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Impact of frontline demonstrations on chickpea (*Cicer arietinum* L.) productivity and profitability at tribal farmer's fields in Dhar district of Madhya Pradesh

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Abstract
The present study was carried out by Krishi Vigyan Kendra, Dhar, Madhya Pradesh to study the impact of frontline demonstrations on chickpea (*Cicer arietinum* L.) productivity and profitability at tribal farmer's fields in Dhar district of Madhya Pradesh. The results revealed that, an average highest yield (1743 kg/ha) was recorded in front line demonstrations plots of chickpea by adopting integrated crop management technology as compared to farmers practice (1330 kg/ha). By the adoption of improved production technology of chickpea, the yield was found in increasing trend *i.e.* 31.05% over farmer practices. The average technological gap (257 kg/ha), extension gap (413 kg/ha) and technological index (12.85%) were noticed during the year of 2019-20. The maximum gross monetary return (Rs. 69720/ha) was recorded under demonstration over farmer's practice (Rs. 53200/ha) during 2019-20. Similarly, the highest net profit (Rs. 45220/ ha) was recorded under front line demonstrations' plots over farmer's practice (Rs 31700/ha) during the year of study. The maximum yield was recorded in demonstration plots over local check due to adoption of knowledge and full package of practices.

Keywords: Front line demonstrations, technological gap, extension gap, technology index, yield and economics

Introduction
The Chickpea (*Cicer arietinum*) is a prime legume which belongs to family Leguminosae. It is also known as Bengal gram, Gram, and *Chana* in Hindi. It is a type of pulse with high nutritive value rich in protein, dietary fiber and minerals. It is the prime pulse crop used in diet of vegetarians in India. It is a major source of protein in developing nations. It is a rich source of vegetable protein (20-24%) which is almost three times as compared to cereals and other minerals and vitamins. In addition, it is also used as nutritive fodder, especially for milch animals. Chickpea is a major pulse crop of India accounting for more than 40% of the total pulses area and production. Madhya Pradesh is one of the leading pulses producing state (having first position among other states of India) contributing about 21.35% pulse area (2.10 million hectares) and production (1488 kg/ha) of the country (Anonymous 2021). In addition, the chickpea crop improves the soil fertility by fixing atmospheric nitrogen in the soil by fixing atmospheric N up to 140 kg/ha.

Chickpea is an important *rabi* pulse crop for livelihood and nutritional security of tribal farmers in Dhar district of Madhya Pradesh and it is mostly sown in October-November and harvested in March. The productivity (1210 kg/ha) of chickpea in the Dhar district is far below as compared to the potential yield (2000 kg/ha) due to non-availability of quality seed, infestation of wilt disease, deterioration in soil health and poor adoption of improved agronomical practices. For the sustainable production of chickpea, numbers of technologies are available but farmers' perception towards adoption of good agricultural practices is very poor and they are still practicing the unscientific methodologies. To sustain production of chickpea, several steps were taken. In this regard, to sustain the potential production and consumption system, the Indian Institute of Pulse Research, Kanpur had sanctioned the project "Frontline Demonstrations on *rabi* pulses under Tribal sub Plan'' to ICAR-Agriculture Technology Application Research Institute, Zone-IX, Jabalpur. The basic strategy of the Mission is to promote and extend improved technologies along with capacity building of farmers.

In view, the aim of frontline demonstrations is to identify the production constraints of the technology and extension gap in chickpea through various extension methods and technologies.

Tribal Sub Plan project implemented to boost the production and productivity of pulses through front line demonstrations with latest and specific transfer of technologies at tribal farmers' fields.

Materials and Methods

Front line demonstrations (FLDs) are one of the most powerful tools of extension because farmers, in general, are driven by the perception that "Seeing is believing". The main objective of frontline demonstrations is to demonstrate newly released crop production and protection technologies and its management practices at the farmer's fields under the micro-farming situation.

Krishi Vigyan Kendra, Dhar conducted the 50 front line demonstrations on chickpea crop during rabi season 2019-20 in the two blocks of Dhar district *viz*., Nalcha and Sardarpur. Each frontline demonstration was conducted on 1.0 acre area and adjacent 1.0 acre was considered as control for comparison (farmer's practice). The total area of 20 ha was covered for chickpea demonstrations. A list of farmers was prepared from group meeting and specific skill training was imparted to the selected farmers regarding different aspects of recommended production and protection technologies. The technological interventions on pulse crops were comprised of suitable improved varieties of chickpea that was RVG 203 and demonstrated with full package of practices like soil testing, line sowing, seed treatment with fungicide and inoculation with bio-fertilizer, fertilizer application, weed management, integrated pest management practices etc. for chickpea cultivation as recommended by the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) and need based inputs were provided to the beneficiaries (Table 1). Improved variety (RVG-203) having bold seeded, 112 days maturity and wilt resistant characters was selected. Critical inputs like seed, fungicide, culture and insecticide were facilitated to the beneficiaries under the programme by KVK scientists during the course of training and visits (Table 2). In case of local check, the traditional practices were followed by using existing varieties (Vishal). The yield data were collected from both the demonstration and farmers practice by random crop cutting method. Qualitative data was converted into quantitative form and expressed in terms of per cent increase in yield. The data was further analyzed by using simple statistical tools. The front line demonstrations were conducted to study the technology gap, extension gap and technology index were calculated as given below.

Technology gap

It means the differences between potential yield and yield of demonstration plot.

Technology gap = Potential yield - Demonstration yield

The Extension gap

It means the differences between demonstration plot yield and farmers yield.

Extension gap = Demonstration yield - Farmer's yield

Technology Index

It indicates the feasibility of the evolved technology in the farmers' fields. Lower the value of technology index, higher is the feasibility of the improved technology.

$$\text{Technology index (\%)} = \frac{\text{Potential yield} - \text{Demo.yield}}{\text{Potential yield}} \text{ X } 100$$

Table 1: Comparison between demonstration package and existing practices under FLD

Particulars	Chickpea		
Technology	**Demonstration**	**Farmers Practice**	**GAP (%)**
Farming situation	Irrigated	Irrigated	-
Variety	RVG-203	Vishal	100
Time of sowing	October to November	October to November	No gap
Method of sowing	Line sowing	Line sowing	No gap
Seed rate	80 kg/ha	120 kg/ha	Higher seed rate
Fertilizer as per STV	NPK 20:60:20 kg/ha	NPK 18:46:00 kg/ha	Full gap
Seed treatment and inoculation	With Carboxin 17.5 + Thiram 17.5 @ 2.5 ml/kg of seed and inoculation with Rhizobium and PSB @ 5 g/kg of seed	Nil	Full gap
Weed management	Pre-emergence herbicide (Pendimethalin)	No herbicide	Full gap
Plant protection	IPM	Indiscriminate use	Full gap
Grading & processing	Grading followed	Not followed	Full gap

Table 2: Details of need based critical inputs/technological packages distributed in front line demonstrations of chickpea

Year	Village covered	No. of demo.	Variety	Technology demonstrated	Need based input distributed
2019-20	Hatod, Mograbav, Hedri & Talwada	50	RVG-203	Improved variety, seed treatment, inoculation, nutrient management, weed management and integrated pest management	Improved seed (80 kg/ha), soil testing, seed treatment with Carboxin 17.5 + Thiram 17.5 @ 2.5 ml/kg of seed and inoculation with Rhizobium and PSB @ 5 g/kg of seed, pendimethalin, Indaxacarb, *tricoderma virdii*, on and off campus trainings, exposure visits and field days

Results and Discussion

Frontline demonstrations are effective educational tools in introducing various new technologies to the farmers to boost the farmer's confidence level by comparison of productivity levels between good agricultural practices in demonstration trials. The performance of chickpea crop owing to the adoption of improved technologies is assessed during 2019-20.

Yield attributing parameters

The maximum number of branches (8.7), number of pods (51) and seed index (46.5) was recorded in front line

demonstration while minimum number of branches (5.8), number of pods per plant (36) and seed index (33.2) was recorded in local check. The average highest yield (1743 kg/ha) was recorded in demonstrations when adopted full package of practices over the lowest yield (1330 kg/ha) in farmer's practice. Whereas, the integrated crop management practice in chickpea recorded average 31.05% increase in the yield as compared to local practices (Table 3 & 4).

Technology Gap

The technology gap of demonstration plots was recorded 257 kg/ha during 2019-20 (Table-4). On The technology gap observed during study may be attributed due to dissimilarity in the soil fertility status, production, protection practices and local climatic situation (Table 5).

Extension Gap

Extension gap of 413 kg/ha was noticed during 2019-20 (Table-4). On an average extension gap under FLD programme was emphasized the need to educate the farmers through various extension programs *i.e.* front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. Timely use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap (Table 5).

Technology Index

The technology index 12.85% was recorded (Table-4) which shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of chickpea (Table 5).

Economic Returns

Results revealed that the cost involved in the adoption of improved technology in chickpea production varied and was more profitable. The cultivation of chickpea under improved technologies gave higher net return of Rs. 45220 per ha over farmer's practice (Rs 31700 during 2019-20. The highest B:C (2.85) was recorded under improved package of practices (FLDs) during assessment year as compared to farmers practice (2.47). This may be due to higher yield obtained under improved technologies compared to local check (Table 6).

Table 3: Data on yield attributes in chickpea

S. No.	Crop	Yield attributing characters					
		Av. no of pods/plant		No of Branches /Plant		Seed index (100 grain wt.)	
		Demo.	FP	Demo.	FP	Demo	FP
1	Chickpea (RVG-203)	51	36	8.70	5.8	46.5	33.2

Table 4: Impact of demonstrations on the yield of chickpea

Year	No. of Demonstrations	Area (ha)	Yield kg/ha			% increase in yield over farmers practice
			Potential yield	Demonstration Yield	Farmers practice	
2019-20	50	20	20	1743	1330	31.05

Table 5: Technology gap, extension gap and technology index in chickpea production

Year	Area (ha)	No. of farmers	Technology gap (kg/ha)	Extension gap (kg/ha)	Technical index (%)
					FLD
2019-20	20	50	257	413	12.85

Table 6: Economics of demonstrations under chickpea demonstration

S. No	Year	Cost of Cultivation (Rs./ha)		Gross Monetary Return (Rs./ha)		Net Return (Rs.)		B:C ratio	
		Demo.	FP	Demo.	FP	Demo.	FP	Demo.	FP
1	2019-20	24500	21500	69720	53200	45220	31700	2.85	2.47

* Rate of Chickpea during 2019-20 in the Mandi of Dhar was Rs 4000/q

Conclusion

It is concluded from the study that there exists a wide gap between the potential and demonstration yields in chickpea mainly due to lack of technology, extension gaps and lacking of awareness about new technology in chickpea cultivation in Dhar district of Madhya Pradesh. The above findings of FLDs on chickpea *var*. RVG-203 revealed that the technology gap can be reduced to a considerable extent by adopting modern production technologies of chickpea cultivation and it may lead to increase productivity and profitability. The FLD showed a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology at the farmers' fields, which have been advocating for long time. The productivity gain under FLD over existing practices of chickpea cultivation created greater awareness and motivated the other farmers to adopt suitable production technology in the district. It was also observed that potential yield can be achieved by imparting scientific knowledge to the farmers, providing the quality inputs and their proper utilization. Horizontal expansion of improved technologies may be achieved by implementation of various extension activities like field days, exposure visit, training programme *etc.* organized in FLD programmes at the farmer's fields.

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