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IMPACT OF IMPROVED TECHNOLOGY FOR ENHANCING WHEAT PRODUCTIVITY IN WEST BENGAL

Dhiman Mukherjee

Directorate of Research, Bidhan Chandra KrishiViswavidyalaya, Kalyani-741235, West Bengal, India

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KEYWORDS

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Improved cultivar

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ABSTRACT

Field trials were conducted in farmers' fields of Nadia and Murshidabad district of West Bengal, India under frontline demonstration to study the potential of new technology with new genotype. Present FLD programme was conducted with the objective to increase wheat production capacity and enhance farmer income per unit area. Demonstration programme was conducted during *rabi* season of 2016-17 along with 162 unit with improved wheat culver viz. HD2967. Improved cultivation practices in newly introduced cultivar gave 39.75q/ha grain yield and showed better performance to over age old cultivar UP 262 and Sonalika. Further, HD 2967 gave 56.91% higher grain yield than the Sonalika (local check). Stover production was high with HD 2967 (57.79 q/ha) compared to local check variety (39.98 q/ha). Improved variety registered 30.81 % more straw yield over the traditional variety of farmers. Economics revealed that FLD plot registered more gross return (Rs. 82,316/ha) and higher B:C ratio (1.80).

* Corresponding author
E-mail: dhiman_mukherjee@yahoo.co.in (Dhiman Mukherjee)

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1 Introduction

Wheat 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. In historical perspective India had made spectacular advancement in productivity and sustainability of wheat and wheat based cropping system. The scenario of the past ten years has clearly indicated that the wheat production in the country has soared ahead despite area remaining the same. According to Joshi et al. (2014) this is mainly because of poor technological intervention in north eastern plain zone (NEPZ). Recently due to change in food habit particularly in West Bengal and Southern State of India, this crop becomes favorite to the growers. North Eastern Plain Zone is not a traditional wheat growing area in India, however different state under this zone become prime focus for another green revolution (Mukherjee, 2016). Exploiting this area for wheat production has become a challenging task especially for West Bengal. In spite of a wide range of adoptability, little attention has been paid towards wheat production and maximization of yield potential of this crop mainly in few states (West Bengal, Bihar, Jharkhand etc.), and its share to national production is less than 1% (Anonymous, 2016). Productivity of these states confined to 2.8 t ha^{-1}, and is far below the national average of 3.14 t ha^{-1} (Mukherjee, 2017). Amongst the various productions technology of wheat, suitable genotype and good agronomic practices plays a significant role for optimum output in term of yield. Usually farmers were unaware about the suitable cultivar due to poor extension support system (Sharma & Choudhary, 2014). Front Line Demonstration is one of the most powerful tools for transfer of technology, and this may be very helpful for new alluvial zone farmers. The main objective of front line demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmers' field. The scientist are required to study the factors contributing higher crop production , field constraints of production and thereby generate production data and feedback information. Keeping in view of an effective extension approach of FLDs for dissemination of wheat technology, it was thought that impact of FLDs conducting by our unit was to be assessed. Various observation during our study programme revealed that, most of the wheat growers stick to the age old traditional variety, which gave very poor return to the farmers. Hence, an effort made by scientist of AICPR on Wheat and Barley improvement, BCKV, Kalyani by introducing new wheat cultivar with improved technologies for enhancing wheat production through frontline demonstration.

2 Materials and Methods

Present work was conducted during *rabi* season of 2016-17 in two different district of Nadia and Murshidabad of West Bengal, as mandatory programme of All India Coordinated Research Programme on Wheat and Barley Improvement, under the aegis of Bidhan Chandra KrishiViswavidayalaya, Kalyani, West Bengal, India. Under this programme, extensive training and field day was conducted to excel wheat grower's better know how and skill about the recent technology of cultivation. All the demonstration work was conducted under strict supervision of scientist and technical staff of the AICRP unit. Sixteen number of demonstration was conducted (eight in each district) with the objective to enhance wheat grower income and change in cropping pattern from rice –rice to rice –wheat system. Under demonstration plot, improved cultivars with need based agronomic management were adopted. Trial mainly comprised of newly introduced high yield variety i.e. HD 2967. Farmer's practice mainly includes UP 262 and Sonalika wheat cultivar (Table 1). Sowing time of crop was same in demonstration plot and famer field. All other steps like site choice, farmer's selection, design of demonstration, farmers involvement etc. were charted as suggested by Choudhary (1999). For clarification of outcome, $8 \times 8 m^2$ plot harvested in three different locations in each demonstration and farmer's practice plot. Grain weight measured in term of quintal per hectare (q/ha). To know the economics cost of cultivation, net returns and benefit cost ratio (B:C ratio) were calculated by using prevalent prices of inputs and outputs.

3 Result and discussion

Present FLD programme was conducted in ten hectare area and farmers who generally use the old varieties and don't follow proper irrigation schedule and don't apply the recommended dose of fertilizers were selected. Split application of recommended dose of nitrogen i.e. 75 kg per hectare (half of the recommended dose) in the form of urea, full dose of phosphate (60 kg / ha) and potash (40 kg/ha) in the form of SSP and MOP, respectively were applied uniformly as basal dose. Remaining part of nitrogen i.e. 75 kg / ha (half dose) in the form of urea was top-dressed at first irrigation i.e. 21 days after sowing. The crop was irrigated four times (first one at CRI stage, second one at jointing, third at flowering and fourth at soft dough stage of the crop) based on soil moister content. The farmers usually adopt broadcasting of seed, however in present study, an attempt to convince them about line sowing was carried out, but studied respondents denied to follow the given suggestion due to labour problem (Meena et al., 2016).Usual farmer exercise vary from demonstrated plot in term of date of sowing, fertilizer application and number of irrigation and few other agronomic practices i.e. weed control etc. (Table 1). Enhanced skill involvement with suitable variety, revealed that

Table 1 Components of the FLD and farmer's practices

S. No.	Particulars	FLD plot	Farmer's practice
1.	Date of sowing	17.11.16 to 24.11.16	20.11.16 to 25.11.16
2.	Variety	HD 2967	UP 262 and Sonalika
3.	Seed Rate used (kg/ha)	100 (kg/ha)	125 (kg/ha)
4.	Duration of the variety (in days)	114-118 (HD2967)	114-118 days
5.	Name of previous crop	Rice	Rice/pulse
6.	Type of soil	Clay loam , Loam	Clay loam, Loam
7.	Fertility status (Low / Medium / High)	Medium	Medium
8.	Fertilizer used (N:P:K in kg/ha)	N: 150 P: 60 K: 40 (based on soil test value)	N: 100 P: 40 K: 0
9.	Sowing methods	Line sowing (20 cm row to row spacing)	Broadcasting
10.	Irrigation type (Tube well/Canal/Well/Tank irrigated)	Tube well	Tube well
11.	Number of irrigations	Four to five	Three
12.	Time of harvesting	24.03.17 to 04.04.17	02.04.17 to 12.04.17
13.	Harvesting method used (Combine / Manual)	Manual	Manual
14.	Threshing method (Thresher/Bullock/Manual /Other)	Manual	Manual
15.	Price of grain (Rs./quintal)	Rs. 1935 /q	Rs. 1860 /q
16.	Price of straw (Rs./quintal)	Rs. 93.50 / q	Rs. 93.50 / q

Table 2 Cultivar, area, economic and straw yield under FLDs and farmer's practice

FLD plot				Farmer's practice			
Name of cultivars	Area sown (ha)	Grain yield (q/ha)	Stover yield (q/ha)	Name of cultivars	Area sown (ha)	Grain yield (q/ha)	Stover yield (q/ha)
*HD 2967	4.25	40.56	57.38	UP 262	0.91	26.55	39.46
**HD 2967	5.75	38.94	58.20	UP 262	0.79	23.20	37.25
				Sonalika	0.46	26.26	43.23
Total/Mean	10.00	39.75	57.79		2.16	25.33	39.98

* Murshidabad District (Golahat and Jalangi block), ** Nadia District (Kanchrapara and Kalyani block)

economic (grain) yield of HD 2967 (39.75 q/ha) was quit good enough compared to traditional variety of UP 262 and Sonalika (25.33 q/ha). Use of good cultivar resulted 56.91 % grain yield which is significantly superior to the grain yield of UP 262 and Sonalika (Table 2). Stover yield was quite prominent in case of HD 2967 (57.79 q/ha) and showed better performance over the farmer cultivars (39.98 q/ha) (Table 2). Further, improved variety registered 30.81 % more straw yield over the traditional variety of farmers. Benefit: cost ratio exposed that farmer outflow towards the husbandry of wheat was Rs. 35,100 /ha compared to new variety in demonstration plot of Rs. 45,600/ha. This high cost was chiefly due to better variety, cost of inputs, irrigation and other post-harvest management (Table 3). Higher B : C ratio observed with FLD plot (1.80) and was very much acceptable by the local growers. Similar kind of observation reported by Meena et al (2016).With the above outcome, FLD were carried out in proper

Table 3 Assessment of different technology intervention on economics of wheat

Operations	FLD plot	Farmer's practice
1. Land preparation	**5000**	**5000**
2. Sowing cost (including seed cost)	**5400**	**4800**
3. Composts cost	**1200**	**1200**
4. NPK cost	**3850**	**2050**
5. Plant protection chemicals		
a. Herbicides	**1400**	**600**
b. Chemical insecticides	**200**	
c. Fungicide	**200**	**400**
6. Irrigation	**1600**	**1400**
7. Manual weeding	**2500**	**1000**
8. Harvesting		
a. Manual harvesting	**7550**	**7550**
b. Combine harvester		
9. Watch & ward	**5000**	**5000**
10. Threshing & winnowing	**5700**	**4700**
11. Drying, Weighing, Bagging	**6000**	**1400**
Total expenditure (Cost of cultivation	**45600**	**35100**
Gross return	**82319**	**47113**
B:C ratio.	**1.80**	**1.34**

and scientific manner on farmer's field to show the value of a new change, and convincing agricultural community about potentialities of better invention technologies of wheat for further adoption (Joshi et al.,2014). Response receives from different farmer's revealed that farmer were very much benefitted with the FLD and their response were quite good and positive. This corroborate with the earlier work of Mishra et al. (2009). The farmers became familiar with novel cultivars of wheat and came to recognize more about improved wheat production through these programmes. Farmers from FLDs field trials, were happy because better varieties did better yield and fetch more economic returns than the check cultivar. Agro-ecological restraints exposed that few of stern disease and weeds were observed. Adjacent farmers' reaction was positive about the demonstrated FLD. With the above study, we came to conclusion that, wheat FLDs were perceived by the farmers as effective method of transfer of technology from field to knowledge level of farmer's. No serious diseases, neither in demonstration plot nor in check plot except few cases in Jalangi, Murshidabad district were reported during FLD programme. Few notable, observation on termite infestation were reported in few pockets. Further findings of present study revealed that, usually famer lack the knowledge of suitable dose and technique of herbicide use. Aggravated problem of *Cyprus rotundus*,*Chenopodium album*, wild rice and *Rumexdentatus* observed (Table 4). Under abiotic stress, water shortage and high temperature at maturity was also become severe restraints. With discussion to the farming community, it came to know that lack of information among farmers about recent knowledge and poor contribution of farmer in exposure visits was most restraining factor for enhancing wheat production. Day to day observation of present study revealed that, poor land holding and lack of suitable mechanized technology was one of the most important constraints.

Table 4 Agro - economical, technical constraints /problems limiting wheat yields in the area

S. No.	Constraint/Problem	MS	S	NS	S.No.	Constraint/Problem	MS	S	NS
I. Diseases					**V. Socio-economic**				
i.	Yellow Rust			√	i	Non availability of labour	√		
ii	Loose smut			√	ii	Non availability of crop loan	√		
iii	Powdery Mildew			√	iii	Higher custom hiring rate of land leveling, field preparation, sowing & harvesting		√	
iv	Karnal Bunt			√	iv	Small land holdings	√		
II. Insects-Pests					**VI. Inputs**				
i	Aphid				i	High cost of inputs		√	
ii	Termite		√		ii	Poor quality seeds	√		
iii	Stem borer		√		iii	Non-availability of seed of newly released variety	√		
iv	Leaf folder				iv	Poor soil fertility (NPK)			√
III. Weed Infestation					v	Non-availability of Nitrogen/ Phosphorus fertilizer at desired time			√
i	Resistance against herbicide				vi	Poor quality herbicides/pesticides	√		
ii	Lack of knowledge about appropriate dose and method of herbicide application among the farmers	√			vii	Lack of irrigation facilities	√		
iii	Phalaris minor (Kanki/Mandusi/Gehoonka mama)			√	viii	Non-availability of diesel			√
iv	Cyprus rotundus (Motha)	√			**VII. Technological**				
v	Chenopodium album (Bathua)	√			i	Late sowing	√		
vi	Avenaludoviciana (Jangali Jai)		√		ii	Poor/Low plant population		√	
vii	Malvaparviflora (Chughra)				iii	Zn deficiency			√
viii	Convolvulus arvensis (Hirankhuri)		√		iv	Poor soil fertility (NPK)			√
ix	Rumexdentatus (JangaliPalak)		√		v	Low organic matter	√		
x	Anagalisarvensis (Krishnanil)			√	vi	Low micro-nutrients	√		
xi	Argemonemaxicana (Satyanashi)			√	vii	Lodging			√
IV. Abiotic Stress					viii	Lack of land leveling		√	
i	Water stress		√		ix	Imbalanced use of fertilizer			
ii	Poor quality irrigation water			√	x	Faulty irrigation methods			√
iii	Water logging			√	xi	Lack of facility of canal irrigation water	√		
iv	Untimely rain/ Erratic rainfall/ Weather vagaries			√	xii	Poor drainage facilities			
v	High Temperature at maturity	√			xiii	Faulty tillage methods	√		
vi	Declining water table			√	xiv	Non availability of farm machinery	√		
vii	Temperature fluctuation during crop growth	√							

S. No.	Constraint/Problem	MS	S	NS	S.No.	Constraint/Problem	MS	S	NS
VIII. Extension					**IX. Others**				
i	Lack of knowledge among farmers about recent technologies	√			i	Non-availability of electricity			√
ii	Poor information delivery by state extension machinery	√			ii	Erratic power supply			√
iii	Poor participation in exposure visits arranged by various departments		√		iii	Low price of wheat / barley		√	
iv	Poor participation in kisanmelas/ field day/kisangoshthi/ training		√		iv	Problem in marketing of wheat / barley	√		
v	Lack of extension literature	√			v	Birds	√		
vi	Lack of training facility	√			vi	Rodents		√	

MS: Most Serious S: Serious (S): NS : Not Serious (NS)

Conclusion

Study revealed that, frontline demonstration convincingly brought out that the yield of wheat could increased higher with the intervention on varietal replacement and improved technology viz. appropriate nutrient and weed management and proper irrigation in wheat. To safe guard 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 demonstration 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 by various extension functionaries.

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Conflict of Interest

The author hereby declared no potential conflicts of interest with respect to the research or publication of this article.

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