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Impact of Technological interventions through FLD on yield, adoption and horizontal spread of Chickpea (*Cicer arietinum*) in Gird zone of Madhya Pradesh

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Abstract
A study on frontline demonstration on chickpea was conducted in different villages of Sheopur district during 2012 to 2016. A total number of 69 farmers were associated under this programme. The demonstrations were laid out on farmers' field according to recommended package of practices of RVSKVV, Gwalior. The farmers' practice was considered as control plot in demonstrations. Chickpea yield under FLDs fluctuated over the years of demonstration. Grain yield of demonstration plot of chickpea was 19.2 q/ha (2012-13), 16.98 q/ha (2013-14), 15.82 q/ha (2014-15), 13.92 q/ha (2015-16) and 21.15 q/ha in 2016-17. There was significant increase in yield of chickpea over the control by 20.75%, 14.49%, 17.62%, 18.36% and 16.59% for the year 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17 respectively. Moreover, production year 2016-17 observed to be more conducive year that registered maximum yield (21.15 q/ha) which was higher than potential yield (20.0q/ha) of chickpea variety RVG 202. The overall technologies adoption of chickpea production was increased by 247.03% due to FLDs. There was significant increase in area under improved varieties from 11.0 ha. to 104 ha. The FLD made positive impact on horizontal spread of recommended improved technologies of chickpea production.

Keywords: frontline demonstration, adoption, horizontal spread, yield

Introduction
Pulses are valued for their importance in food and nutritional security, soil amelioration and sustainable crop production. They also play important role in protecting the environment from the associated with high input agriculture. India has pride of being the world's largest producer, consumer and importer of pulses contributing 17.58 million tones to global pulse basket (72.34 million tons) (Joshi & Rao, 2017) [2]. Chickpea is one of the important pulse crop of world which is used extensively as a primary source of protein for human beings as well as nitrogen for many cropping systems and is widely grown in all Indian states. India is the largest producer of chickpea accounting for about 70 per cent of global production. Out of 13.73 mt. chickpea produced world over from 13.98 m ha, India produces 9.5 mt. form 9.92 m ha. In Madhya Pradesh , chickpea occupies an area of 30.76 lac ha with a production of 33.98 lac tones with an average productivity of 1105kg/ha, accounts for 30.94per cent and 35.46 per cent area and production of country, respectively (Annual report DPD 2016-17). In spite of highest production, the state productivity in comparison to other state's average productivity is low. The low yield of chickpea is not only due to its cultivation on marginal land, but also because of lack of quality seed of improved variety, inadequate and imbalance fertilizer, uneven plant population, severe infestation of seasonal and perennial weeds, no adoption of intercultural operations, plant protection measures and climate variability are major reasons to limiting the potential yield of chickpea. The mandate of KVK is to plan and carry out on farm trial to asses and refine location specific technologies developed by the National Agricultural Research System (NARS). The main purpose is to have an appropriate technology which may be economically profitable, ecologically sustainable, technically feasible and culturally compatible. Another important acitivity of KVK is to demonstrate the assessed, refined & flagship technologies developed by NARS on farmers field to enhance productivity and profitability of principle crops growing in the district. Therefore, KVK should know that to what extent the productivity of these crops are in round due to demonstrations, to what extent crops demonstrations helped for horizontal spread of technologies in their operational area and extent to what the new technologies area adopted by the farmers. With this background,

present study was undertaken to assess the impact of front line demonstration (FLDs) organized by KVK, Sheopur. Study was conducted with the objective to study the impact of frontline demonstration (FLDs) on yield enhancement of chickpea, impact of front line demonstration (FLDs) on adoption of technology and the extent of horizontal spread of chickpea technology through FLDs.

Methodology

The technological intervention on chickpea were implemented at farmer's field in participatory mode by Krishi Vigyan Kendra Sheopur during the year 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17 in seventeen villages viz. Panwada, Ochhapura, Bardha, Basond, Sesaipura, Hathwari, Ajapura, Makdawadakalan, Lalitpura, Kudayatha, and Chandrapura of district sheopur. This district located in the gird zone of Madhya Pradesh, locally equipped with 5 tahsil, 3 blocks and around 600 villages. The average annual rainfall is 822 mm while temperature ranges between 45 ºC to 4.0 ºC during summer and winter. In general the soils under study were clay loam in texture with PH 7.1-7.9. The available nitrogen and phosphorus were low to medium and potassium was medium to high. Farmers were selected on basis of group approach and specific skill training was imparted to the selected farmers regarding various aspects on proven technologies. During five years of demonstration, a total of 69 farmers were associated under this programme. The demonstrations were laid out on farmer's field according to recommended package of practices of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior. The farmers practice was considered as control plot in demonstration. The demonstration plot was supervised by the KVK scientists. The data from FLDs were collected by KVK scientist and used to assess the impact on yield. However, data about adoption and horizontal spread of technologies were collected from the farmers with help of interview schedule. Data were subjected to suitable statistical methods. The following formulae were used to assess the impact of different parameters of chickpea.

$$\text{Impact on Yield (\% Change)} = \frac{\text{Yield of demonstration plot - yield of control plot}}{\text{Yield of control plot}} x100$$

$$\text{Impact on adoption (\% change)} = \frac{\text{No of adopters after demonstration - No. of adopter befor demonstraion}}{\text{No. of adopters before demonstration}} x100$$

$$\text{Impact on Horizontal spread (\% change)} = \frac{\text{After area (ha) - Before area (ha)}}{\text{Before area (ha)}} x100$$

Result and Discussion

Impact on yield

The findings on impact of front line demonstration (FLDs) on yield enhancement of chickpea are presented in table -1. The pool data of five years are clearly indicate that chickpea yield under technology interventions fluctuated over the year of demonstrations. None of the year is found quite superior in respect of potential yield produced during the evaluation period except cropping year 2012-13 and 2016-17. It is evident from the date in table-1 the grain yield of chickpea under demonstration plot was 19.2 q/ha (2012-13), 16.98 q/ha (2013-14), 15.82 q/ha (2014-15), 13.92 q/ha (2015-16) and 21.15 q/ha in 2016-17. It shows that yield of chickpea increased significantly over the control by 20.75 per cent, 14.49 per cent, 17.62 per cent, 18.36 per cent and 16.59 per cent for the year 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17, respectively. Similar trend of FLD was found by Mishra *et al.* (2009) [4] on potato crop and Mahale *et al.* (2016) [3] on ground nut crop. Moreover, production year 2016-17 observed to be more conducive year that registered maximum yield (21.15q/ha) which was higher than potential yield (20.09q/ha) of chickpea variety RVG 202, this shows the positive impact of FLD of chickpea crop. Yield enhancement in different crops under front line demonstration was also reported by Tiwari and Saxena (2001) [6] Tomar *et al*, (2003) [7] and Naberia *et al.* (2015) [5]. The yield of chickpea under farmers' practice was lower due to low yielding local varieties, imbalanced fertilization and improper plant protection measures. However in case of demonstration plot, the factors led to enhance the yield of crop were timely sowing, use of high yielding recommended varieties, balanced fertilization and strong technology back stopping from KVK.

Impact on adoption of technology

Impact of front line demonstrations (FLDs) on adoption of chickpea production technology by the farmers is presented in table -2. It was found that adoption of recommended improved varieties of chickpea by the farmers was less before demonstration period, which was increased by 555.55 per cent after demonstration. This was followed by adoption of important operation of chickpea i.e. seed treatment with fungicide which was increased 418.18 per cent, use of *Rhizobium* & PSB culture was increased by 316.66 per cent due to FLD. In addition to above technologies, the per cent of adopters of recommended technologies such as seed rate, spacing, fertilizer management, weed management and plant protection measures were increased by 240 per cent, 133.33, 115.78, 100.00 and 96.77 per cent respectively. The overall technology adoption of chickpea production was increased by 247.03 per cent due to FLDs conducted by KVK Sheopur. Same findings were reported by Mahele *et al.* (2016) [3] in oilseed crops.

Impact on Horizontal spread

Horizontal spread of improved technologies of chickpea production was presented in table-3. The FLD organized on chickpea crop helped to increase area under recommended improved technologies. There was significant increase in area under improved varieties from 11.0 ha to 104 ha. Maximum increase in area wad recorded under variety RVG-202 (0-60ha) which was followed by JAKI-9218, JG-13, JG-11 & Pratap -1. Similarly, area under seed rate, seed treatment with fungicide, use of Rhizobium+PSB culture, spacing, fertilizer management, weed management and Pest management was increased from 8.0 ha to 31 ha, 7 ha to 81 ha, 3 ha to 13ha, 2 ha to 11 ha, 11 ha to 48 ha, 13 ha 61 ha and 17 ha to 78 ha.

respectively due to FLD. The FLDs made positive impact on horizontal spread of recommended improved technologies of chickpea production

Conclusion

Keeping above findings in view, it can be concluded that the front line demonstrations (FLDs) enhanced the yield of crops vertically and ensured rapid spread of technologies horizontally. The FLDs made positive and significant impact on yield enhancement of chickpea as well as adoption and horizontal spread of technology. Therefore, it can be recommended that for transfer of improved agriculture technologies on farmers field priority should be given to organize front line demonstration (FLDs) extensively in cluster approach for enhancing yield of major crops and to make rapid spread of improved technologies.

Table 1: Impact of Front Line Demonstration (FLDs) on yield of chickpea

Year	Technology intervention	No. of farmers	Demo. Area (ha)	(yield q/ha) control plot	PY	Yield (q/ha) Demo. plot	Impact (% change)
2012-13	Improved variety JG-11 + seed treatment with carbendazim + *Rhizobium* +PSB+NPK: 20:50:20+ need based pesticide	12	4.80	15.9	17	19.20	20.75
2013-14	Improved variety JAKI-9218	19	7.60	14.83	20	16.98	14.49
2014-15	Improved variety JG-130	12	4.80	13.45	16	15.82	17.62
2015-16	Improved variety Pratap-1	13	5.20	11.76	20	13.92	18.36
2016-17	Improved variety RVG-202	13	5.20	18.14	20	21.15	16.59
Total /Av.		69	27.6	14.81	18.61	17.41	17.55

Table 2: Impact of Front Line Demonstration (FLDs) on Adoption of Chickpea Production Technology

Technology	No. of adopters (N-69)		Change in No. of adopters	Impact (% change)
	Before demon.	After Demon.		
Recommended improved variety (JG-11, JAKI-9218, JG 130, Pratap-1, RVG-202)	09	59	+50	555.55
seed rate (75kg/ha)	15	51	+36	240.00
Seed treatment with fungicide	11	57	+46	418.18
Rhizobium + PSB	06	25	+19	316.66
Spacing (30 x 15 cm)	09	21	+12	133.33
Fertilizer management 20:50	19	41	+22	115.78
Weed management	27	54	+27	100.00
Pest management	31	61	+30	96.77

Table 3: Impact of Front Line Demonstration (FLDs) on Horizontal Spread of Improved Technology of Chickpea Production

Technology	Area (ha)		Change in area	Impact (% change)
	Before demon.	After Demon.		
RVG 202	0	60	+60	
JAKI 9218	03	21	+18	600
JG 130	05	13	+08	160
JG 11	02	07	+05	250
PRATAP-1	01	03	+02	200
Seed rate (75kg/ha)	08	31	+23	287
Seed treatment with fungicide	07	81	+74	1057
Seed treatment with *Rhizobium* + PSB	03	13	+10	333
Spacing (30x15 cm)	02	11	+09	450
Fertilizer management 20:50	11	48	+37	336
Weed management	13	61	+48	369
Pest management	17	78	+61	358

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