Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(4): 936-938

Received: 16-05-2020
Accepted: 18-06-2020

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Impact of front line demonstration on the yield and economics of chickpea in Shajapur district of Madhya Pradesh

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Abstract
The present study was conducted continuously during three years from *Rabi* 2016-17, 2017-18 and 2018-19 to assess the impact of front line demonstration on the yield and economics of chickpea in Shajapur District of Madhya Pradesh. The improved technologies consisting use of improved variety, sowing method, seed treatment with rhizobium and PSB culture, balanced fertilizer application and integrated pest management. FLD recorded higher yield as compared to farmer's practice. The average results of three pooled data revealed that the front line demonstration on chickpea an average yield was recorded 18.24 q/ha under demonstrated plots as compare to farmers practice 15.31 q/ha. The improved technology gave higher gross return, net return with higher benefit cost ratio as farmer's practices.

Keywords: Chickpea, yield, technology gap, extension gap

Introduction
Chickpea is one of prominent pulse crop in India, accounting 75 percent of world production. 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) [11]. Front line demonstration (FLDs) is introduced by the Indian Council of Agricultural Research, New Delhi with inception of technology mission of pulse and oil seed crops during mid eighties. The field demonstration could under the close supervision of scientist of the KVKs. Poonia and Pithia (2011) [8] concluded that the yield gap between conventional practices and improved package of practices was much higher ranging from 21 kg/ha to 349 kg/ha. Mishra and Khare (2017) [7] concluded that front line demonstration was effective in changing attitude, skill and knowledge of latest production technology viz., HYV, seed treatment with fungicide and biofertilizer, balance dose of fertilizer, timely sowing and insect pest and disease management of chickpea. Dhakad *et al.* (2018) [4] revealed that the front line demonstration on chickpea an average yield was recorded 14.95 q/ha under demonstrated plots as compare to farmers practice 11.98 q/ha for JG 11 variety and average yield was recorded 13.95 q/ha under demonstrated plots as compare to farmers practice 8.74 q/ha for JG 16 variety. Singh *et al.* (2019) concluded that the frontline demonstrations enhanced the yield of crops vertically and ensured rapid spread of technologies horizontally. The technological demonstrations made positive and significant impact on enhancement of chickpea seed yield by 55.27 percent and lentil by 64.45 percent. Singh *et al.* (2020) [14] reveals the increases yield of demonstrated plots that was 46.30 percent as compared to existing farming practices for chickpea respectively due to adoption of improved package of practices for chickpea crop. Keeping the importance of FLDs, the KVK, Shajapur conducted demonstrations on chickpea at farmers field in rabi season during the year 2016-17, 2017-18 and 2018-19.

Materials and Methods
The present study was conducted by the Krishi Vigyan Kendra, Shajapur of Madhya Pradesh continuously for three consecutive years (*Rabi* 2016-17, 2017-18 and 2018-19) to assess the impact of improved technology of chickpea under real farm situations. In general soil of the area under study was medium black with medium fertility status. The component demonstration of front line technology in chickpea was comprised of improved variety JG-130 and JAKI 9218, proper seed rate and improved sowing method, balance dose of fertilizer

(18 kg Nitrogen + 46 kg P2O5 /ha), use of Trichoderma @ of 5g/kg of seed as seed treatment, proper irrigation, weed management and protection measure. In the demonstration, one control plot was also kept where farmers practices was carried out. The aim of the FLDs was to demonstrate the impact of research emanated production technologies that of improved varieties, seed treating chemicals, Integrated Nutrient management, Integrated pest Management and strategies to economize water application and prevent the crop from abiotic stress particularly frost in the month of December and January and high temperatures at seed filling to maturity stages. The FLD was conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. Site selection, farmers selection were considered as suggested by Choudhary (1999) [3]. The observation on seed yield, straw yield per ha were recorded. Other parameters like harvest index, technology index were worked out as suggested by Kadian *et al.* (1997) [5]. The gross return, net return, cost of cultivation and benefit cost ration were also calculated. Training to the farmers of respective villages was imparted before conducting the demonstrations with respect to envisaged technological.

Results and Discussion

There is a general feeling that pulses (C-3 plants) suffer from inherently low yield potential and are a physiologically inefficient group of plants compared to cereals (C-4 plants) such as sorghum and maize. However Aggarwal *et al*., (1997) [1], reviewed the comparative advantages of C-3 and C-4 group of plants and argued that C-3 and C-4 plants seem to compete on fairly even terms in hot dry environments. The fact that C-3 plants usually do better in cool climates suggests that C-3 plants are better for rabi season. Grain Yield, technology gap, Extension gap, Technology index of Chickpea in district Shajapur was presented in Table-1 for rabi season during the year 2016-17, 2017-18 and 2018-19.

Yield

The data results revealed that the front line demonstration on chick pea an average yield was recorded 19.4 q/ha under demonstrated plots as compare to farmers practice 16.1 q/ha for two year pooled data for JAKI 9218 variety. The data for JG 130 variety revealed that the front line demonstration on chickpea an average yield was recorded 15.92 q/ha under demonstrated plots as compare to farmers practice 13.73 q/ha. 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 i.e. appropriate varieties such as JG 130, JAKI 9218 timely sowing, improved sowing method, seed treatment with *Trichoderma* @ 5g/kg of seed, use of balanced dose of fertilizer (18 kg N and 46 kg P_2O_5 ha^{-1}), method and time of sowing, timely weed management and need based plant protection. The average yield of chickpea increased from 14 to 28 percent. The yield of chick pea could be increased over the yield obtained under farmers practices (use of non-descriptive local variety, no use of the balanced dose of fertilizer, untimely sowing and no control measure adopted for pest management) of chick pea cultivation. The above findings are in similarity with the findings of Singh (2002) [10] Poonia and Pithia (2011) [8] and Dhakad *et al.* (2018) [4].

Technology gap

The technology gap the differences between potential yield and yield of demonstration plots were 9.08 and 5.60 q/ha for JG-130 and JAKI 9218 variety respectively. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agricultural practices and local climatic situation.

Extension gap

Extensions gap of 2.19 and 3.30 q/ha were observed for JG-130 and JAKI 9218 variety respectively which emphasized the need to educate the farmers through various extensions means i.e. front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap.

Technology index

The technology index shows the feasibility of the demonstrated technology at the farmers field. The technology index varied from 36.32% and 22.4% for JG-130 and JAKI 9218 variety respectively (Table-1).Higher technology index reflected the insufficient extension services for transfer of technology. The lower value of technology index shows the efficacy and excellent performance of technological interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of chick pea. The FLD produces a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology (intervention) under real farming situation which they have been advocating for long time. Similar findings were reported by Singh *et al.* (2018) [12], Singh et.al (2014) [11].

Economic return

The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table 2). The cultivation of chickpea variety of JG-130 and JAKI 9218 under improved technologies gave higher net return per hectare of Rs. 50412 and 50320 respectively as compared to farmers practices. The benefit cost ratios of chickpea variety of JG-130 and JAKI 9218 under improved technologies were 4.12 and 3.81 as compared to 3.67 and 3.43 under farmers practices.This may be due to higher yields obtained under improved technologies compared to local check (farmers practice). This finding is in corroboration with the findings of Mokidue *et al.* (2011) [6] Raj *et al.* (2013) [9], Bhargav *et al.* (2015) [2] and Dhakad *et al.* (2018) [4].

Table 1: Grain Yield, Technology gap, Extension gap, Technology index of Chickpea under FLDs

Year	Crop	Variety	Area (ha)	No of farmers	Grain Yield (q/ha)			% increase over FP	Technology Gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
					Potential	RP	FP				
2016-17	chickpea	JG 130	20	50	25	15.92	13.73	15.95	9.08	2.19	36.32
2017-18	chickpea	JAKI 9218	15	37	25	20.6	18	14.44	4.4	2.6	17.6
2018-19	chickpea	JAKI 9218	20	50	25	18.2	14.2	28.16	6.8	4	27.2
Average			25.00	18.24	15.31	19.52	6.76	2.93	27.04	25.00	18.24

Table 2: Economic analysis of the recommended Practices of Chickpea under FLDs

Chickpea variety	Yield (q/ha)		% increase over FP	Gross Expenditure (Rs/ha)		Gross Return (Rs/ha)		Net Returns (Rs/ha)		B:C Ratio	
	RP	FP		FP	RP	FP	RP	FP	RP	FP	RP
2016-17	15.92	13.73	15.9505	18900	19500	69312	80406	50412	60906	3.67	4.12
2017-18	20.6	18	14.4444	21000	22500	79200	90728	58200	68228	3.77	4.03
2018-19	18.2	14.2	28.169	20000	22000	62445	80081	42441	58082	3.1	3.6
Average	18.24	15.31	19.52	19966	21333	70319	83738	50351	62405	3.51	3.92

Conclusion

Front line demonstration (FLDs) play a very important role to disseminate recommended technologies is shows the potential of technology resulting in an increased in yield at farmers level. These practices may be popularized in this area by the extension agency to bridge the higher extension gaps. This also improved the relationship between farmers and scientist and built confidence between them. Under sustainable agricultural practices, with this study it is concluded that the FLDs programmes were effective in changing attitude, skill and knowledge of improved package and practices of HYV of chickpea adoption.

Acknowledgement

Authors are thankful to Agricultural Technology Application Research Institute (Indian Council of Agricultural Research), Zone-IX, Jabalpur (MP) for providing necessary budget to conduct the frontline demonstrations on chickpea with the intend to raise the productivity and livelihood.

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