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YIELD GAP ANALYSIS THROUGH FRONT LINE DEMONSTRATION OF INTEGRATED NUTRIENT MANAGEMENT IN COTTON

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ABSTRACT

Front line demonstration is an actual and suitable tool to determine recommended technologies among the farmers field. Krishi Vigyan Kendra, JAU, Amreli conducted 30 demonstrations on integrated nutrient management in cotton during 2019-20, 2020-21 and 2021-22 in the villages of Amreli district. The study found, the yield of cotton in IP under irrigated conditions ranges from 12.20 to 19.58 q/ha whereas in FP it ranges between 11.00 to 17.61 q/ha. The per cent increase in yield with IP over FP was recorded in the range of 10.9 to 16.6 %. The technology gap, extension gap and technological index were ranging from 5.4 to 12.8 q/ha, 1.2 to 2.5 and 21.7 to 51.2 per cent, respectively. The trend of technology gap reflected the farmer's cooperation in carrying out integrated nutrient management demonstrations with encouraging results in subsequent years. The cost benefit ratio was 3.0 to 3.59 under INM demonstration, while it was 2.27 to 2.70 under control plots. By conducting front line demonstration of proven technologies, yield potential of cotton crop under INM could be enhanced to a great extent with increase in the income level of the farming community.

Keywords: *frontline demonstration; cotton technology gaps; extension gaps; technology index*

INTRODUCTION

Cotton is a very important cash, oilseed and fiber crop of India. Which plays an important role in strengthening the Indian economy by contributing 1/3rd of the country's earnings. Cotton cultivation in India covers an area of about 12.23 mh with a production of 377 lakh bales and a productivity of 524 kg/ha. India ranks first in the world in terms of area and production. (Anonymous, 2017). In Gujarat, farmers usually adopt multiple cropping system in a year using only major chemical fertilizers to get higher production. Due to which the soil health is deteriorating due to addition of organic fertilizers and organic fertilizers and micro elements in the soil. Therefore, there is an urgent need to improve soil health by applying organic fertilizers, micronutrients in addition to organic fertilizers through integrated nutrient management which can increase yield, as well as improve soil health to sustain cotton productivity. Biofertilizers increase beneficial symbiotic microorganisms in the soil, making scarce nutrients available to crops as an alternative to chemical fertilizers. Enriched with nutrients using microorganisms that also stabilize symbiotic relationships with plants are therefore cost-effective renewable sources of plant nutrients. These bio-fertilizer also mobilize important elements of nutrients from non-useful to useful forms. Organic fertilizers such as castor cake provide nutrients to crops and improve soil structure. Micronutrients improve the quality of crop production. Keeping in view the above fact, KVK, Amreli set up front line demonstration of Integrated Nutrition Management on farmer's field to achieve higher yield and lower cost in cotton crop.

Front Line Demonstration (FLD) was started in cotton INM to generate production data and feedback information to various development agencies, which are engaged in dissemination of technological advances through researchers to the farmer's fields.

Thirty FLDs were conducted from 2019-20 to 2021-22 in Amreli district of Gujarat to demonstrate the integrated nutrient management in cotton were suitable for that eco-system. The simultaneous impact of such demonstrations is given in (Table 1).

Table 1 : Difference between technology intervention and farmers practice under INM FLD on cotton

Particulars	Improved practices	Existing practice	Gap
Hybrid	Gujarat cotton Hybrid-8 (BT), Gujarat cotton Hybrid-6 (BT), GTHH-49/Private varieties	Gujarat cotton Hybrid-8 (BT), Gujarat cotton Hybrid-6 (BT), GTHH-49/Private	Nil
Land preparation	Three ploughing	Three ploughing	Nil
Sowing method	Line sowing (120X45 cm)	Line sowing (120-150 X 90-120 cm)	Partial gap
Fertilizer dose	Chemical fertilizers: 240:50:150 kg NPK/ha Bio-fertilizers, Castor cake, micro-nutrients, FYM	250-300:50-80:0 NPK/ha	Full gap
Weed management	Pre-emergence application of Pendimethalin @1.0 kg a.i./ha along with two inter-culturing and two hand weeding operations at 30 and 60 DAS	One or two hand weeding along with two inter-culturing	Partial gap
Plant protection	Need based plant protection measure	Used different pesticides	Uneven use of pesticide

OBJECTIVE

To analyze the impact of the demonstrations in vertical and lateral spread of the technologies and the resultant improvement in yield and income of the cotton growers

METHODOLOGY

The present study was carried out during the year 2019-20 to 2021-22 in villages of Amreli district of Gujarat. Thirty numbers of demonstrations on integrated nutrient management in cotton were conducted in different villages with an objective to identify the yield gaps as well as to work out the difference in input cost and monetary returns under front line demonstrations and farmers' practices (local checks) of cotton crop.

The critical inputs under integrated nutrient management were applied as per the scientific package of practices recommended by the Cotton research station, JAU, Junagadh (Gujarat). The component demonstration of front-line technology in cotton was comprised of improved hybrids varieties, proper tillage, proper seed rate and sowing method, balance dose of fertilizer, seed treatment, proper irrigation, weed management and protection measure (Table no. 1). The data on production cost and monetary returns were collected for three years (2019-20 to 2021-22) from front line demonstration plots to work out the economic feasibility of improved and scientific cultivation of cotton. Besides, the data from local checks, data were also collected where farmers were using their own practices for cultivation of cotton crops. The technology gaps, extension gaps and technology index were calculated as given by Samui *et al.* (2000) as:

(1) Percent increase yield $= \dfrac{\text{Demonstration yield farmers yield}}{\text{Farmers yield}} \text{ X } 100$

(2) Technology gap = Potential yield - Demonstration yield

(3) Extension gap = Demonstration yield - Yield from farmers practice (Local check)

(4) Technology index $= \dfrac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \text{ X } 100$

RESULTS AND DISCUSSION

Economic impact of front-line demonstrations

Table 2 : Economics of cotton production under frontline demonstrations and farmers practice in Amreli district

Year	Mean yield (q/ha)		% increase in yield	Cost of cultivation (₹/ha)		Gross returns (₹/ha)		Additional Net returns (₹/ha)	B:C ratio	
	IP	LC		IP	LC	IP	LC		IP	LC
2019-20	19.58	17.61	11.2	30000	32000	103774	86289	15485	3.46	2.70
2020-21	17.60	15.10	16.6	31582	33300	94932	75550	17664	3.00	2.27
2021-22	12.20	11.00	10.9	30682	32400	109800	82200	25882	3.59	2.54

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 no. 2). The economic analysis under front line demonstrations in improved practices (IP) recorded higher productivity of yield (19.58 q/ha) over local check during the year of 2019-20 but % increase in yield (16.6 %) higher over local check during the year of 2020-21. In case of gross returns (₹ 109800 ha^{-1}), additional net returns (₹ 25882 ha^{-1}) and B: C ratio (3.59) higher as compared to the local checks in the year 2021-22. This results clearly indicated higher productivity of cotton under improved technologies plots over the years compare to local check due to knowledge and adoption of full package of practices i.e. sowing of latest high yielding hybrids, adoption of improved nutrient, moderate disease resistant hybrid, adoption of improved weed and pest management techniques. The year wise fluctuation in yields was observed mainly on the account of variations in soil fertility status, climate and moisture availability. Similar results were also recorded Joshi *et al*. (2014), Sharma *et al*. (2016) and Rai *et al*. (2020) also reported higher net returns and B:C ratio in the FLDs on improved technologies compared to the farmer's practices.

Technology gap

Table 3 : Productivity of cotton, yield gaps and technology index

Year	No. of Demonstrations	Productivity (q/ha)			% increase over local	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
		Potential	IP	LC				
2019-20	10	25	19.58	17.61	11.2	5.4	2.0	21.7
2020-21	10	25	17.6	15.1	16.6	7.4	2.5	29.6
2021-22	10	25	12.2	11.0	10.9	12.8	1.2	51.2
Average	**10**	**25.0**	**16.5**	**14.6**	**12.9**	**8.5**	**1.9**	**34.2**

The technology gap shows the gap in the demonstration yield over potential yield and it was highest (12.8 q/ha) in the year 2021-22 in comparison to year 2019-20 (5.4 q/ha) and year 2020-21 (7.4 q/ha). On an average technology gap under three-year FLD programme was 8.5 q/ha. The observed technology gap was mainly attributed to poor irrigation water in the district. The other reasons include dissimilarity in soil fertility status, agricultural practices and local climatic situation. This finding is supported by Ajrawat *et al*. (2013), Singh *et al*. (2014), Romade *et al.* (2018) and Shah *et al.* (2019).

Extension gap

Further the higher extension gap of 2.5 q/ha and 2.0 q/ha was recorded in the year 2020-21 and 2019-20 respectively as compare to the year 2021-22 (1.2 q/ha). This emphasized the need to educate the farmers through various extension 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. (Padmaiah *et al.* 2012 and Meena and Dudi, 2018) has also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity.

Technology index

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index varied from 21.7 to 51.2 % (Table no. 3). The technology index was minimum (21.7 %) in the year 2019-20 as compared to year 2020-21 (29.6 %) and 2021-22 (51.2 %). On an average technology index was observed 34.2 per cent during the three years of FLD programme, 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 cotton. Similar results were also recorded by Shukla *et al.* (2020) and Shalini *et al.* (2016) in tomato.

CONCLUSION

It may be concluded that the yield and returns in cotton crop increased substantially with INM under real farming situation, which they have been advocating for long time. However, the yield level under INM FLDs was better than the farmer practice and by adopting recommended production technologies. So, there is need to disseminate the improved technologies among the farmers with effective extension methods like training and field demonstrations. The farmers should be encouraged to adopt the recommended agro techniques for getting maximum returns in specific locations. With this study concluded that the FLDs programmes were effective in changing attitude, skill and knowledge of improved package and INM practices in cotton adoption.

CONFLICT OF INTEREST

The authors of the paper declare no conflict of interest

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