

Original Research Article

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Impact of Front Line Demonstration on Yield and Economics of Wheat under North Gujarat Condition

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ABSTRACT

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Productivity of wheat in India is in quite low and owing to partial adoption of recommended technologies and inappropriate application of critical inputs. It is imperative to demonstrate high yielding variety of wheat GW-366 and GW-451 which is dwarf and resistant to lodging and seed treatment practices with bifenthrin for termite management on farmer's field for improving the overall production and productivity of wheat under close supervision of the scientist. Krushi Vigyan Kendra, Banaskantha-I conducted 175 front line demonstrations on wheat during 2013-14 to 2019-20 (7 years) to compare the yield levels of wheat under FLD field and farmer's practices and collect the feedback of farmers for further improvement in research and extension programmes. The results obtained from seven years data revealed that average yield of wheat varieties under demonstration practices was 38.72 q ha⁻¹ as against 31.19 q ha⁻¹ observed under farmer's practices, thereby recording an average yield increase of 26.32 per cent. The average extension gap, technology gap and technology index were 7.93 q ha⁻¹, 14.94 q ha⁻¹ and 27.96 per cent, respectively in FLD of wheat. The demonstrated practices gave higher benefit cost ratio ranging from 2.44 to 3.76 with a mean of 2.90 compared to farmer's practices (2.18).

Introduction

Wheat (*Triticum aestivum* L.) is the second most important cereal crop in India after rice and it contributing substantially to the national food security by providing more than 50% of the calories to the peoples. Globally, it was cultivated on an area of 219 m ha with production of 715.9 million ton in the year 2013. In India, wheat is being cultivated on an area of 30.79 m ha with 98.51 million ton of production and 3.20 t ha⁻¹ of average

productivity (Anon, 2017-18). In Gujarat, wheat is an important *rabi* crop and is grown almost throughout the state with 1.05 million hectares area under cultivation, total production of 3.05 million tonnes and an average yield of 2.89 tonnes per hectare during 2017-18 (Anon. 2017-18).

There are several factors, which are responsible for low average yield of wheat in Gujarat like use of old varieties and low quality seed, partial adoption of package of

practices, higher seed rate, unawareness about seed treatment practices and termite damage. This factor affects the yield of wheat crop and created considerable gap in actual productivity and potential yield and there is scope to reach potential level with proper management practices.

The productivity of wheat per unit area could be increased by adopting recommended scientific and sustainable management production practices using suitable high yielding varieties namely GW-366 and GW-451. Frontline demonstration is the new concept of field demonstration evolved by the Indian Council of Agriculture Research (ICAR) with main objective to demonstrate newly released crop production and protection technologies and its management practices in the farmer's fields under different agro-climatic regions of the country under different farming situations. While demonstrating the technologies in the farmer's fields, the scientists are required to study the factors contributing higher crop production, field constraints of production and thereby generate production data and feedback information. Taking into account the above considerations, Frontline demonstrations (FLD,s) were carried out in a systematic manner on farmer's field to show the worth of a new improved variety with seed treatment practices with bifenthrin for termite management and convincing farmers to adopt improved production management practices of wheat for enhancing productivity of wheat, technology transformation on large scale and improving livelihood of farmers.

Materials and Methods

The present front line demonstration was carried by Krishi Vigyan Kendra, Deesa, Banaskantha-I, Gujarat during *rabi* season of 2013-14 to 2019-20 (7 years) on 175 farmers' field covering 70 ha of area on adopted village of different talukas of Banaskantha

district. The region is characterized by sub-tropical and semi-arid weather comes under IV- North Gujarat Agro-climatic zone. Soils in the demonstrated area were sandy clay loam texture with pH ranges between 7.1 to 8.3 and EC 0.22 to 0.31. The available nitrogen content was low and ranges from 170 to 277 kg N ha⁻¹, available phosphorous content was medium (26.44 to 58.60 kg P₂O₅ ha⁻¹) and available potassium content was high (420.1 to 575.4 kg K₂O ha⁻¹) respectively. To popularized improved wheat production package constrains were identified through PRA survey, top ranked farmers problems on wheat were identified and front line demonstration were planned and conducted on farmers' field. Each demonstration was conducted in an area of 0.4 ha and adjacent to the farmer's fields in which the crop was cultivated with farmers practice / local variety. In demonstration package (DP), critical inputs like improved variety GW-366 and GW-451 and bifenthrin insecticide for termite management were demonstrated to farmer's in group meeting programme and trained each farmers' for their appropriate window of application. Other technological information like balanced fertilizer uses, weed management and irrigation scheduling etc also given time to time and comparison has been made with existing farmers practices which is shown in Table 1.

The necessary steps for the selection of site and farmers, lay out of demonstration etc were followed as suggested by Chaudhary (1999). The farmer's practices (FP) plots were maintained as local check for comparison study. To study the impact of Frontline demonstrations, data from FLDs and local practices were collected and analyzed. The Extension gap, technology gap and technology index were calculated using the formula as suggested by Samui *et al.*, (2000) as given below.

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers yield

$$\text{Technological index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}}$$

Results and Discussion

Seed yield

It is evident from data presented in table 2 that demonstration plot of improved package in wheat recorded higher seed yield ranged from 37.97 to 41.40 q ha⁻¹ with mean yield of 38.72 q ha⁻¹ as compared with the farmers' practices (28.40 to 34.57 q ha⁻¹) during 2013-14 to 2019-20, respectively. The percent increased in seed yield was 14.71 to 33.70 with average of 26.32 percent during demonstration period. The above trend of successively increased in seed yield of wheat over the year was obtained due to adoption of improved variety of wheat GW-366 AND GW-451, recommended seed rate (120 kg ha⁻¹) which maintain optimum plant population and seed treatment with bifenthrin for termite management. This increment in grain yield with improved practices was mainly because of high yielding varieties of wheat GW-366 and GW-451. Further, seed treatment practices with bifenthrin prevent the termite damage and reduced the cost of cultivation and yield loss. Similar yield enhancement in different crops in Frontline demonstration has amply been documented by Haque (2000), Tiwari and Saxena (2001), Tiwari *et al.*, (2003), Nazrul Islam *et al.*, (2004), Hiremath *et al.*, (2007), Mishra *et al.*, (2009), Tomar *et al.*, (2009), Dhaka *et al.*, (2010), Kumar *et al.*, (2010) and Sreelakshmi *et al.*, (2012). From these results it is evident that performance of improved varieties was found better than the local check under local conditions. Farmers

were motivated by results of demonstrated technologies applied in the FLDs trials and it is expected that they would adopt these technologies in the coming years also.

Yield gap

Yield of the Frontline demonstration trials and potential yield of the different varieties of crop was compared to estimate the yield gaps which were the extension gap was calculated *i. e.* 7.93 q ha⁻¹ (Table 2). The extension gap showed increasing trends in each consecutive year of study during demonstration years which emphasizes there is a need to educate the farmers through various means for adoption of improved agricultural production technologies to reverse the trend. In case of technology gap shows the gap in the demonstration yield over potential yield and it was 14.94 q ha⁻¹. The observed technology gap may be attributed to dissimilarities in soil fertility and other vagaries of weather conditions in the area. Hence, to narrow down the gap between the yields of different varieties, location specific recommendation appears to be necessary. Technology index shows the feasibility of the variety at the farmer's field. The lower the value of technology index (27.96%) more is the feasibility (Table 3). The finding of the present study is in line with the findings of Sawardekar *et al.*, (2003), Hiremath and Nagaraju (2009) and Dhaka *et al.*, (2010), Joshi *et al.*, (2005), Pawar *et al.*, (2017) and Malve *et al.*, (2018).

Economics

Gross return, net return and Benefit-Cost ratio were recorded higher under intervention practices against farmer's practices in all the years of study (Table 3). The Benefit-Cost ratios were ranges from 2.13 - 2.72 in intervention practices (IP) against 1.78 - 2.02 in farmer's practices (FP) during

demonstrated year (Table 3). Higher benefit cost ratio under intervention practice was self explanatory indicated economic viability of the technology and convinced the farmers for adoption of intervention imparted.

The economic feasibility of demonstrated practices (DP) over traditional farmer's practices (FP) was calculated depending on the prevailing prices of inputs and output costs (Table 4). It was found that cost of cultivation of wheat under demonstrated practices (DP) varied from Rs. 21,400 to 23,950 ha⁻¹ in case of GW-366 and Rs. 22502

to 23750 ha⁻¹ in case of GW-451 with overall an average of Rs. 22,967 ha⁻¹ as compare with Rs. 24,602 ha⁻¹ in farmers practice. Frontline demonstrations recorded higher mean gross returns (Rs. 67,709 ha⁻¹) and mean net return (Rs. 44742 ha⁻¹) with higher benefit cost ratio (2.90) under demonstrated practices of different improved varieties of wheat as compared to local checks (BCR 2.18). These results are in line with the findings of Gurumukhi and Mishra (2003), Sawardekar *et al.*, (2003), Sharma (2003), Pawar *et al.*, (2017) and Malve *et al.*, (2018).

Table.1 Comparison between demonstration practices (DP) and existing farmer's practice (FP) of wheat

Sr. No	Particulars	Demonstration practices (IP)	Farmers practice (FP)
1	Farming situation	Irrigated	Irrigated
2	Variety	GW-366, GW-451	GW-496
3	Sowing time	November	Oct – Nov.
4	Seed rate	100-120 kg ha ⁻¹	160-180 kg ha ⁻¹
5	Sowing method	Line sowing	Broadcasting
6	Seed treatment	Thiram @ 2 g followed by Bifenthrin @ 2.5 ml per kg of seed, Shade drying for 7 hours	Without seed treatment
7	Fertilizer application	NPK: 120:60:0	180:60:0
8	Weed management	Pre-emergence application of Pendimethaline and post emergence application of metsulfuron methyl	Post emergence herbicide 2-4 D or metsulfuron methyl

Table.2 Seed Yield, technology gap, extension gap and technology index of wheat under demonstration and farmers' practices

Sr. No.	Year	Area	No. of farmers	Seed yield (q/ha)			% increase over FP	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
				Potential	DP	FP				
1	2012-13	10	25	51.70	37.67	32.33	16.52	14.03	5.34	27.14
2	2014-15	10	25	51.70	41.40	34.00	21.76	10.30	7.40	19.92
3	2015-16	10	25	51.70	35.49	29.48	20.39	16.21	6.01	31.35
4	2016-17	10	25	55.00	38.64	29.48	31.07	16.36	9.16	29.75
5	2017-18	10	25	55.00	37.97	28.40	33.70	17.03	9.57	30.96
6	2018-19	10	25	55.00	40.12	34.57	24.69	14.79	7.50	27.82
7	2019-20	10	25	55.00	39.00	34.00	14.71	16.00	5.00	29.09
		70	175	53.59	38.72	31.19	26.32	14.94	7.93	27.96

Table.3 Economics of wheat under demonstration and farmers’ practices

Sr. No.	Year	Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		BCR	
		DP	FP	DP	DP	FP	FP	DP	FP
1	2012-13	23950	24750	58389	50112	34439	25362	2.44	2.02
2	2014-15	21400	24450	67523	55454	46123	31004	3.16	2.27
3	2015-16	23275	25425	59765	49644	36490	24219	2.57	1.95
4	2016-17	22502	23660	65688	50116	43186	26456	2.92	2.12
5	2017-18	23750	24680	64701	48280	40951	23600	2.72	1.96
6	2018-19	22650	23800	70611	60843	47961	37043	2.76	2.06
7	2019-20	23245	25450	87288	73540	64043	48090	3.76	2.89
		22967	24602	67709	55427	44742	30825	2.90	2.18

Table.4 Extent of farmers satisfaction of extension services rendered (n=175)

Satisfaction level	Number of respondent	Percent
Low	16.32	9.33
Medium	38.68	22.10
High	120.0	68.57

Farmer’s satisfaction

The extent of satisfaction level of farmers over extension services and performance of demonstrated variety depends on demonstrated farmers’ feedback and it was measured by Client Satisfaction Index (CSI) (Table 4). The data depicted in the Table 4 indicated that majority of the farmers expressed the high (68.57%) level of satisfaction for improved variety of wheat GW-366 and GW-451 and low cost technology of seed treatment with bifenthrin for termite management under demonstration whereas, very few (9.33) percent of respondents expressed lower level of satisfaction. The results are in close conformity with the results of Narayanaswamy and Eshwarappa (1998) on pulses crops, Kumaran and Vijayaragavan (2005) on mustard and gram crops, Dhaka *et al.*, (2010) and Meena *et al.*, (2014) on maize crop. The higher level of satisfaction with respect to services rendered, linkage with

farmers’ and technologies demonstrated etc. indicate stronger conviction, physical and mental involvement in the frontline demonstration which in turn would lead to higher adoption. It indicates that wheat grown with traditional practices with low yields are identified by low knowledge, lack awareness about high yielding varieties, low risk bearers with negative perception of wheat production technology.

From the above finding it is concluded that yield gap between farmers’ practices and improved practices was perceptibly higher; there is urgent need to make stronger extension services for educating the cultivators in the implementation of improved practices. However, the yield level under FLDs was better than the old varieties and performance of these varieties could be further improved by adopting recommended packages of practices. Hence, it can be also observed that increment in yield was because of adoption of high yielding varieties, seed

treatment practices and frontline demonstration of proven technologies. Yield potentials of crop can be increased to greater extent. This will subsequently increase the income as well as the livelihood of the farming community of the district. From the above research findings it can be also concluded that the maximum number of the respondents had high level of knowledge, more acceptability for this demonstrated technology and year by year improved variety replacing old varieties through not only through demonstration but also through various capacity building programmes, exposure visit, field visits, field day, mass media channels, interviews etc.

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