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# Yield Gap Analysis of Chickpea Productivity through Front Line Demonstrations in Sagar District of Madhya Pradesh

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**ABSTRCT**

The frontline demonstrations on proven technology on chickpea was conducted on 80 farmer's fields in the six villages of Sagar district of Bundelkhand region of Madhya Pradesh during *rabi* seasons of 2012-13 to 2013-14 under rainfed condition on medium to heavy soil with medium fertility status. Demonstration was conducted under Soybean – Chickpea cropping system to study the productivity enhancement of Chickpea through improved production technologies. The results revealed that integrated crop management practices reduced the wilt incidence reduced from 10.45 to 4.05 per cent (61.2 per cent) and larval population of Gram pod borer decreased from 1.2 to 0.50 per plant (58.3 per cent) in both the years. The average 45-46 pods per plant were obtained under improved technology over to farmer's practices (36-40). The seed yields of chickpea under improved technology ranged between 9.83 q $ha^{-1}$ to 15.79 q $ha^{-1}$ with increase in seed yields by 22.8 and 39.8 per cent in both the years. The average seed yields under improved technology were 12.81 q $ha^{-1}$ as against farmers practice where seed yield was 9.94 q $ha^{-1.}$ On an average an additional cost Rs. 1376 $ha^{-1}$ with improved package given additional benefits of Rs. 8795/ha from chickpea crop . However, maximum average net returns (Rs.37588 $ha^{-1}$) as well as benefit cost ratio (4.61) were recorded under improved technologies as compared to farmer's practice (Rs.28793 $ha^{-1}$ and 4.18). Technology gap of 319 kg/ha and extension gap of 291 kg/ha were found in chickpea production due to differential in feasibility of recommended technologies, lack of awareness, timely unavailability of quality input at farmers level.

**Keywords:** Chickpea production technology, demonstration, ICM, yield gap analysis

## INTRODUCTION

Indian farmers grow more than a dozen of pulses among them Chickpea (*Cicer aretinum* L.) is a economic importance. India is the largest producer and consumer of pulses in the world contributing around 25-28 per cent of global production. The total pulse production is 17.2 million tons from 24.8 million ha (Anon., 2012). Majority of Indian population are vegetarian, and pulses are cheap and best source of protein for them. Chickpea occupying 8.56 million ha and contributas 39 per cent (7.35 million tons) to the total production of pulses in the country (Meena *et al.*, 2012 and Singh *et al.*, 2012). Its seeds contain higher quality digestive protein 22 per cent and carbohydrate 14 per cent. The residues of chickpea have the capacity to improve the physical, chemical and biological properties of soil thus increase the productivity of land. It also fix atmospheric nitrogen (25 kg/ha) through the symbiotic relationship between the host mungbean roots and soil bacteria and thus improve soil fertility. The major chickpea growing states are Madhya Pradesh, Uttar Pradesh, Haryana, Gujrat, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Bihar and West Bengal. Madhya Pradesh is a leading state of pulse production, chickpea

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occupies /contributing 15 per cent of total production of 45 million tons in the area of 31, 28,700 hectare with productivity of 1083 kg/ha. Sagar is one of the district where chickpea is being cultivated in *Rabi* season in about 1,95,000 ha area under rainfed conditions with the productivity of 930 kg/ha.

Presently India importing about 3 million tons(Singh, 2011). There is potential to increase production of pulses by using best production practices and proper plant protection measures at right time. In general, average productivity of chickpea continuous to be lower due to heavy infestation of wilt, dry root rot diseases and pod borer infestation reported to reduce the productivity by 60-80 per cent. Apart from this its cultivation on marginal land, not availability of good quality seed, and imbalance use of fertilizers are also responsible for low productivity of chickpea. A large number of high yielding varieties resistant to wilt disease have been developed by the researchers for enhancing chickpea production whis is yet to reach the farmers. The productivity continuous to be lower in Sagar district. To demonstrate the scientific cultivation of chickpea front line demonstrations was laid out at farmer's field under rainfed situation during Rabi 2012-13 and 2013-14.

## METHODOLOGY

Front line demonstrations on Chickpea were conducted on during two consecutive Rabi 2012-13 and 2013-14 at farmers field in district Sagar (Madhya Pradesh) to assess its performance. The soils of the demonstration site were light to medium with medium fertility status (low in available nitrogen, medium in available phosphours and potash). Chieckpea farmers were randomly selected after group meeting. Specific skill training was imparted to the selected farmers on different aspects of recommended production and protection technologies through two days on campus training at KVK. Difference between technological interventions and farmer's practices were studied based on survey and group discussion with chickpea growers. Each demonstration plot size was 0.40 ha, and adjacent to the demonstration plot, a plot was which farmer's practices as suggested by Das *et.al*. (1998). The package of improved production technologies included wilt resistant variety JG 16 in 2012-13 and JG 63 in 2013-14, fertilizer 20:60:20 NPK as basal application, Seeds were treated with Carboxin + Thiram (Vitavax power) @ 2 g $kg^{-1}$ and inoculated with Rhizobium and PSB @ 10 g /kg seed was line sowing with spacing was 30 cm between rows and 10 cm between plants in the row done between November 02 to 10 in both the year with a seed rate of 75 kg/ ha. Recommended dose of fertilizer (20:60:20 NPK kg $ha^{1}$) were supplied through urea, single super phosphate and murate of potash as basal application. One hand weeding was done at 30-35 DAS for effective control of weed. Foliar spray of Profenophos 20 EC was done at flower initiation stage for management of pod borer. The crop was harvested between March 15 to 25 after the pods turn yellow. In the second plot, locally seed of chickpea (Ujjain 21 and JG 315; locally known as *Khajwa*) treated with Carbendazim 50 W P @ 2 gm/kg was sown with basal dose of DAP 40 kg/ha and maintained as farmers practice.

The demonstrations on farmer's field were regularly monitored from sowing till harvest by scientists of KVK, Sagar. The data on incidence of wilt, dry root rot disease, pod borer; grain yield of demonstration as well as control plot was recorded and analyzed. Different parameters as suggested by Yadav *et al*. (2004) and Dayanand *et al*. (2012) were used for calculating gap analysis, costs and returns. The analytical tool used for assessing the performance of the FLD on Chickpea was as follows:

- Extension gap = Demonstration yield- farmers practice yield
- Technology gap = Potential yield – Demonstration yield
- Technology index = (Potential yield – Demonstration yield) X 100 /Potential yield
- Additional return = Demonstration return – Farmers practice return

## RESULTS AND DISCCUSION

### Performance of FLDs

A comparison of Frontline Demonstrations (FLD) based on recommended crop management technology and farmers practice were analyzed (Table 1). During the period of study, 80 FLDs were conducted on farmer's field in the 06 villages of Sagar district. The yield ranged from 9.83 q to 15.79 q/ha which among be to varying in biotic and a biotic stress observed across different time horizon.

### Wilt and pod borer incidence

In the demonstration plots wilt incidence reduced from 10.45 to 4.05 per cent in both the years. It may be attributed to sowing of improved variety, seed treatment (Carboxin + Thiram) and seed inoculation (Rhizobium and PSB culture). Maheshawari *et. al*. (2008) also found significant reduction in wilt incidence with the seed treatment of systemic fungicide. By the installation of pheromone trap and timely spray of insecticide larval population of pod borer decreased from 1.2 to 0.50 per plant. Singh *et al.* (2009) reported IPM modules to be significantly superior over the untreated control both in term of protection and production of chickpea. They reported that line sowing of gram with installation of pheromone traps, bird perches and spray of endosulphan, gave 1449 kg/ha yield and maximum B:C ratio of 5.26 with low pod damage by pod borer (10.86 %).In the present demonstration endosulfan was replaced by profenophos 20 EC, as the farmers is banned.

### Grain yield

The proper management of crop enhances the productivity of Chickpea under demonstration plots. Balance fertilizer application indicated higher number of pods per plant. Number of pods per plant under improved production technology was 45 and 46 as against 36 and 40 under farmer's practice. Yield of Chickpea ranged between 9.83 q ha$^{-1}$ to 15.79 q ha$^{-1}$ with increase in seed yields by 22.8 and 39.8 per cent in both the years. The average seed yields under improved technology were 12.81 q ha$^{-1}$ as against farmers practice where seed yield was 9.94 q ha$^{-1}$. Balance fertilizer (NPK 20:50:20 kg/ha) application with biofertilizer increased the seed yield of pulses and higher monetary returns as reported by Tomar *et.al*. (2009) and Sahu *et. al*. (2002).

### Economic analysis

The economic viability of improved technologies over traditional farmer's practices was calculated depending on prevailing prices of inputs and output costs (Table 2). It was found that cost of production of chickpea under improved technologies varied from Rs. 8505 to 9600/ha in various years, whereas in farmers practice it varied from Rs. 6852 to 8500 ha$^{-1}$. On an average an additional cost Rs. 1376 ha$^{-1}$ was required to raise the crop with improved package. Cultivation of Chickpea under improved technologies gave higher net return of Rs 29,512 to 45,665 ha$^{-1}$ in different years with an average of Rs.37,588 ha$^{-1}$ as against in farmer practices Rs. 21,112 to 36,475 ha$^{-1}$ with an average of Rs. 28,793 ha$^{-1}$. The improved technologies also resulted in better benefit cost ratio of 5.75 and 3.47 as compared to 5.29 and 3.08 under farmer practice in the corresponding years. The results

**Table 1: Wilt disease incidence, insect population, seed yield of Chickpea as affected by improved and local practices on farmer's fields**

| Year | Wilt disease (%) | | No. of Pod borer larvae/plant | | No. of pods per plant | | Yield (q ha$^{-1}$) | | Increase in yield (%) |
|---|---|---|---|---|---|---|---|---|---|
| | Demo | FP | Demo | FP | Demo | FP | Demo | FP | |
| 2012-13 | 4.8 | 11.2 | 0.70 | 1.4 | 46 | 36 | 15.79 | 12.85 | 22.8 |
| 2013-14 | 3.3 | 9.7 | 0.30 | 1.0 | 45 | 40 | 9.83 | 7.04 | 39.8 |
| Average | 4.05 | 10.45 | 0.50 | 1.2 | 45.5 | 38 | 12.81 | 9.94 | 28.8 |

Demo- Demonstration, FP- Farmer practice

**Table 2: Economics of Chickpea production as affected by improved and local practices**

| Year | Cost of cultivation (Rs) | | Additional cost of cultivation (Rs) | Net returns (Rs) | | Additional net return (Rs.) | B:C ratio | |
|---|---|---|---|---|---|---|---|---|
| | Demo | FP | | IT | FP | | IT | FP |
| 2012-13 | 9600 | 8500 | 1100 | 45665 | 36475 | 9190 | 5.75 | 5.29 |
| 2013-14 | 8505 | 6852 | 1653 | 29512 | 21112 | 8400 | 3.47 | 3.08 |
| Average | 9052 | 7676 | 1376 | 37588 | 28793 | 8795 | 4.61 | 4.18 |

IT- Improve Technology,FP-Farmers Practice

from the current study clearly demonstrated the potential of improved production technologies for Chickpea cultivation in rainfed condition of Madhya Pradesh in the corresponding years as also reported by Ray *et. al* (2010). Kirar *et al.* (2006) and Singh *et al*. (2012) reported that Frontline demonstrations produces a significant results and provide the researchers an opportunities to demonstrate the productivity potential and profitability through the latest technology under real farming situation.

## Gap analysis

The results revealed that an extension gap of 291 kg/ha between demonstrated technology and farmers practice (table -3). Such gap may be attributed to adoption of improved technology in demonstrations which resulted in higher grain yield than that in the farmers practice. During the period, technological yield gap was observed as 319 kg/ha. The difference in technology gap during different years could be due to differential feasibility of recommended technologies. Singh *et al*., (2007) observed technology gap in pulse production may be due to dissimilarity in the soil fertility status, agricultural practices and local climatic situations. Tripathi (2016) also reported a gap in technology adoption in pulse crops due lack of awareness, timely unavailability of quality input. It concludes that recommended package of practices for chickpea cultivation gave maximum yield as well as net returns.

**Table 4: knowledge levels of the farmers about scientific farming practices of chickpea**

n=100

| Mean score | | | 't' value |
|---|---|---|---|
| Before FLD implementation | After FLD implementation | Mean difference | |
| 23 | 42 | 32.5 | 8.90* |

* Significant at 5% probability level.

## Increase in knowledge

Knowledge level of selected farmers on various aspects of improved chickpea production technologies before and after conducting front line demonstration was measured and compared by applied 't' test. Table 4 found that average knowledge score of farmers increased by 42 after conducted front line demonstrations. The results are in accordance with Narayanaswamy, C. and Eshwarappa, G. (1998). It means there was significant increase in knowledge level of the farmers due to (Improved production technologies of Chickpea) front line demonstration. Positive impact of front line demonstration on knowledge of the farmers that have resulted in higher adaption of improved farm practices as also observed by Shakti *et.al*. (2016).

## CONCLUSION

The front line demonstrations of Chickpea realized that 28.8 per cent increase in yield over farmers

**Table 3: Yield gap analysis of Chickpea production Technology**

| Crop | Potential yield kg/ha | Avg. District yield kg/ha | Avg.FLD yield kg/ha | Avg. Farmers yield kg/ha | Extension yield gap (4-5) kg/ha | Technology yield gap (2-4) |
|---|---|---|---|---|---|---|
| Chickpea | 1600 | 930 | 1281 | 990 | 291 | 319 |

practice. This increase was with an additional expenditure of Rs 1376/ha which may be within the budget any allowance of small and marginal farmers. It is not the cost that deters the farmers from adoption of latest technology but ignorance is the primary reason. It is quite appropriate to call such yield gap as extension gap. The extension gap was found to be 291 kg/ha. The B:C ratio 4.18 is sufficiently high for short duration crop and to motivate the farmers to adopt the technology. Therefore, FLD programme was effective in changing attribute, skill and knowledge of farmers towards improved practice of Chickpea cultivation.

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