Plant Archives Vol. 26, Supplement 1, 2026 pp. 7-11 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-1.002

IMPACT OF IMPROVED TECHNOLOGY ON YIELD AND ECONOMIC VIABILITY OF PEARL MILLET AND WHEAT UNDER FRONTLINE DEMONSTRATION IN GURUGRAM DISTRICT OF HARYANA, INDIA

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(Date of Receiving : 04-09-2025; Date of Acceptance : 08-11-2025)

ABSTRACT

Front line demonstration on wheat and pearl millet were carried out at Farmer field in Gurugram district of Haryana, India. The main objective of research was to assess the impact of improved technology practices on production and economics of frontline demonstration on farmer's field over the period of 2019-2023. The result showed that significant increase in average grain yield was 5.86 % in wheat and 1.92 % in pearl millet over the farmer's practices. In pearl millet, the percentage increase was observed in growth parameters and yield attributes *i.e.* no. of tillers/plant (13.15 %), panicle length (1.55%), panicle diameter (12.5%), test weight (9.37%), straw yield (8.13%) and economics yield attributes were cost of cultivation (0.74%), gross return (0.74%), net return (8.41%) and B:C ratio (9.45%) over the farmers practices cultivation. In wheat, it was observed that the percentage increase in growth parameters and yield attributes were no. of tiller/plant was (3.70%), no. of grains/spike (0..46%), test weight (1.02%), grain yield (5.86%), straw yield (6.98%) and percentage increase in economics yield attributes were cost of cultivation (6.48%), gross return (1.53%), net return (5.20%) and B:C ratio (8.11%) over the farmer practices cultivation. It was observed that extension gap (0.92 q/ha & 2.73 q/ha), technology gap (17.45 q/ha & 0.14 q/ha), technology index (38.78 % & 0.28 %) in pearl millet and wheat respectively over the period of 2019 -23. In contribution of improved technology, it was observed that the percentage increase in equivalent yield in pearl millet and wheat was (3.56% & 1.06 %), system productivity (3.08 % & 3.07 %) over the farmers practices cultivation technology. However, the contribution of improved technology and continuous monitoring of crops could help to enhance the income level of the farming community.

Keywords **:** FLD, Improved technology, Equivalent yield, System Productivity

Introduction

Wheat (*Triticum aestivum* L.) ranks second in area and production in India. Wheat is one of the important cereals Rabi crop grown in all over the Haryana. In Haryana, area and production of wheat crop was 2354.0 thousand ha. and 11406 metric ton respectively during 2020-21and similarly 2304.7 thousand ha. and 10447.2 metric ton respectively during 2021-22. Pearl millet [*Pennisetum glaucum* (L)] is one of the most important among the millets or nutritious coarse grain cereals crops. In Haryana, area and production of pearl millet was 594.1 thousand ha. and 1411.0 metric ton respectively during 2020-21 and similarly 483.1 thousand ha. and 1119.7 metric ton respectively during 2021-22 (Statistical Abstract of Haryana, 2020-21 & 2021-22). In Haryana, Wheat and pearl millet area and production decreased 2% & 8.41% and 18.6 % & 20.64 % respectively during period 2020-21 to 2021-22. The area, production and yield of wheat in Gurugram district of Haryana was 40.6 & 41.8 thousand ha., 205 & 198 metric ton and 5063 & 4740 kg/ha. during 2020-21 and 2021-22 respectively. The area, production and yield of Pearl millet in Gurugram

district of Haryana was 31.3 & 37.8 thousand ha., 87 & 99 metric ton and 2772 & 2629 kg/ha during 2020-21 and 2021-22 respectively (Statistical Abstract of Haryana, 2020-21 & 2021-22). The productivity of this crop is low in the district due to poor adoption of improved technologies of wheat and pearl millet by the farmers. The high yielding varieties of bajra hybrid recorded a grain yield 15.2% higher over local varieties of bajra (1050 kg/ha) under demonstrated plots (Parveen *et al.,* 2022). Frontline demonstrations on farmer's field help to identify the constraints and potential of the pearl millet and other crop as it helps in improving the economic and social status of farmers (Kumar *et al.,* 2016). FLDs the grain yield of wheat was increased by 28.83 per cent and extension gap, technology gap and technology index were calculated as 4.80 q/ha, 3.51 q/ha and 14.28 per cent, respectively over farmer's field practices (Singh S.B. 2017). Tiwari *et al*., (2015) analyzed that the improved technologies recorded mean yield was 47 percent higher than that obtained from farmers practice. Improved technologies gave higher mean net return with a benefit cost ratio 2.32 as compared to farmer's practice 1.93. Soni *et al.,* (2017) showed that the per cent increase in the yield of wheat in improved practices under irrigated conditions was higher as compare to farmer's practices.

Therefore, it is very essential to demonstrate the high yielding varieties which are resistant to biotic and abiotic stress and other production technologies, which enhanced the farmer's income. Hence, the Krishi Vigyan Kendra (KVK), Gurugram has organized Front Line Demonstrations (FLD's) with improved variety of wheat and pearl millet along with recommended package of practices. The main purpose of these demonstrations was to enhance the productivity levels of farmers and to transfer the latest production technology to farmers in the district. The main objective of paper was to assess the impact of improved technology practices on production and economics of frontline demonstration on farmer's field.

Material and Methods

The study was conducted in Gurugram district of Haryana. Krishi Vigyan Kendra, Gurugram had implemented FLD programmes on selected varieties of *Rabi* and *Kharif* crops namely; Wheat and Pearl millet during last three years (2019-20 to 2022-23) were selected for analysis of impact of transfer of improved technology through FLDs programme on farmer's income for the study. Varieties of each crop namely; Pearl millet (HHB 299, Pioneer-86 M 90), Wheat (HD 9086, HD 2967, HD 3298, HD 3249, HD 3271) which was having paramount significance in terms of production potential and wide acceptance by the farmers in their local farming systems were considered for the study.

Experimental Details

Krishi Vigyan Kendra used all the technological interventions in accordance with the recommended package of practices for the region for suitable field crops as shown in Table 1. KVKs scientist organized the training and awareness programmes for farmers as part of technological interventions with improved package or practices in demonstration plots at farmers' field. For check of technological intervention, demonstration plot compares with control or Farmers practice, which was maintained by farmers according to own traditional knowledge with repeated or old varieties and technology. As per project guidelines or mandates, KVK scientist provided inputs such as seeds, fertilizers, IPM package, and bio-fertilizers to the farmers for demonstration plots with technical support. KVK scientist visited to the cluster frontline demonstration field and farmer's field (control plot) on regular basis or important phenophase of crop for close supervision and data collection.

Data Collection and Analysis

The data was collected form demonstration plots as well as control plots on regular basis and continued till harvesting of crops to assess the overall performance of FLDs on selected pulses and oilseed crops. A predetermined questionnaires interviewing of farmers to elicit the information from beneficiary and non-beneficiary farmers about technology, varieties, constraint to application of technology and increase area of pulse and oilseeds crop etc. The basic information from the farmer's field as well as feedback information were systematically recorded and analyzed to see the comparative performance of cluster frontline demonstrations (FLDs) and farmer's practice (control). The data outputs were also collected from FLD plots and control plots and finally the extension gap, technology gap, technology index and benefit cost ratio were calculated (Table 3 &4) as per the formula adopted by (Samui *et al.*, 2000) as given below:

Extension Gap = Demonstrated yield - Farmers' practice yield

Technology Gap = Potential yield - Demonstration yield

Additional Return = Demonstration return – Farmers practice return

Technological Index

$$= \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \times 100$$

Benefit-Cost ratio $= \frac{\text{Gross return}}{\text{Gross cost}}$

Results and Discussion

Growth parameters

The average number of plant height (cm), no. of tillers/plant, panicle length (cm), panicle length (cm) was observed higher in improved technology used farmer's field as compared to traditional technology used farmer's fields as shown in Table 2 & 3. In pearl millet crop, it was observed that percentage increment in plant height (7.87 %), no of tiller per plant (13.15 %), panicle length (1.55 %) and panicle diameter (12.5 %) in improved technology provided in FLDs field over the farmer's practices. In wheat crop, the improved technology showed percentage increased in plant height (0.26 %), no. of tillers per plant (3.70 %) and no of grains per spike (0.46 %) over traditional technology of farmer's practices due to adaptation of recommended package of practices of crops and regular visualize the crops condition at most critical phenological stage.

Yield and Yield attributes

Yield and Yield attributes was observed significantly higher in improved technology provided fields as compared to traditional technology adaption farmer's fields as shown in Table 2 & 3. In pearl millet crop, the improved technology percentage increased in test weight (9.37 %), grain yield (1.92 %), straw yield (8.13 %) and Biological yield (34.10 %) over the traditional farmer practices. In Wheat crop, it was observed that percentage increment in test weight (1.02 %), grain yield (5.86 %), straw yield (6.98 %) and biological yield (6.40 %) over the farmer's practices due to sowing high yield varieties and latest technology demonstrated in FLDs.

Economic significance

On the basis of result, economic analysis was showed that improved technology gave higher return as compared to traditional technology used farmer's practices as shown in Table 2 & 3. In Pearl millet crop, analysis showed that percentage in gross return (8.41 %), net return (15.89%) and B:C ratio (9.45%) and percentage cost of cultivation (0.74 %) was lower as compared to farmer's practices. In Wheat crop, it was analyzed that percentage increased in gross return (1.53 %), net return (5.20 %) and B: C ratio (8.11 %) and percentage cost of cultivation (6.48%) was significantly lower over farmer's practices. Parveen *et al*. (2022) showed that demonstrated plots gave higher gross returns with higher benefit cost ratio compared to farmer's practice. Singh S.B. (2017) showed that yield enhancement and higher net returns observed under FLDs of improved technologies in wheat due to adoption of recommended improved package of practices.

Technology transfer analysis

It was observed that average productivity was higher in FLDs field over the farmer's practices in Pearl millet and wheat over the period of study as shown in Table 4. Technology transfer showed that Extension gap was (0.25 q/ha.) & 2.73 (q/ha.), technology gap was 17.45 q/ha & 0.14 q/ha and technology index was 38.78 % & 0.28 % in Pearl millet and Wheat respectively. Similar result found by Singh *et al.,* (2020), Parveen *et al.,* (2022), Tiwari *et al*., (2014).

Conclusion

Frontline Demonstration conducted on wheat and peal millet at farmer's field showed that the adoption of improved technology significantly increased yield and yield attributes and also enhance the net returns to the farmers. It was clearly showed that improved technology yield adoption farmer's field crop's performance was significantly higher as compared to local technology adoption farmers. Hence, it can be observed that high yield varieties and front line demonstration transfer technology result high yield and return. So, it is required to disseminate the improved technology among the farmers through different awareness programs or trainings.

Table 1: Details of recommended package of practices for selected wheat and pearl millet crops

Technological intervention	**Recommended package and practices followed in FLDs demonstration**	
Crops	**Wheat**	**Pearl millet**
Seed treatment.	Vitavax @ 2.5 g/kg seed	Thiarm @ 2.5g/kg seed
Soil type	Sandy loam and loam	Sandy loam and loam
Sowing method/Spacing	Line to Line	Line to line
Nutrient management	Fertilizer dose @150:60:30:N:P:K kg/ha	62.5 kg nitrogen per acre, 25 kg phosphorus, 12 kg potash
Weed management	Spray of Clodinofop propargyl 15%WP @60 g a.i. + Metsulfuran methyl to control both type of weeds	Immediately after sowing, sprinkle 400 grams of atrazine (50 percent H.P.) mixed in 250 liters of water per acre.

Plant Protection	Termite Control: Chloropyriphos 20 EC @ 1.5 liter/acr. Rust control: Saaf (Mancozab 63 % WP + Carbendazim 12 %) @ 2g/litr.	For the control of Fall Army Worm apply HAMLA-550 or LARA-909 or Biopesticide *Bacillus thuriengiensis* k-strain SA-11@ 2 ml per litre water solution

Table 2 : Average yield attributing traits of wheat under FLDs over a period of 2019-20 to 2022-23

Parameters	**IT***	**FP***	**% increase over FP**
Plant height (cm)	96.00	95.75	0.26
No of tillers/plant	293.00	283.50	3.70
No of grains/spike	53.45	53.20	0.46
Test weight (gm)	36.47	36.10	1.02
Grain yield (q/ha)	49.30	46.57	5.86
Straw yield (q/ha)	70.78	66.16	6.98
Cost of Cultivation (Rs/ha)	44925.00	47837.00	6.48
Gross Return (Rs/ha)	149525.75	147259.50	1.53
Net Return (Rs/ha)	104600.75	99422.50	5.20
B:C ratio	3.33:1	3.08:1	8.11

*IT- Improved technology, FP- Farmers practices

Table 3: Average yield attributing traits of Pearl millet under FLDs over a period of 2019-20 to 2022-23.

Parameters	**IT***	**FP***	**% increase over FP**
Plant height (cm)	205.50	190.50	7.87
No of tillers /plant	2.58	2.28	13.15
Panicle length (cm)	26.10	25.70	1.55
Panicle diameter (cm)	3.15	2.80	12.50
Test weight (gm)	12.60	11.52	9.37
Grain yield (q/ha)	27.55	27.03	1.92
Straw yield (q/ha)	46.96	43.43	8.13
Biological Yield (q/ha)	94.50	70.46	34.10
Cost of Cultivation (Rs/ha)	29258.33	29475.00	0.74
Gross Return (Rs/ha)	71018.00	65507.00	8.41
Net Return (Rs/ha)	41759.67	36032.00	15.89
B:C ratio	2.43:1	2.22:1	9.45

*IT- Improved technology, FP- Farmers practices

Table 4 : Productivity, extension gap, technology gap and technology index of wheat and pearl millet crops under FLDs (average over years)

Crops	**No. of Demonstration**	**Area (ha.)**	**Average productivity (q/ha.)**			**% increase over FP**	**Extension Gap (q/ha)**	**Technology gap (q/ha)**	**Technology Index (%)**
			Potential	**FLD**	**FP**				
Pearl millet	19.6	12.00	45.00	27.55	27.30	0.92	0.25	17.45	38.78
Wheat	38.5	13.46	49.44	49.30	46.57	5.86	2.73	0.14	0.28

Acknowledgment

I am grateful for the invaluable support provided by the ICAR-IARI, Krishi Vigyan Kendra, Shikohpur, Gurugram throughout the research process. The facilities and resources offered were extremely helpful and have been instrumental in completing this manuscript successfully. My sincere gratitude to the editorial team, especially Dr. Manjeet, whose careful editing significantly improved the clarity of the study. Finally, I would like to thank all those who have contributed to the success of this research.

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