INTRODUCTION

Pulses are important food crops for human consumption and animal feed. Being leguminous in nature, they are considered to be important components of cropping systems because of their viability to fix atmospheric nitrogen, add substantial amounts of organic matter to the soil and produce reasonable yields with low inputs under harsh climatic and soil conditions. Moong-wheat cropping system is predominant and is continuously practiced by the farmers in the arid zone of Rajasthan. There is evidence of system productivity stagnation, nutrient water imbalances and increased insect-pest and diseases incidence due to prolonged use of this cereal dominated system source. Green gram (Vigna radiate L. Wilczek.) is the third important pulse crop in India. It can be grown both as kharif green gram and summer green gram. With the advent of short duration, MYMV (Mungbean yellow mosaic virus) tolerant and synchronous maturing varieties of green gram (55-60 d), there is a big opportunity for successful cultivation of green gram in green gram-wheat rotation without affecting this popular cropping pattern.

Green gram has strong root system and capacity to fix the atmospheric nitrogen into the soil and improves soil health and contributes significantly to enhancing the yield of subsequent crops (Meena et al., 2012). However the production and productivity is very low in green gram mainly due to its cultivation in resource poor lands with minimum inputs, non-synchronous maturity and indeterminate growth habit. Green gram yield is also affected by insect-pests and diseases, especially by green gram yellow mosaic virus (MYMV) and Cercospora leaf spot (CLS). The green gram production among pulses was 3.73 lac tons from the area of 8.85 ha in Rajasthan during the year 20015-16. The major cultivation of green gram is based upon rainfed conditions. Pali district stands first rank in term of area and production of green gram in the state. In this district, the green gram crop is grown in an area...
of 2.46 lac ha with an annual production of over 1.30 t.

The front line demonstration (FLD) is an important method of transferring the latest package of practices in totality to farmers. Further, these demonstrations are designed carefully where provisions are made for speedy dissemination of demonstrated technology among farming community through organization of other supportive extension activities, such as field days and farmers convention. The main objective of the FLD is to demonstrate newly released crop production and protection technologies and management practices at the farmers’ field under different agro-climatic regions and farming situations. During demonstration, the scientists study the factors contributing to higher crop production, field constraints, generate production data and feed-back information. FLD are conducted in a block of two to four hectares of land in order to have better impact of the demonstrated technology on the farmers and field level extension functionaries with full package of practices. Keeping in view, the present study was undertaken to increase the green gram productivity by conducting the FLDs.

**MATERIALS AND METHODS**

A total of 40 FLDs were conducted at farmers’ field in 5 villages namely Balara, Bedkallan, Boyal, Kushalpura and Balara Jaitaran of Pali district of Rajasthan, during kharif season 2014, 2015 and 2016 under raised conditions. Each demonstration was conducted on an area of 0.4 ha, and 1.0 ha area adjacent to the demonstration plot was kept as farmers’ practices. The package of improved technologies like line sowing, nutrient management, seed treatment and whole package were used in the demonstrations. The variety of greengram IPM-02-3 was included in demonstrations methods used for the present study with respect to FLDs and farmers’ practices are given in Table 1. In case of local check plots, existing practices being used by farmers were followed. In general, soils of the area under study were sandy loam and medium to low in fertility status. The spacing was 30 cm between rows and 10 cm between plants in the rows. The thinning and weeding was done invariably 30-35 d after sowing to ensure recommended plant spacing within a row because excess population adversely affects growth and yield of crop. Sowing was done in the first week of July with a seed rate of 15-20

<table>
<thead>
<tr>
<th>Operation</th>
<th>Existing practice</th>
<th>Improved practices demonstrated</th>
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<tbody>
<tr>
<td>Line sowing</td>
<td>Broad casting of seed</td>
<td>Spacing 40 cm between rows and 10 cm between plants.</td>
</tr>
<tr>
<td>Use of variety</td>
<td>Local/ K 851</td>
<td>HYV IPM 02-3 for better production</td>
</tr>
<tr>
<td>Weather effect</td>
<td>For normal condition</td>
<td>Drought and heat tolerance variety</td>
</tr>
<tr>
<td>Seed treatment</td>
<td>No seed treatment</td>
<td>Seed treatment with Bavistin 2gm/kg seed</td>
</tr>
<tr>
<td>Weed management</td>
<td>No weed management</td>
<td>Weeds control by using herbicide Pendimethaline 1kg/ha in 500 liter of water as pre-emergence treatment for effective control of weeds within two days after sowing.</td>
</tr>
<tr>
<td>Nutrient management</td>
<td>Only FYM and no fertilizer application</td>
<td>10 tons/ha farm yard manure and 20kg/ha nitrogen</td>
</tr>
<tr>
<td>Whole package</td>
<td>Farmers are cultivating the greengram crop without adoption of any improved technology</td>
<td>All the crop (production and protection) management practices as per the package of practices for kharif crop by CAZRI, Jodhpur, were followed for raising the crop</td>
</tr>
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</table>
kg/ha. Other management practices were applied as per the package of practices for kharif crops by Department of Agriculture, Agro-climatic Zone IIb Jalore (DOA, 2016). The data with respect to grain yield from FLD plots and from fields cultivated following local practices adopted by the farmers of the area were collected and evaluated. Potential yield was taken in to consideration on the basis of standard plant population (404440 plants/ha) and average yield per plant 22.5 g/plant under recommended package of practices with 30 X 10 cm crop geometry (Chandra, 2010). Different parameters as suggested by Yadav et al (2004) was used for gap analysis, and calculating the economic. The details of different parameters and formula adopted for analysis are as under:

Extension gap = Demonstration yield - Farmers’ practice yield
Technology gap = Potential yield - Demonstration yield
Technology index = \( \frac{\text{Potential Yield} - \text{Demonstration Yield}}{\text{Potential Yield}} \times 100 \)
Additional cost = demonstration Cost
Effective gain = Additional Returns - Additional cost
Additional returns = Demonstration returns - Farmers’ practice returns

**RESULTS AND DISCUSSION**

**Yield attributing traits**

The number of productive pods per plant under improved technology were 25.8, 22.6 and 24.2 as against local check (farmers' practices), 19.7, 17.3 and 18.9 (Table 2) during the year 2014, 2015 and 2016, respectively. There was an increase of 30.9, 30.6 and 28.0 per cent in number of productive pods under demonstration of improved technology over farmers’ practice. The average number of productive pods per plant in improved technology was 24.2 and 18.6 under farmers’ practice, thus there were 29.8 per cent more pods per plant under improved technology demonstrations. The findings confirm with the findings of Yadav et al (2007).

**Seed yield**

The productivity of green gram under improved production technology ranged between 920-1045 kg/ha with mean yields of 982 kg/ha (Table 3). The productivity under improved technology was 920, 1045 and 980 kg/ha during 2014, 2015 and 2016,
respectively as against a yield range between 730 to 785 kg/ha under farmers’ practice. In comparison to farmer’s practice, there was an increase of 17.2, 43.2 and 30.2 per cent in productivity of greengram under improved technologies in 2014, 2015 and 2016, respectively. The increased grain yield with improved technologies was mainly because of line sowing use of nutrient management and weed management. The findings were in line with Singh and Meena (2011), Poonia and Pithia (2011), Meena et al (2012).

**Gap analysis**

The study (Table 4) revealed that an extension gap of 284 to 320 kg/ha was found between demonstrated technology and farmers’ practice and on average basis the extension gap was 267 kg/ha. The extension gap was highest (315 kg/ha) during 2015 and lowest (135 kg/ha) during 2014. Such gap might be attributed to adoption of improved technology especially high yielding varieties sown with the help of seed cum fertilizers drill with balanced nutrition, weed management and appropriate plant protection measures in demonstrations which resulted in higher grain yield than the traditional farmers’ practices. The study further exhibited a wide technology gap during different years. It was lowest (305 kg/ha) during 2015 and highest (430 kg/ha) during 2014. The average technology gap of all the years was 368 kg/ha. The difference in technology gap in different years was due to better performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of study.

Similarly, the technology index for all demonstrations in the study was in accordance with technology gap. Higher technology index reflected the inadequate transfer of proven technology to growers and insufficient extension services for transfer of technology. On the basis of three years study, overall 27.3 per cent technical index was recorded, which was reduced from 31.9 per cent, 22.6 and 27.4 during 2014, 2015 and 2016, respectively. Hence, it can be inferred that the awareness and adoption of improved varieties with recommended scientific package of practices have increased during the advancement of study period. These findings were in the conformity of the results of study carried out by Chandra (2010), Meena and Dubi (2012), Meena and Singh (2016), Meena and Singh (2017), Khedkar et al 2017 and Dayanand et al (2012).

**Economics**

Different variables like seed, fertilizers, bio-fertilizers and pesticides were considered as cash input for the demonstrations as well as farmers practice and on an average additional investment of Rs. 1533/- per ha was made under demonstrations. Economic returns as a function of gain yield and MPS sale price varied during different years. The maximum returns (Rs. 8784/-) during the year 2015 were obtained due to high grain yield and higher MPS sale rates as declared by GOI. The higher additional returns and effective gain obtained under demonstrations could be due to improved technology,

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of FLDs</th>
<th>Potential yield (kg/ha)</th>
<th>FLD yield (kg/ha)</th>
<th>FP yield (kg/ha)</th>
<th>Per cent increase</th>
<th>EG (kg/ha)</th>
<th>TG (kg/ha)</th>
<th>TI (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>10.5</td>
<td>1350</td>
<td>920</td>
<td>785</td>
<td>17.2</td>
<td>135</td>
<td>430</td>
<td>31.9</td>
</tr>
<tr>
<td>2015</td>
<td>15.5</td>
<td>1350</td>
<td>1045</td>
<td>730</td>
<td>43.2</td>
<td>315</td>
<td>305</td>
<td>22.6</td>
</tr>
<tr>
<td>2016</td>
<td>15.5</td>
<td>1350</td>
<td>980</td>
<td>750</td>
<td>30.2</td>
<td>230</td>
<td>370</td>
<td>27.4</td>
</tr>
<tr>
<td>Average</td>
<td>08.8</td>
<td>1350</td>
<td>982</td>
<td>755</td>
<td>35.4</td>
<td>267</td>
<td>368</td>
<td>27.3</td>
</tr>
</tbody>
</table>
non-monetary factors, timely operations of crop cultivation and scientific monitoring. The lowest and highest incremental benefit cost ratio (IBCR) were 5.7 and 3.1 in 2013 and 2014, respectively (Table 5) depends on produced grain yield and MPS sale rates. Overall average IBCR was found to be 4.3. The results were in conifrmity with the findings of front line demonstrations on pulses by Yadav et al (2004), Gauttam et al (2011), Lathwal (2010), Chaudhary (2012), Dayanand et al (2012), Meena and Dudi (2012).

CONCLUSION
It may be concluded that the frontline demonstrations conducted on greengram at the farmers’ field revealed that the adoption of improved technologies significantly increased the yield as well as yield attributing traits of the crop and also the net returns to the farmers. Hence, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers’ should be encouraged to adopt the recommended package of practices for realizing higher returns.

REFERENCES


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