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RESEARCH ARTICLE :

Effect of front line demonstration for enhancing the yield of chickpea (*Cicer arietinum* L.)

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SUMMARY : Frontline demonstration (FLD) was conducted at Krishi Vigyan Kendra, Azamgarh, Uttar Pradesh on chickpea (pulse) using seed plus phosphate solublizing bacteria (PSB), *Rhizobium* plus *Trichoderma* plus insecticide (indoxacarb) in combination, at farmers fields for two consecutive years (2013-14 and 2014-15). The highest grain yield (14.10 q/ha) was observed in variety PG-186 in year 2014-2015. It was 46.9 per cent higher yield over the farmers practice (9.60 q/ha). The study indicates FLD enhances the productivity of chickpea over conventional farmer field methods in each progressive year. The highest grain yield was observed in 2014-15 which was close to yield obtained in 2013-14. The lowest yield was recorded in the year 2013-14 under demonstration when compared to traditional chick pea production method which resulted more than succeeding year (in farmers practice). The increasing trend in the per cent increase of yield was found due to variation in agro-climatic factors under rainfed condition. The FLD produces a significant positive result and provide an opportunity to demonstrate the productivity potential and profitability of the latest technology under existing farming conditions.

KEY WORDS :
Chickpea,
PSB, FLD,
Rhizobium,
Trichoderma

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BACKGROUND AND OBJECTIVES

The chickpea (*Cicer arietinum*) is a legume (a type of pulse) of the family Fabaceae. It is also known as gram and sometimes known as Egyptian or Kabuli chana particularly in northern India. Its seeds contain high amount of protein. India is by far the world largest producer, but is also the largest importer. All leguminous crops play an important role in sustainable agriculture by enhancing the fertility of soil via symbiotic biological nitrogen fixation (BNF) with the help of *Rhizobium leguminosarum*. It is an important *Rabi* season food legume having extensive geographical distribution and contributing 39 per cent to the total production of pulse in the country (Singh *et al.*, 2014).

It is a good source of protein (18-22 %), carbohydrate (52-70 %), fat (4-10%), minerals (calcium, phosphorus, iron) and vitamins (Singh *et al*., 2014). It is an excellent animal feed. Its straw also had good forage value. The world's total production of chickpea hovers around 8.5 million metric tons annually

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and is grown over 10.7 million hectares of land approximately. Its average productivity is 789 kg/ha.The chickpea productivity is far below the potential yield. For making the nation self- sufficient in pulses, the productivity levels need to be increased substantially from 598 kg ha^{-1} to 1,200 kg ha^{-1} by 2020 (Ali and Kumar, 2005). Conventional farmers sowing practices, improper crop geometry, avoid use of balanced major (N,P,K), Secondary nutrients and biofertilizers, biopesticide and climatic variabilities are prime reasons for limiting the possible yield of pulses.

Front line demonstration (FLDs) was conducted by Krishi Vigya Kendra, Azamgarh (U.P.) with start of technology mission of pulse. The present study is aimed with an objective of field level demonstration (Using seed + Phosphate solublizing bacteria (PSB), *Rhizobium* + *Trichoderma* + indoxacarb) for enhancing chickpea production over the existing technology opted by the farmers.

RESOURCES AND METHODS

The Front line demonstration on chickpea was conducted by Krishi Vigya Kendra, Azamgarh (U.P.) during 2013-2014 and 2014-2015 in two villages *viz.*, Gopalpur and chek khairula covering two blocks Palani and Ranike Saray, respectively of district Azamgarh U.P. A total 08 farmers were associated under FLD programme.The components of demonstration of front line technology for chickpea production were comprised of improved variety PG-186, proper tillage, proper seed rate and line sowing method, balance dose of fertilizer, use of *Trichoderma*@ of 5g/kg of seed as seed treatment, phosphate solubilising bacteria (PSB), *Rhizobium*, *Trichoderma*, indoxacarb, proper irrigation, weed management and protection measure (Table 1).

Total 8.0 acres area was covered in three consecutive years. In the demonstration, one control plot was also kept where farmers practices was carried out. The FLD was conducted to study the technology gap between potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice. The yield data were collected from both the demonstration and farmers practice using random crop cutting method and analyzed. The technology gap, extension gap and technological index (Samui *et al.*, 2000) were calculated by using following formula (Eq. 1 to 4) as given below :

$$\text{Per cent increase yield} = \frac{\text{Demonstration yield} - \text{farmers yield}}{\text{Farmers yield}} \times 100 \quad \ldots(1)$$

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstrated yield} \quad \ldots(2)$$

$$\text{Extension gap} = \text{Demonstrated yield} - \text{Yield under existing practice} \quad \ldots(3)$$

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstrated yield}}{\text{Potential yield}} \times 100 \quad \ldots(4)$$

The yield data were collected from the selected FLD farmers by random crop cutting method. Qualitative data were converted into quantitative form and expressed in terms of per cent increase in yield calculated using following formula:

$$\text{Grain yield under FLD} - \frac{\text{Grain yield under farmers practice}}{\text{Grain yield under farmers practice}} \times 100$$

$$\text{Extension gap} = \text{Demonstrated yield} - \text{Yield under existing practice}$$

OBSERVATIONS AND ANALYSIS

Field level demonstration was laid out on chickpea to assess the yield and economics at farmers' field. The results indicate that use of improved variety of vegetable chickpea integrated with bio-fertilizers and others agronomical management enhancing the yield of chickpea over farmer. Different parameters were analysed for production of chickpea. Front line demonstration technology results obtained during two consecutive years (2013-2014 and 2014-2015) are presented in Table 2.

Table 1 : Comparison between technological intervention and farmers practices (under FLD on chick pea)

Parameter	Technological intervention	Farmers practice
Variety	PG-16	Local (non-descriptive)
Weed management	Pendimethalin (pre-emergence) 3.5 lit ha^{-1}	Occasional manual weeding for fodder
Fertilizer dose	22 kg N and 60 kg P_2O_5 ha^{-1}	No use of phosphatic fertilizer
Plant protection measures	Indoxacarb @1.5 lit. ha^{-1} at 50 % poding stage	No control measure
Seed treatment	*Rhizobium* @ 25 g kg^{-1} of seed, PSB @ 25 g kg^{-1} of seed *Trichoderma* powder @ 5 g kg^{-1} of seed	No seed treatment

Table 2 : Comparative average yield of chick pea under FLD and farmers practices

Year	Coverage		Average yield		% increase in yield in FLD over farmers practices	Extension gap (q ha^{-1})
	Total farmers	Total area (acre)	Demonstrated plot (FLD) (ha)	Farmers practices		
2013-2014	8.0	8.0	12.17	8.85	38.86	3.32
2014-2015	8.0	8.0	14.10	9.60	46.90	4.50

The results revealed that due to front line demonstration on chickpea an average yield was observed 13.11q/ha as compared to farmers practice 8.05 q/ha. The highest yield in the FLD plot was 15.32 q/ha and in farmers practice 9.2 q/ha during 2014-15 and the lowest yield was recorded in 2013-14. This results clearly indicated that the higher average grain yield in demonstration plots over the years compare to local check due to knowledge and adoption of full package of practices *viz.*, timely sowing, seed treatment with *Trichoderma* @ 5g/kg of seed, use of balanced dose of fertilizer (N and P), weed management and need based plant protection system. The average yield of chickpea increased 62.42 per cent.

The better yield of chickpea was observed might be due to the adoption of appropriate variety like PG-186, balanced doses of fertilizers and seed treatment with *Rhizobium*, phosphorus solublizing bacteria and *Trichoderma* 10 g kg^{-1} of seed. The proper plant protection measures effectively increased the chickpea yield compared to the yield observed under farmers practices. The lesser yield of chickpea at farmer's practices over FLD may be due to the use local or old-age varieties instead of the recommended high yielding resistant varieties, unavailability of seed in time and lack of awareness. Farmers followed broadcast method of sowing against the recommended line sowing and because of this, they applied higher seed rate than the recommended limit (Singh *et al*., 2014).

The extension gap that ranged from 3.20 to 6.66 q ha^{-1} emphasizes that there is need to educate the farmers by many ways for adoption of improved production methods. A descending trend of technology gap (ranging 12.4 to 8.70 q ha^{-1}) reflects the farmers cooperation in carrying out such demonstrations with encouraging results in subsequent years. The technology gap may also be attributed to the dissimilarity in soil fertility status and weather conditions etc. Technology index showed the feasibility of the evolved technology at the farmer's fields. However the lower value of technology index indicates that more is the feasibility of technology at farmers fields. As such fluctuation in technology index during the study period in certain regions may be attributed to the dissimilarity in soil fertility status, weather conditions and pest management, etc. The frontline demonstration on chickpea was helpful for farmers to adopt the new technologies to increase in chickpea production.

Therefore, for enhancing the production of chickpea, strategy should be made for getting the more and more recommended technologies adopted by the farmers (Raj *et al*., 2013; Mokidere *et al*., 2011 and Sharma *et al*., 2011). The variation in per cent increase in the yield was found due to the lack of knowledge, and poor socio-economic condition. The present study indicates that the OFTs and FLDs programmes were effective in chickpea production.

Conclusion :

Demonstration at field level provides an opportunity to display the productivity potential and profitability of the latest technology under the natural farming conditions. The under FLD over existing practices of chickpea cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of chickpea.

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