Int.J.Curr.Microbiol.App.Sci (2021) *10*(10): 457-461

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 10 Number 10 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1010.055

Chickpea Yield Improvement through Front Line Demonstrations in Rajsamand District, India

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Keywords

Cicer arietinum, Front line demonstration, INM, IPM, Productivity, Technology gap, Extension Economics

Article Info

Accepted:
18 September 2021
Available Online:
10 October 2021

A B S T R A C T

The study was carried out during *rabi* season of 2015-16, 2016-17 and 2017-18 in 6 villages across 3 blocks (Rajsamand, Railmagra and Amet) of Rajsamand district. In all 225 front line demonstrations on chickpea crop were carried out in an area of 90.0 ha with the active participation of farmers with the objective to demonstrate the latest technology of chickpea production potential, technological gap, extension gap, technology index and economic benefit of improved technologies consisting suitable varieties GNG 1581, integrated nutrient management (20:40:0 NPK kg/ha + *Rhizobium* + PSB @ 20 g/kg seed) and integrated pest management (deep ploughing + seed treatment with *Trichoderma viridae* @ 6 g/kg seed +pheromone trap @ 10/ha + spray of Quinalphos @ 1.2 l/ha with 600 litres of water) at Rajsamand, Railmagra and Amet blocks of Rajsamand district during 2015-16 to 2017-18. The results revealed that FLD recorded higher yield as compared to farmers' practices over the years of study. The improved technologies recorded average yield of 18.94 q ha^{-1} which was 27.97 per cent higher than that obtained with farmer's practices of 14.81 q ha^{-1}. In spite of increase in yield of chickpea, technological gap, extension gap and technology index existed which was 4.06, 4.13 q ha^{-1} and 17.67 per cent, respectively. The extension gap can be bridged by popularizing package of practices where in stress need to be laid on improved variety, use of proper seed rate, balanced nutrient application and proper plant protection measures. Improved technologies gave higher net return of Rs. 67727 ha^{-1} with benefit cost ratio 4.88 as compared to local check (Rs. 50487 ha^{-1}, benefit cost ratio 4.22).

Introduction

Pulses constitute a very important dietary constituent for humans and animals because of their richness with proteins (ranging from 20 to 27%, depending upon the crop species) and essential minerals, vitamins and dietary fibres. The protein content of grain legumes is double that of wheat and three times that of rice. Therefore, pulses as a complement to cereals, make one of the best solutions to protein-calorie malnutrition. India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. The highest pulses production of 23.15 million tonnes was attained in the year 2019-20. The three largest pulses producing states are Rajasthan, Maharashtra and Madhya Pradesh contributed 19.41%, 17.40% and 16.41%, respectively in all India pulses production during 2019-20 (Annual Report 2019-20). Chickpea (*Cicer arietinum*) is the pre dominant crop among pulses in Rajasthan, occupying 15.72 lakh ha area with 16.88 lakh tones production accounting 16.15 and 14.92 per cent of the national chickpea area and production, respectively (Rajasthan Agricultural Statistics 2017-18). The average productivity of chickpea was 7.25 kg/ha is far below the potential expected from improved technologies due to adoption of local cultivar, low and imbalance of use of fertilizer and no use of insecticides. The seed yield of chickpea on farmer fields can be enhanced at least 75 per cent with adoption of improved technologies such as improved cultivar, recommended dose of fertilizers and control of insect pests (Tomar 2010).

Materials and Methods

Krishi Vigyan Kendra, Rajsamand situated at (25.029°N latitude, 73.89°E longitude and an altitude of 547 m above msl) Sub Humid Southern plain and Aravalli hills of Rajasthan (Agro climatic Zone IV a). The district has a semi-humid climate with average temperature of the district varies from 21.8-46°C in summer and 09- 26°C in winter and annual rainfall is about 500-900 mm. In the present study performance of improved technologies of chickpea against local check was evaluated through front line demonstrations conducted at farmer's field during *rabi* season. Application of integrated nutrient management and proper plant protection measures are most critical inputs for increasing seed yield of chickpea (Jadhav *et al.*, 1992). Keeping this in view, front line demonstrations of chickpea were conducted to demonstrate the productivity potential, economic benefit of improved technologies along with extension gap, technology gap and technology index were workout under real farmers conditions. In the present performance of chickpea variety GNG 1581 against local check was evaluated through front line demonstrations conducted at farmer's field during *rabi* season in irrigated conditions. In total of 225 demonstrations were laid out in the year 2015-16 to 2017-18 on 90 ha area in six adopted villages (Kharbamania and Kabra) of Railmagra block, (Bhagwanda kalan and Amloi) of Rajsamand block and (Jilola and Bhadala) of Amet block in Rajsamand district. Initial status of available N, P and K in soil were 190, 27 and 492 kg/ha, respectively with 8.1 pH. Each demonstration was conducted in an area of 0.4 ha adjacent to the plots of farmer's practices (local check). The improved technologies included improved variety GNG 1581, integrated nutrient management (20:40:0 NPK kg/ha + *Rhizobium* + PSB @ 20 g/kg seed) and integrated pest management (deep ploughing + seed treatment with *Trichoderma viridae* @ 6 g/kg seed +pheromone trap @ 10/ha + spray of Quinalphos @ 1.2 l/ha with 600 litres of water) were tested under demonstrations. The crop was sown between 15 October to 5 November with spacing of 30 × 10 cm and seed rate was 75 kg/ha. An entire dose of N and P through diammonium phosphate was applied as basal dose before sowing. The seeds were treated with *Trichoderma viride* @ 6 g/kg seed then seeds were inoculated by *Rhizobium* and phospho-solubilizing bacteria bio-fertilizers each 20g/kg seed. Hand weeding was done once at 25-30 days after sowing. The pheromone trap @ 10/ha was fixed after 30 days of sowing, one spray of Quinalphos @ 1.2 l/ha with 600 litres of water was given at the time of incidence of *Helicoverpa armigera*. Fields were irrigated prior to sowing, at pre flowering (35 days after sowing) and at pod formation stage and the crop was harvested between last week of February to first week of March. At harvesting, five random samples of one meter square area from each demonstration fields were harvested and composite sample was weighted for total biological yield. After weighing seeds were separated by beating and cleaned seeds were weighted for seed yield. The technology gap, extension gap and technology index were calculated using following equations (Samui *et al.*, 2000).

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers yield

Technology index (%) = Technology gap/ Potential yield × 100

Results and Discussion

The productivity of chickpea ranged from 18.11 to 19.92 q/ha with average yield of 18.94 q/ha under improved technologies on farmers fields as against a yield ranged 14.25 to 15.10 q/ha with an average of 14.81 q/ha recorded under farmers practices (local check).

The highest productivity following improved technology as well as local check was during the year 2016-17 which might be due to continuous use of integrated pest and nutrient management practices and weather conditions. In comparison to local check there was an increase of 27.09, 32.44 and 24.37 per cent productivity, respectively during 2015-16, 2016-17 and 2017-18 following improved technologies. The higher yield of chickpea under improved technologies was due to the use of high yielding variety, integrated nutrient and pest management. Similar results have been reported by Yadav *et al.*, (2007). The technological gap, which is the difference between potential and demonstration yield was maximum in the year 2015-16 (4.89 q/ha) and lowest in the year 2016-17 (3.08 q/ha). However, overall average technological gap in the study was 4.06 q/ha. The technological gap observed may be attributed to the dissimilarity in soil fertility status and weather conditions (Mukharjee 2003). The extension gap ranged from 3.68 to 4.85 q/ha during the period of study, emphasizes the need to educate the farmers through various means for adoption of improved technologies to reverse the trend of wide extension gap. Technology index shows the feasibility of evolved technology at the farmer’s field and lower the value of technology index more is the feasibility of the technology (Jeengar *et al.*, 2006). Technology index in the present case varied between 13.39 to 21.26 per cent and averaged 17.67 per cent during the period of study.

The inputs and outputs prices of commodities prevailed during each year of demonstrations were taken for calculating cost of cultivation, net return and benefit cost ratio (Table 2). The investment on production by adopting improved technologies ranged from Rs. 12500 to 25455/ha with a mean value of Rs 17972/ha against local check where the variation in cost of production ranged from Rs. 11000 to 23000/ha with an average of Rs 16000/ha. The cultivation of chickpea under improved technologies gave higher net return of Rs. 72325, 73680 and 57177/ha as compared to Rs 54340, 53680 and 43440/ha under local check in the corresponding years. The average benefit cost ratio of improved technologies was 4.88, varying from 3.25 to 6.79 and that of local check was 4.22, varying from 2.89 to 5.94. This may be due to higher yields obtained under improved technologies compared to local check (farmers practice).

Table.1 Productivity, technology gap, extension gap and technology index of chickpea (cv GNG 1581) under FLDs

Year	Area (ha)	No. of Demon.	Seed yield (q/ha)			Per cent increase in yield over local check	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
			Potential	Improved technologies	Local Checks				
2015-16	20	50	23	18.11	14.25	27.09	4.89	3.86	21.26
2016-17	30	75	23	19.92	15.10	32.44	3.08	4.85	13.39
2017-18	40	100	23	18.78	15.07	24.37	4.22	3.68	18.35
Mean			**23**	**18.94**	**14.81**	**27.97**	**4.06**	**4.13**	**17.67**

Table.2 Cost of cultivation (Rs/ha), net return (Rs/ha) and B:C ratio as affected by improved and local practices

Year	Cost of cultivation		Net return		B:C ration	
	Improved practices	Local check	Improved practices	Local check	Improved practices	Local check
2015-16	12500	11000	72325	54340	6.79	5.94
2016-17	15960	14000	73680	53680	4.61	3.83
2017-18	25455	23000	57177	43440	3.25	2.89
Mean	**17972**	**16000**	**67727**	**50487**	**4.88**	**4.22**

This finding is in corroboration with the finding of Mokidue *et al.*, (2011). The cultivation of chickpea with improved technologies including suitable variety, integrated nutrient and pest management has been found more productive and seed yield might be increase up to 27.97 per cent. Technological and extension gaps existed which can be bridged by popularizing package of practices with emphasis on improved variety seed, use of proper seed rate, balanced nutrient application and proper use of plant protection measures.

The improved technologies recorded average yield of 18.94 q/ha which was 27.97 per cent higher than that obtained with farmers practices of 14.81q/ha. In spite of increase in seed yield of chickpea, technological gap, extension gap and technology index existed which was 4.06, 4.13 q/ha and 17.67 per cent, respectively. The extension gap can be bridged by popularizing package of practices where in stress need to be laid on improved variety, use of proper seed rate, balanced nutrient application and proper plant protection measures. Improved technologies gave higher net return of Rs. 67727/ha with benefit cost ratio 4.88 as compared to local check (Rs. 50487/ha, benefit cost ratio 4.22).

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How to cite this article:

Mani Ram and Balai, C. M. 2021. Chickpea Yield Improvement through Front Line Demonstrations in Rajsamand District, India. *Int.J.Curr.Microbiol.App.Sci.* 10(10): 457-461.
doi: https://doi.org/10.20546/ijcmas.2021.1010.055