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Impact of front line demonstration to transfer of technology in wheat (*Triticum aestivum* L.) growers in Maharajganj District of Eastern Uttar Pradesh

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Abstract
Front Line demonstrations (FLDs) is a unique approach to provide an direct interface between researcher and farmers as the scientists are directly involved in planning, execution and monitoring of the demonstrations for the technologies developed by them and get direct feedback from the farmers' field about the crops like wheat, rice and pulses production in general and technology being demonstrated in particular. The present study was carried out by Krishi Vigyan Kendra, Mahrajganj (ANDUAT), U.P. to know the yield gaps between improved package and practices under Front Line Demonstration (FLD) and farmer's practice (FP) of wheat crop. Front line demonstrations (FLDs) were conducted on 40 farmers fields each year to demonstrate the impact of improved agro-techniques on production and economic benefits in terai condition of Eastern U.P. during rabi seasons of two consecutive years i.e. 2019-20 and 2020-21. The technologies demonstrated in FLDs recorded additional yield over farmers practice. Under FLDs the grain yield of wheat was increased by 26.02 percent over FP. The extension gap, technology gap and technology index were calculated as 8.50 q/ha and 15.74 percent, respectively. Adoption of improved package of practices in wheat cultivation recorded higher B:C ratio (3.79) as compare to FP (2.77). Yield enhancement and higher net returns observed under FLDs of improved technologies in wheat. Thus, the productivity of wheat could be increased with the adoption of recommended improved package of practices. The present study resulted to convincing the farming community for higher productivity and returns.

Keywords: Extension gap, technology gap, technology index, wheat yield

Introduction
Wheat is one of the principle food crops of the world. Its importance in Indian agriculture is second to the rice. Wheat is usually ground into flour before use as food. Wheat flour based products, such as the chapatti, are part of the staple diet in most parts of India - particularly in northern India. It is mainly used as bread in a variety of ways in different parts of the world. Wheat is used to make rolls, biscuits, cookies, cakes, pastas, tortillas, pastries, donuts, batters and variety of breakfast items. Globally wheat provides almost 50 percent more protein per capita than rice. The germ or embryo of the wheat is relatively rich in protein, fat and B vitamins. Wheat germ oil is rich in tocopherols and essential fatty acids. Wheat is considered to be a most nutritious food crop. Per 100 gm, the grain is reported to contain 326-335 Calories, 11.57-14.00gm of water, 9.40-14.00 gm protein, 1.80- 2.50 gm fat, 69.10-75.40 gm carbohydrate, 1.80-2.30 gm fiber, 36-46 mg Calcium, 354-400 mg Phosphorous, 3.00-4.3 mg Iron, 370-435 mg Potassium, 0.43- 0.66 mg Thiamine, 0.11- 0.12mg Riboflavin and 4.3-5.3 mg Niacin (Nanda and Agarwal, 2009). In India, wheat is being cultivated on an area of 29.6 m ha with 93.5 mt of production and 3.15 t/ha of average productivity (FAO, 2013) [5]. The requirement of wheat will be around 109 mt for feeding the 1.25 billion populations by 2020 AD (Singh, 2010) [14]. 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) [1]. He major Wheat producing States are Uttar Pradesh, Punjab, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat, Karnataka, West Bengal, Uttaranchal, Himachal Pradesh and Jammu & Kashmir. These States contribute about 99.5% of total Wheat production in the country. Remaining States namely, Jharkhand, Assam, Chhattisgarh, Delhi and other North Eastern States contribute only about 0.5% of the total Wheat production in the country. Among the key factors affecting the wheat production and productivity, weeds play a panic role to loss the grain yield to the extent of 73% (Pandey and Verma, 2004) [12].
Frontline demonstration (FLD) was started in wheat 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. Agricultural development means increasing the productivity and improving the economic condition of the farmers. This, to a certain extent, depends upon the level of knowledge and skills of the farmers. Thus, FLDs provide an opportunity to researchers and extension personnel for understanding the farmer's resources and requirement to fine tune and/or modify the technologies for easy adaptability at farmers' fields. The FLD aimed at achieving this twin objective by bringing about the change in knowledge and adoption behaviour of farmers. The frontline demonstration is the important mandate to Krishi Vigyan Kendra.

Materials and Methods

Present study was conducted under the aegis of Krishi Vigyan Kendra, Mahrajganj (ANDUAT), U.P. during rabi season of 2019-20 and 2020-21 in the Mahrajganj district of Uttar Pradesh. Participatory rural appraisal (PRA), group discussion and transect walk were followed to explore the detail information of study area. For easy understanding of the farming community of the region, training, field day and farmer awareness programme were conducted to excel the farmers understanding and skill about the demonstrated technology on wheat. Field demonstrations were conducted under close supervision of staff and scientist working under KVK. Total 40 front line demonstrations of wheat variety HD 3086 under real farming situations were conducted at five different villages namely; Barwa, Dwariha, Idupur, Mathia and Pahriarpur in Siswa Bazar, Lazmipur and Gaughli block, respectively. All the participating farmers were trained on various aspects of wheat production technologies. The area under each demonstration was kept 0.40 ha. A one fifth area was also devoted to grow local standard check (farmer's practices). Soil sample were analyzed for NPK as per standard laboratory procedures (Jackson, 1973) [8]. The necessary steps for the selection of site and farmers, lay out of demonstration etc were followed as suggested by (Chaudhary 1999) [2]. The other management practices like seed treatment, nutrient management and plant protection etc. were applied for improved as well as farmers practice. The wheat crop was sown at 22 cm (row-row) a part in line using seed rate of 100 kg/ha in 2nd fortnight of November during both the years. The average yield of each FLD and farmer practice has been taken in both the years for interpretation of the results. The extension gap, technology gap and technology index were calculated using the following formula as suggested by (Samui *et al.* 2000 and Dayanand, 2012) [13, 3].

1. % increase over farmers practices = Improved practices – Farmers practices / farmers practices x 100
2. Technology gap = Potential yield – Demonstration yield
3. Extension gap = Demonstration yield – farmers yield
4. Technology index = [(Potential yield – Demonstration yield) /Potential yield] x 100
5. Client satisfaction index = (Individual score obtained/ Maximum score possible) x 100.

The data on yield were recorded and analysed to interpret the results. The economic parameters (gross return, net return and B: C ratio) were worked out on the basis of prevailing market prices of inputs and minimum support prices of outputs.

Results and Discussion

Socio-personal and economic characteristics of the beneficiaries and non-beneficiaries under FLD:

1. **Age:** The age of respondents was considered as length of number of years in their present life, the data presented in table 1 revealed that in case of beneficiaries growers the higher numbers of the respondent (44%) were of middle age group followed by young age group (26%) and old age group (10%) respectively.
2. **Education:** Education was considered as the number of years of formal education acquired by the respondent which may affect the adoption of improved technology and development of socio economic status. The maximum numbers (24%) of respondents were found to middle education followed by (20%) in high school, Intermediate 14% primary, 10% illiterate,6%, and 6.% graduate and above level.
3. **Occupation:** Wheat growers the higher numbers of the respondent (44%) were of Farming followed by Farming and business group (20%) and Farming and services (16%) respectively.
4. **Size of Land Holdings:** Size of land holding is directly co-related with the size of farm business and their production process. In case of beneficiaries of frontline demonstration wheat growers, the maximum number of respondents belongs to large (12%) medium category (26%) and Marginal category (42%) respectively.
5. **Economic motivation:** Economic motivation may be considered as the process of initiating a conscious and purposeful action in respect of economic growth. It is the process of orientation towards profit maximization. Beneficiaries of frontline demonstration of wheat growers, the majority of respondents (40%) were found in the Moderate level of economic motivation category followed by (26%) Higher level of economic motivation category and (14%) Lower level of economic motivation category respectively.

Yield and Yield gap: It is evident from data presented in table 2 that demonstration plot of improved package in wheat recorded higher seed yield ranged from 44.40 to 46.60 q ha-1 with mean yield of 45.50 q ha-1 as compared with the farmers' practices (35.10 to 37.11 q ha-1). The percent increase in seed yield with average of 26.02 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 HD 3086, recommended seed rate (120 kg ha1) which maintain optimum plant population and seed treatment with bifenthrin for termite management. 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) [6, 15, 16, 11, 7, 9, 4].

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. 9.40 q ha-1. 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 8.50 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 (15.74%) more is the feasibility.

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 3.70 – 3.88 in intervention practices (IP) against 2.76 – 2.78 in farmer's practices (FP) during demonstrated year. The economic feasibility of demonstrated practices (FLD) over traditional farmer's practices (FP) was calculated depending on the prevailing prices of inputs and output costs. It was found that cost of cultivation of wheat under demonstrated practices from Rs. 28798 ha-1, as compare with Rs. 25385 ha-1 in farmers practice. Frontline demonstrations recorded higher mean gross returns (Rs. 88,725 ha-1) and mean net return (Rs. 18320 ha-1).

The result of front line demonstration convincingly brought out that the yield of wheat could be increased with the intervention on varietal replacement i.e. HD 3086 with improved cultivation practices for Eastern Uttar Pradesh. To safeguard and sustain the food security in India, it is quite important to increase the productivity of wheat under limited resources. Favorable benefit cost ratio is self-explanatory of economic viability of the demonstrated technology and convinced the farmers for adoption of improved technology of wheat production. The technology suitable for enhancing the productivity of wheat and calls for conduct of such demonstration under the transfer of technology programme.

Table 1: Age wise, Education, Occupation, Land Holding and Economic motivation distribution of the respondents (f=40) given by farmers

S. No.	Age (in years)	Farmers	Percentage
1	Young (up to 35 years)	22	44.00
2	Middle (36-50)	13	26.00
3	Old (51 years & Above)	5	10.00
	Education		
1	Illiterate	3	6.00
2	Primary	5	10.00
3	Middle	12	24.00
4	High School	10	20.00
5	Intermediate	7	14.00
6	Graduate and above	3	6.00
	Occupation		
1	Farming	22	44.00
2	Farming and services	8	16.00
3	Farming and business	10	20.00
	Land holding		
1	Marginal (up to 1ha)	21	42.00
2	Small (2-4ha)	13	26.00
3	Large (above 4ha)	6	12.00
	Economic motivation		
1	Lower level of economic motivation (5 – 8)	7	14.00
2	Moderate level of economic motivation (9 – 11)	20	40.00
3	Higher level of economic motivation (12 – 14)	13	26.00

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

Year	Area (ha)	Potential grain yield (q/ha)	Plant height (cm) (At harvest)		Grain Yield (q/ha)		% increase over FP	Extension gap (q/ha)	Technology gap (q/ha)	Technology index
			FLD	FP	FLD	FP				
2019-20	12	54	89	79	44.40	35.10	26.50	9.30	9.60	17.78
2020-21	12	54	96	71	46.60	37.11	25.57	9.49	7.40	13.70
Mean	12	54	93	75	45.50	36.11	26.02	9.40	8.50	15.74

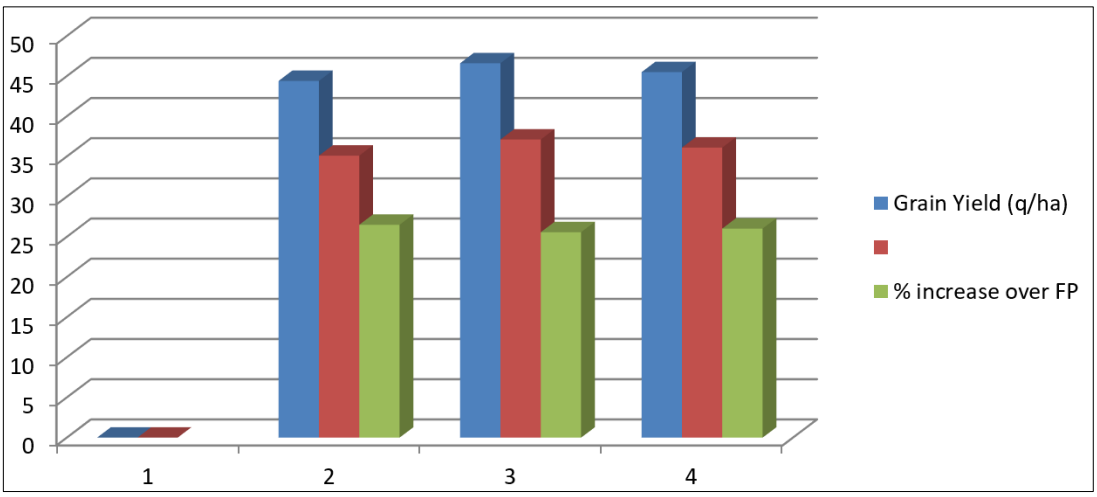

Fig 1: Seed Yield and increase %

Table 3: Economics of wheat under demonstration and farmers' practices

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
2019-20	12	54	27626	24448	2811	1925	44.40	35.10	85470	67568	17903	3.70	2.76
2020-21	12	54	29970	26321	3160	1975	46.60	37.11	92035	73292	18743	3.88	2.78
Mean	12	54	28798	25385	2986	1950	45.50	36.11	88725	70405	18320	3.79	2.77

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