiled and analyzed by t-test at 5% level of probability (p ≤ 0.05) using least significant difference (LSD) test through SAS analysis (Gomez and Gomez, 1984) [5].

### Table 1: Details of need based inputs of black gram used in CFLD

<table>
<thead>
<tr>
<th>S. No</th>
<th>Critical input</th>
<th>Name of critical input</th>
<th>Technology demonstrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seed</td>
<td>Mash 114</td>
<td>• High yielding and yellow mosaic virus resistant variety</td>
</tr>
<tr>
<td>2</td>
<td>Seed treatment with culture</td>
<td>Rhizobium culture</td>
<td>• Seed treatment with rhizobium culture @ half kg/acre seed</td>
</tr>
<tr>
<td>3</td>
<td>weedicide</td>
<td>Pendimethalin</td>
<td>• Weedicide: Pendimethalin@ 1 litre/acre</td>
</tr>
<tr>
<td>4</td>
<td>insecticides</td>
<td>Quinalphos Acephate</td>
<td>• Insecticides: Mechanical control &amp; Ekalux 25 EC (quinalphos) @ 500ml/acre to control hairy caterpillar</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Asatof 75SP (acephate) @ 800g/acre to control pod borer (Helicoverpa armigera) and tobacco caterpillar (Spodoptera litura)</td>
</tr>
</tbody>
</table>

### Results and Discussion

The data (Table 2, 3) revealed that average yield in demonstration plots was 9.5 q/ha which was significantly higher than the average yield of control plots (7.92 q/ha). Earlier, similar pattern of higher yield in demonstration plots was observed by Veeramani et al. (2017) [13] who conducted CFLDs on black gram at Vallore district of Tamil Nadu. In case of our demonstration plots, gross and net returns were Rs. 54850/ha and Rs. 19850/ha, respectively whereas for control plots, gross returns were Rs. 47,000/ha and net returns were Rs. 12600/ha. The increase in yield was observed 19.94 per cent in demonstration plot over control plots. The benefit cost ratio for demonstration and control plots was 1.57 and 1.37, respectively. Hence, by adopting proven technologies of black gram cultivation as per need based chemical use was practiced to control insects. Most of the black gram insects (Hairy caterpillars, tobacco caterpillars, pod borer) were below economic threshold level (ETL). Young larvae of hairy and tobacco caterpillar were collected by pulling the infested leaves and destroyed. Grown-up hairy caterpillars were destroyed by crushing them under feet. Insecticides were used only in few cases where insect level crossed ETL.

#### Table 2: Effect of improved technology on yield and economics of Mash 114

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (q/ha)</th>
<th>Gross cost (Rs./ha)</th>
<th>Gross Return (Rs./ha)</th>
<th>Net Return (Rs./ha)</th>
<th>B:C ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: Farmers practice (broadcasting, irrational use of insecticides)</td>
<td>7.92</td>
<td>34400</td>
<td>47,000</td>
<td>12600</td>
<td>1.37</td>
</tr>
<tr>
<td>T2: (Rhizobium culture + line sowing + plant protection)</td>
<td>9.5</td>
<td>35000</td>
<td>54850</td>
<td>19850</td>
<td>1.57</td>
</tr>
</tbody>
</table>

#### Table 3: t-test comparing yield of demonstration and control plots

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of demonstrations</th>
<th>Mean Yield (q/ha)</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>Minimum</th>
<th>Maximum</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>55</td>
<td>7.92</td>
<td>0.38</td>
<td>0.05</td>
<td>6.50</td>
<td>8.50</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>T2</td>
<td>55</td>
<td>9.5</td>
<td>0.86</td>
<td>0.12</td>
<td>7.60</td>
<td>10.60</td>
<td></td>
</tr>
</tbody>
</table>

T1-Demonstration Plots; T2-Control plots; *p< 0.05 = significant

### Constraints faced by farmers

The yield of control plots of farmers was affected by various factors like improper seed selection, no seed treatment, broadcast method of sowing and unawareness of ICM and IPM techniques etc. Heavy losses in crop yield were observed due to hairy caterpillar attack. Due to favorable weather for...
insect development and improper selection of insecticides by the farmers, the crop got adversely affected in control plots. On desi black gram varieties, attack of YVMV was noticed which cause crop loss. Therefore, low average yield was observed in control plots as compared to demonstration plots.

Conclusion

Results revealed that use of resistant variety, seed treatment with rhizobium culture, line sowing and plant protection measures (Mechanical control + need based use of insecticides) contributed to a great extent for achieving potential yield of black gram. Attack of hairy caterpillar was noticed under some demonstration plots but controlled with recommended technology. Successful implementation of CFLDs and dissemination of improved technology were achieved through various extension activities like training programme, kisan goshties, field days, exposure visits and harvesting days organized for farmers. KVK staff also motivated the farmers for self marketing of their produce. It can be concluded that newly introduced variety of black gram along with improved package of practices performed well in the Mohali district of Punjab.

Acknowledgements

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References