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# Performance of Improved Varieties of Pulse Crops at Farmers' Field in Kymore Plateau and Satpura Hills Zone of Madhya Pradesh

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**ABSTRACT**

The Panna district falls under Kymore plateau and Satpura hills agro climatic zone of Madhya Pradesh. This zone occupies the major pulse producing regions of the state, however recording the low productivity as compared to yield potential of the crops. Majority of the farmers in this region were still cultivating the traditional old varieties along with higher seed rate which causes reduced production as well as higher cost of production. Under such circumstances the frontline demonstration (FLD) is an appropriate tool for the introduction and dissemination of improved varieties of pulse crops. In view of this performance of improved varieties of pulse crops viz. Chickpea (JG-11, JG 16 and Vijay), Lentil (JL-3), Pigeonpea (JKM-189 and TJT-501) and Black gram (PU-35) were assessed through front line demonstration during 2010-11 to 2013-14 in Panna district. The result on the performance of improved varieties of Chickpea, Lentil, Pigeonpea and Black gram, respectively increased the average yield by 40.4 percent, 60.0 percent, 40.0 percent and 55.0 percent over local existing varieties of the pulse crops. Higher yield of the improved varieties of the pulse crops facilitate and boost up the farmers to start seed production of the concerned varieties that brought out a significant achievement in the adoption of the improved varieties. It has been observed that the technology gap for all the crops is higher than the extension gap which indicates that there is scope to a great extent to improve the level of conducted FLDs. In addition, the technology index was also higher which express that there is need to educate the farmers for rapid adoption of improved varieties of pulse crops in this agro climatic zone.

**Keywords:** Yield, Yield Gap, Technology Gap and Technology Index.

## INTRODUCTION

Pulses are the main source of protein to vegetarian people of India. It is second important constituent of Indian diet after cereals. Pulses being legumes fix atmospheric nitrogen into the soil thus, improve the soil fertility. They also play an important role in crop rotation, mixed and intercropping as they help to maintain the soil fertility along with checking the soil erosion as they have more leafy growth and close spacing. They also add good organic matter into the soil in the form of leaf mould. Besides these, they also supply additional fodder for cattle, which improve their health and milk production. India is producing 14.76 million tons of pulses from an area of 23.63 million hectare which is one of the largest pulses producing countries in the world. However, about 2-3 million tons of pulses are imported annually to meet the domestic consumption requirement. Thus, there is need to increase production and productivity of pulses in the country by more intensive interventions. To achieve target of additional production of pulses, it is necessary to make efforts on important pulse crops depending upon their contribution in national productivity. The national and state (M.P.) productivity of chickpea (*Cicer arietinum* L.), lentil (*Lens esculenta* L.), pigeonpea (*Cajanus cajan* L.) and black gram (*Vigna mungo* L.) is 799, 633, 760, 451 kg/ha and 711, 508, 620, 351 kg/ha respectively during 2011-12 (Anonymous 2011). The Panna district is situated in Kymore Plateau and Satpura hills agro climatic zone of Madhya Pradesh. The productivity of pulses *viz.* chickpea, lentil, pigeonpea and black gram is 620, 470, 1069 and 430 kg/ha, respectively during 2013-14 in Panna district, which is quite lesser than their yield potential. The cause of low productivity of pulses is due to use of old varieties, higher seed rate and broadcasting method of sowing in the district. Thus, there is need to create awareness among the farming community to popularize the location specific improved varieties to increase the production and productivity of pulse crops in the district. In view of this, an intensive intervention such as front line demonstration was conducted to introduce

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and disseminate improved varieties of pulse crops to increase the crop yield during 2010-11 to 2013-14. Thus, the present manuscript deals with the yield performance of improved varieties of pulse crops along with yield gaps at farmer's fields.

## METHODOLOGY

The performance of improved varieties of chickpea, lentil, pigeonpea and black gram were conducted in three blocks of Panna district *viz.* Pawai, Gunour and Panna during *Kharif* and *Rabi* during 2010-11 to 2013-14. An extensive survey was made before conducting the front line demonstrations (FLDs) to find out the need based farmers. The receptive and innovative farmers were selected through group meeting in each year. The demonstration was consist of improved varieties, recommended seed rate, line sowing with seed-cum-ferti drill. Seed treatment was done with fungicide (carboxin + thiram @ 2 g/kg seed) followed by seed inoculation with *Rhizobium and* PSB cultures @ 5 g per kg seeds. The performance of the crop under module was compared with the farmers' practice in the same location. The farmers practice included sowing of old varieties, use of higher seed rate, broadcasting method of sowing without seed treatment. The following improved varieties of pulse crops viz. Chickpea (JG-11, JG 16 and Vijay), Lentil (JL-3), Pigeonpea (JKM-189 and TJT-501) and Black gram (PU-35) were undertaken for the study. The total FLDs area for chickpea, lentil, pigeonpea and black gram were 46, 16, 12 and 09 hectare respectively during the study period. The trials were regularly monitored and data on crop yield from each demonstration and farmer's crop were collected after harvesting the crop. In order to estimate the technology gap, extension gap and technology index the following formula was used as per described by Samui *et al.* (2000).

Extension gap = Demonstration yield-Farmers yield

Technology gap = Potential yield –Demonstration yield

$$\text{Technology index} = \frac{(\text{Potential yield} - \text{Demonstration yield}) \times 100}{\text{Potential yield}}$$

## RESULTS AND DISCUSSION

It is generally assumed that the technologies at research station will give the same results at farmer's field however, the consistency or repeatability of performance of the technology between research station and farmer's field may not hold universally. Under such circumstances selection of technologies should not be based solely on research station trials, in fact it should be based on farm trials too where the new technology is compared with the farmers existing practices under the local micro climatic regime. The present manuscript also shows a greater impact of improved varieties of pulse crops over the local cultivars.

### Yield gap, Extension gap and technology index

Yield of frontline demonstration trials and potential yield of respective varieties of pulse crops were compared to estimate the yields gap, which were further categorized into technology and extension gaps. The adoption of technology in frontline demonstration trials was studied through technology index, which shows the feasibility of the evolved varieties at the farmer's field. The lower value of the technology index expressed the feasibility of the demonstrated varieties. Thus, lower value of the technology index represents the more suitability of the varieties at the farmer's field condition.

### Chickpea

Three varieties of chickpea (JG-11, JG 16 and Vijay) were demonstrated at 46.0 hectares area of farmer's field in different villages of the Panna district during 2010-11 to 2013-14. The average yield of demonstrated varieties at farmers field was 12.1 q/ha as compared to 9.4 q/ha with local cultivars (Table.1). The results showed that maximum extension gap was recorded with JG- 16 followed by JG-11 and Vijay cultivars, while the highest technology gap was recorded with JG-11 followed by JG-16 and Vijay. It is clearly evident from the results that minimum technology index was recorded with Vijay cultivar followed by JG-16 and JG-11 (Table 1). The difference in the yield among the varieties may be due to variation in soil fertility, irrigation facility, non-congenial weather and location specific management problems as described by Dudhade *etal*. (2009). However, the result clearly shows increase in chickpea yield up to 40.4 per cent over control. The technology index was lowest with Vijay cultivar, which indicates that Vijay is performing best at the farmer's field. The technology index of all three demonstrated varieties ranges between 24.7 to 55 per cent indicating the high level of adoption at farmer's field conditions. Similar findings were also reported by Thakral and Bhatnagar (2002). Good performance of Vijay, JG-16 and JG-11 at farmer's field leads to initiation of seed production by the seed society. Yield enhancement in different crops in Front Line Demonstration has been documented by Thakral and Bhatnagar 2002, Joshi *et al.,* 2002, Dudhade *et al.*, 2009 and Roy Burman *et al*., 2010.

**Table 1. Yield performance of demonstrated varieties of chickpea**

| Years | Varieties | Area (ha) | Potential | Yield q/ha FLD | Control | Yield increase (%) | Technology gap (q/ha) | Extension gap (q/ha) | Technology index (%) |
|---|---|---|---|---|---|---|---|---|---|
| 2010-11 | Vijay | 14 | 19 | 14.3 | 12.2 | 52.5 | 4.7 | 2.1 | 24.7 |
| 2011-12 | JG-16 | 14 | 19 | 12.5 | 9.4 | 33 | 6.5 | 3.1 | 34.2 |
| 2012-13 | JG-16 | 10 | 19 | 13.9 | 10.4 | 33.6 | 5.1 | 3.5 | 26.8 |
| 2013-14 | JG-11 | 08 | 19 | 7.7 | 5.4 | 42.6 | 11.3 | 2.3 | 55 |
| | Total | 46 | Average | 12.1 | 9.4 | 40.4 | 6.9 | 2.75 | 35.2 |

**Lentil**

The improved variety of lentil (JL-3) was demonstrated at 16.0 hectare area of farmer's field in different villages of the Panna district during 2010-11 to 2011-12. The average yield of demonstrated varieties at farmers field was 3.7 q/ha as compared to 2.3 q/ha of local cultivar. The result showed that maximum extension gap of the demonstrated variety was found during 2011-12 however; technology gap and technology index was highest during 2010-11. The performance of improved lentil cultivar (JL-3) was extremely well at the farmers field with technology gap of 9.4 q/ha and technology index of 71.9% (Table 2). The yield obtained from the JL-3 was 60 per cent higher over local variety resulting better adoption at farmer's field condition and local old varieties may be replaced for these regions. Higher technology gap of JL-3 (9.4 q/ha) may be due to the variation in soil and environmental conditions. Thus, yield gap may be reduced through transfer of improved technology through effective front line demonstrations to the farmers (Dudhade *et. al.,* 2009). Technology index varied from 61.5 to 82.3 per cent indicates that a wide gap existed between technology evolved and technology adoption at farmer's field. Similar result was found by Thakral and Bhatnagar, 2002. It is evident from the results that application of different inputs viz. improved varieties, healthy seeds and seed treatment with fungicides and biofertilizers leads to significant increase in growth and yield of lentil under rainfed condition, which is harmonious with the findings of Provorov *et al*., 1998 and Mehboob *et al.,* 2003.

**Pigeon pea**

Two varieties of pigeonpea (JKM-189 and TJT-501) were demonstrated at 12.0 hectares area of farmer's field in different villages of the Panna district during 2010-11 to 2013-14. The average yield of demonstrated varieties at farmers field was 6.8 q/ha as compared to 5.0 q/ha with local cultivars (Table 3). The cultivar TJT-501 recorded highest average yield (10.3 q/ha) over existing local varieties. This medium duration variety has become most popular as it is resistant to wilt disease and tolerant to insect and pests which is the main problems of the crop in this region. The yield obtained from JKM-189 and TJT-501 was 40.0 per cent higher over local varieties expressing better adoption at farmer's field condition. Maximum technology gap was recorded with JKM-189 followed by TJT- 501. The technology index of TJT-501 was 45.8 and 60 per cent during 2011-12 and 2013-14 as compared to JKM-189 which recorded 85.7 per cent during 2010-11 indicating high adoption at farmer's field conditions. The year-to-year fluctuations in yield can be explained on the basis of variations in prevailing social, economical and prevailing microclimatic condition of that particular village. Mukherjee (2003) has also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing

**Table 2. Yield performance of demonstrated variety of lentil**

| Years | Varieties | Area (ha) | Potential | Yield q/ha FLD | Control | Yield increase (%) | Technology gap (q/ha) | Extension gap (q/ha) | Technology index (%) |
|---|---|---|---|---|---|---|---|---|---|
| 2010-11 | JL-3 | 08 | 13 | 2.3 | 1.2 | 91.7 | 10.7 | 1.1 | 82.3 |
| 2011-12 | JL-3 | 08 | 13 | 5.0 | 3.3 | 53.8 | 8.0 | 1.8 | 61.5 |
| Total | 16 | Average | 3.7 | 2.3 | 60.0 | 9.4 | 1.5 | 71.9 | |

**Table 3. Yield performance of demonstrated varieties of Pigeonpea**

| Years | Varieties | Area (ha) | Potential | Yield q/ha FLD | Control | Yield increase (%) | Technology gap (q/ha) | Extension gap (q/ha) | Technology index (%) |
|---|---|---|---|---|---|---|---|---|---|
| 2010-11 | JKM-189 | 04 | 19 | 2.7 | 1.8 | 47.2 | 16.6 | 0.9 | 85.7 |
| 2011-12 | TJT-501 | 06 | 19 | 10.3 | 7.8 | 32.1 | 8.7 | 2.5 | 45.8 |
| 2013-14 | TJT-501 | 02 | 19 | 7.6 | 5.4 | 40.7 | 11.4 | 2.2 | 60.0 |
| Total | 12 | Average | 6.8 | 5 | 40 | 12.2 | 1.8 | 63.8 | |

systems productivity. Yield enhancement in different crops in Front Line Demonstration has amply been documented by Tiwari and Saxena, 2001., Tiwari *et al*., 2003 Tomer *et. al*. 2003 and Roy Burman *et. al.,* 2010.

**Black gram**

The improved variety of black gram (PU-35) was demonstrated at 9.0 hectare area of farmer's field in different villages of the Panna district during 2010-11 and 2013-14. The improved variety of black gram (PU-35) remarkably increased 55.5 per cent yield over local varieties during the span of two years of demonstrations. Technology gap, extension gap and technology index of PU-35 were recorded as 6.4, 2.5 q/ha and 51.2 per cent, respectively. Irrespective of variety and seasonal variations, the average yield achieved under improved variety was 6.1q/ ha as compared to that of 3.7q/ha under farmers practice however, lesser than the potential yield of the variety (Table 4). This is in agreement with the suggestion of Cassman (1999) who reported that even cereals under best production systems can perform to the maximum extent of 80 per cent of potential productivity under real field conditions. The yield increase with the improved varieties under the farming situation of demonstration area is likely to be effective in area with similar micro climate. The results suggested that use of healthy seeds of improved variety along with seed treatment produce vigorous plant as it promote greater absorption of water and nutrients which might play a vital role to enhance the yield of black gram which also support the findings of Provorov *et al.,* 1998 and Mehboob *et al.,* 2003. Lower value of technology index expressed the feasibility of demonstrated variety (PU-35) at farmer's field as it is semi erect, determinate and resistant to YMV. Thus, it has become more popular variety among the farmers in this region.

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**Table 4. Yield performance of demonstrated variety of Black gram**

| Years | Varieties | Area (ha) | Yield q/ha Potential | Yield q/ha FLD | Yield q/ha Control | Yield increase (%) | Technology gap (q/ha) | Extension gap (q/ha) | Technology index (%) |
|---|---|---|---|---|---|---|---|---|---|
| 2010-11 | PU-35 | 04 | 12.5 | 9.2 | 4.7 | 95.7 | 3.3 | 4.5 | 26.4 |
| 2013-14 | PU-35 | 05 | 12.5 | 3.0 | 2.6 | 15.3 | 9.5 | 0.4 | 76 |
| Total | 09 | Average | 6.1 | 3.7 | 55.5 | 6.4 | 2.45 | 51.2 | |