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Original Research Article

Promotion of Improved Production Technology on Wheat *(Triticum aestivum L.)* through Front Line Demonstrations in Chandauli District of Eastern Uttar Pradesh, India

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A B S T R A C T

Front Line Demonstration is one of the most powerful tools for transfer of technology. The present study was undertaken to find out the yield gap through FLDs on wheat crop. Krishi Vigyan Kendra, Chandauli, Eastern U.P. conducted 50front line demonstration on wheat crop at farmers field of three adopted villages within one block during 2017-18and 2018-19 for transfer of technology. In two year demonstration programme of improved wheat production technology on wheat varieties DBW187 and HD 2967 demonstrate production potential and economic benefit of improved technologies consisting integrated nutrient management (100:60:40:25 kg NPKS/ha+ Azotobacter + PSB @ 5g/kg of seed), integrated pest management (deep ploughing + seed treatment with *Trichoderma viridae* @ 5 g/kg seed) were conducted on the farmers' fields. Prevailing farmers' practices were treated as control for comparison with recommended cultivation practices. About 38.18 % higher grain yield was recorded under demonstrations over the farmers' practices (Farmer Practice-FP). The extension gap, technology gap and technology index (%) were observed to be 10.50 q/ha, 12.0 q/ha respectively. The technology index (%) of 24.0 %. Technology index was recorded to be decreased over the successive years of study the successive decreased value of technology index reflected the feasibility of the demonstrated technology in agro - climatic condition of eastern Uttar Pradesh.

Keywords

Wheat, Economics, Extension gap, FLD, Technology gap, Technology index

Introduction

Wheat *(Triticum aestivum)* is the second most important winter cereal in India after rice contributing substantially to the national food security by providing more than 50% of the calories to the people who mainly depend on it. It is not only the staple food for wheat consuming population of India but also the major source of their dietary energy. Wheat is grown globally in about 217 m ha area with a total production of 632 million tonnes. The area under wheat cultivation remained constant at about 220 m ha in the past 3 decades, however, the production has increased many folds from 355 million tonnes (1975) to the present level owing to enhanced wheat productivity. In India, wheat was cultivated in about 29.6 m ha of the total cultivated area with an annual production of

93.5 m tones. The average wheat productivity of India is 31.5 q/ha (FAO, 2013). Uttar Pradesh is largest wheat growing state of the country with an annual production of 30.30 m tones from an area of 9.73 m ha. The average productivity of the Uttar Pradesh is 31.14 q/ ha (Anonymous, 2013). The major wheat production constraints in Uttar Pradesh are declining soil health due to multinutrient deficiencies and low input use efficiency. Due to the late harvesting of preceding crop like rice and sugarcane sowing of the wheat was delayed till December or early January in the majority of the districts of eastern Uttar Pradesh resulted in substantial loss in grain yield. Moreover, poor agronomic practices such as higher seed rate, unsuitable varieties, faulty nutrient management as well as weed control etc. are responsible for low productivity of wheat in India (Tiwari *et al.,* 2014). The similar results finding low productivity is low availability of irrigation water for the proper growth and development, especially on critical stages of growth. (Joshi *et al.,* 2007). The delayed sowing further cause's supra-optimal thermal stress at reproductive phase which results enforced maturity. Poor agronomic practices such as higher seed rate, unsuitable variety, use of imbalance fertilizer, improper use of weed control measures and unavailability of irrigation facilities etc. were also affecting negatively on wheat productivity in the state. The requirement of wheat will be around 109 mt for feeding the 1.25 billion populations by 2020 AD (Singh, 2010). There is no scope for area expansion, additional production has to come by increasing the per hectare productivity (Nagarajan, 1997). Wheat is used by human being in the form of flour for making Chapaties, Semolina and Pasta products. It is also used for preparation of bread, biscuits, cookies, cracks, noodles, dalia, maida, vermicelli, etc. Wheat contains about 70% carbohydrates, 12% protein, 1.7% fat, 2.7% minerals, 2% fiber and 12% moisture (status paper on wheat ministry of agriculture). Crop occupies an area of about 28.5 million hectare with total production of 80.70 million tones and a productivity of 2.83 tones/ha and a shares 12.43% of total production of world (MOF, 2010).

Krishi Vigyan Kendra has been functioning in the Chandauli district. The KVK is sanctioned by the Indian Council of Agricultural Research (ICAR) and constituent of Achrya Narendra Deva Agricultural University situated at Kumarganj, District Ayodhya. The main aim of Krishi Vigyan Kendra is transfer of technology through on and off campus training programmes for farmers and extension functionaries, front line demonstrations, on farm trials and other extension activities. Front line demonstrations on different crops grown in the district are the mandatory activity of Krishi Vigyan Kendra.

Materials and Methods

Field demonstrations were conducted under close supervision of Krishi Vigyan Kendra, Chanduali. Total 50 front line demonstrations under real farming situations were conducted during rabi season of 2017-18 and 2018-2019if adopted one block (Chahaniya) of villages (Ramgarh, Palia and Agastipur) in Chandauli district, respectively on one farmer one replication under Krishi Vigyan Kendra operational area. The area under each demonstration was 20 ha. Before conducting of FLDs a list of farmers was prepared from group meetings and specific skill training was imparted to the selected farmers regarding different aspects of wheat cultivation. The KVK scientists visited the FLDs field regularly on different critical stages of crops to ensure timely application of nutrients, weedicides and plant protection measures and also to give other suggestive measures to the

farmers and collect the feedback information on each stage for further improvement in research and extension programme. The data were collected through personal interview schedule consisting of set of questions, which were asked from the FLD farmers by the investigator in face to face situation to give their response about each improved production technology of wheat. To compare the production and profitability of crop the yield data of FLDs and control plots were collected from each farmers and averaged out in each year at all locations during the study. The soil was sandy clay-loam in texture with moderate water holding capacity, low in organic carbon, low in available nitrogen, low to medium in available phosphorus, low in available potassium. The treatment comprised of recommended practice for Improved variety, integrated nutrient management-@ 100:60:40:25 kg NPK $ZnSO_4$/ha + Azotobacter + PSB @ 5 g/kg seed, integrated pest management- deep ploughing + seed treatment with Trichoderma viridae @ 5 g/kg seed etc. vs. farmers practice. Deep ploughing was done during the April month. The wheat crop was sown at 22.5 cm (row-row) apart in line using seed rate of 100 kg/ha in 2nd week of November during both the years. An entire dose of P_2O_5, K_2O and $ZnSO_4$ through diammonium phosphate, K through muriate of potash and zink through $ZnSO_4$ and 25% nitrogen was applied as basal before sowing; remaining quantity of nitrogen applied in three equal splits at 25, 40 and 60 days after sowing. The seeds were treated with Trichoderma viridae @5 g/kg seeds then inoculated by Azotobacter and phospho-solubilizing bacteria biofertilizers each 5g/ kg of seeds. Application of sulfosulfuron + metsulfuronmethyle @32g a.i./ha at 25-30 DAS for effective weed management; used flat fan nozzle. Farmer's practice constituted there were no deep ploughing was done during summer, seed of old variety PBW 343 was used, crop was sown on the same time of demonstration, broadcasting method of sowing, higher seed rate (125 kg/ha) sown, imbalance dose of fertilizers applied (60:40:0 kg NPK/ha), no seed treatment, no biofertilizers, no plant protection measures and one hand weeding at 30-35 DAS were adopted. Crop was harvested on the same time of harvesting of demonstration plots. Before conduct the demonstration training to farmers of respective village was imparted with respect to envisaged technological interventions. All other steps like site selection, farmers selection, layout of demonstration, farmers participation etc. were followed as suggested by (Choudhary, 1999). The soils of the farmer fields were Sandy-loam in texture and medium to low in NPK. Each demonstration was conducted on an area of 20 ha. FLD plot was kept for assigning farmers practices. To popularize the improved wheat production practices, constraints in wheat production were identified though participatory approach. Preferential ranking technique was utilized to identify the constraints faced by the respondent farmers in wheat production. Farmers were also asked to rank the constraints they perceive as limiting factor for wheat cultivation in order of preference. Based on top rank of farmers problems identified, front line demonstrations (FLD) were planned and conducted at the farmer's fields. The improved technologies selected for FLDs given in Table 1. Crop was harvested on the same time of harvesting of demonstration plots. Harvesting and threshing operations done manually and thresher, respectively, 10 × 5m plot harvested in all farmers in demonstration and average grain weight taken. Similar procedure adopted on FP plots under each demonstration then grain weight converted into ton per hectare (q/ha). The gross returns, cost of cultivation, net returns and benefit cost ratio (B:C ratio) were calculated by

using prevailing prices of inputs and outputs and finally the extension gap, technology gap and technology index were worked out. Technology gap, extension gap and technology index were as per methods of (Samui *et al.,* 2000 and Sagar *et al.,* 2004).

1- Technology gap = Potential yield – Demonstration yield

2- Extension gap = Demonstration yield – farmers yield

3- Technology index = [(Potential yield – Demonstration yield) /Potential yield] x 100

4- % increase over farmers practices = Improved practices – Farmers practices / farmers practices x 100

The satisfaction level of participating as well as neighboring farmers' for the performance of improve demonstrated technology was also assessed. In all, 60 participating farmers' were selected to measure satisfaction level of farmers' for the performance of improve technology of preference. Based on the problems faced by the wheat farmers of the study area, low productivity of the wheat was conceived due to lack of suitable variety, delayed sowing, imbalance use of fertilizer, high weed infestation, indiscriminate use of pesticides etc.

Results and Discussion

Major constraints in wheat production

Socio economic survey of the adopted villages for the demonstration showed that majority of the wheat farmers were resource poor having small land holdings. Major constraints in wheat production were identified and documented. On perusal of data presented table -2 it was found that major constraints in wheat production were non availability of the quality seed of high yielding varieties (74%) was given the top most rank followed by low technical knowledge (72%), weed infestation (70%), Use of higher seed rate (64%), low fertility status (60%) and damage of wheat crop by the wild animals (34%).

Yield and contributing characters

The yields contributing characters like ear head (no./m2) and number of tillers/m2 wheat obtained over the years under recommended practice as well as farmers practice are presented in table 3. Observation revealed that, ear head numbers were high registered with FLD plots compare to farmer's practice. Ear head (no./m2) mean of 280 with improved practices on farmer's field as against a mean of 216 in farmer's practice. The number of tillers/m2 of wheat from mean of 263 under improved technology as against a mean value of 199 recorded under farmers practice. The productivity of wheat from mean grain yield of 38.0 q/ha under improved practice on farmer's field as compared to farmer's practices mean of grain yield 27.50 q/ha and grain yield increase 38.18% over farmer's practices. Similar finding reported by Mukherjee (2016).

Extension gap, technology gap and technology index

The extension gaps from 10.50 q/ha during the period of demonstration emphasized the need to educate the farmers through various extension tools viz. training programmes, kisan gosthies, distribution of literatures for the wider adoption of improved agricultural production technologies to reverse this 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. The new technologies will eventually

lead to the farmers to discontinuance of old varieties with the adoption site specific wheat varieties. The technology gap was 12.0 q/ha. observed may be attributed to the variability in edaphic and climatic factors. The technology index (%) was 24.0% Technology index was recorded to be decreased over the successive years of study the successive decreased value of technology index reflected the feasibility of the demonstrated technology in agro - climatic condition of eastern Uttar Pradesh. The results are in corroborating with the findings of Hiremath and Nagaraju (2009), Kumaran and Vijayaragavan (2005), Dhaka *et al.*, (2010) and (Bar and Das, 2015).

Economic analysis

Different input variables like seed, fertilizers, herbicides and pesticides were considered in economic analysis of FLD demonstrations as well as for farmers practice. It is observed that an additional investment of Rs. 2986/ ha was made under FLD demonstrations. Economic returns was analysed on basis of grain yield revealed that mean additional return of Rs. 18769/ha was obtained in the demonstrations due to higher grain yield. The higher additional returns under demonstrations could be due to improved technology, nonmonetary factors, timely operations of crop cultivation and scientific monitoring. The highest benefit cost ratio (1.90) was also found for the front line demonstrations. The higher B C ratio also encourages the farmers to adopt the improved wheat production technology. The results are in conformity with the findings of earlier work.

Table.1 Comparison between demonstration and farmers practices under FLD Wheat Crop

Particulars	Demonstration package	Farmers practice
Farming situation	Irrigated upland & midland	Irrigated upland & midland
Variety	DBW 187, HD 2967	PBW 343
Time of sowing	2nd week of November	2nd week of November
Method of sowing	Line Sowing	Broadcasting
Seed rate	100 kg ha	130 kg ha
Seed treatment	Azotobactor @ 5-10 gm per kg seed	Nil
Fertilizer Dose	100:60:40 kg/ ha, NPK	50:40:10 kg/ ha, NPK
Weed management	Sulfosulfuron @ 33 g + Carfentrazne @ 25 g/ ha	Isoproturon @ 1.0 kg ai /ha as pre emergence
Water management	Irrigation at critical stages	Frequent Irrigation

Table.2 Ranks for different constraints (f=50) given by farmers

S.No.	Constraints	Farmers	Percentage	Rank
1	Non availability of the seeds of high yielding varieties	37	74.00	I
2	Low technical knowledge	36	72.00	I I
3	Use of higher seed rate	32	64.00	IV
4	Low soil fertility	30	60.00	V
5	Weed infestation	35	70.00	III
6	Damage by bull	17	34.00	VI

Table.3 Impact of FLD on wheat Yield and contributing characters, extension gap, technology gap and technology index

Year	Area (ha)	Potential grain yield (q/ha)	Earhed no./m2		Tiller no./m2		Grain Yield (q/ha)		% increase over FP	Extension gap (q/ha)	Technology gap (q/ha)	Technology index
			FLD	FP	FLD	FP	FLD	FP				
2017-18	10.00	50	271	211	256	196	36.60	26.10	40.23	10.50	13.40	26.80
2018-19	10.00	55	289	221	269	201	39.40	28.90	36.33	10.50	15.60	28.36
Mean	**20.00**	**50**	**280**	**216**	**263**	**199**	**38.00**	**27.50**	**38.18**	**10.50**	**12.00**	**24.00**

Table.4 Economics, additional cost and returns in wheat under frontline demonstrations (FLDs) vs framers practice (FP)

Year	Area (ha)	Potential grain yield (q/ha)	Cost of cash input		Additional cost in demonstrations (Rs./ha)	Sale price of grain (MSP) (Rs./qt)	Grain Yield (q/ha)		Total returns Rs. (ha		Extra returns	Incremental Benefit: Cost ratio	
			FLD	FP			FLD	FP	FLD	FP		FLD	FP
2017-18	10	50	27300	24489	2811	1735	36.60	26.10	63501	45284	18218	3.66	1.85
2018-19	10	55	29410	26250	3160	1840	39.40	28.90	72496	53176	19320	3.94	2.03
Mean	**20**	**53**	**28355**	**25370**	**2986**	**1788**	**38.00**	**27.50**	67925	49156	18769	1.90	1.94

Frontline demonstrations were carried out in a systematic and scientific manner on farmer's field to show the worth of improved production technology of wheat and convincing farmers for further adoption. Response receives from different farmer's revealed that farmer were satisfied with potentialities of demonstrated technology. Front line demonstrations were also found effective in upgrading the knowledge base of farmers regarding improved production technology of wheat which will be helpful in enhancement of the wheat productivity of the area.

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