EVALUATION OF BIOFORTIFIED WHEAT VARIETIES IN DISTRICT BIJNOR (UTTAR PRADESH) WITH THE SPECIAL REFERENCE TO THE YIELD PERFORMANCE, YIELD GAP AND THEIR ADOPTION IN DISTRICT

ABSTRACT:

Four biofortified wheat varieties—WB-02, HPBW-01, DBW-187, DBW-303, and one Non Biofortified (DBW-17)—were evaluated for their yield performance, yield gap, and acceptance in the rice-wheat cropping system from 2019–20 to 2022-23. The analysis of the data indicated that there was considerable yield increase ranging from 18.00 to 47.19 percent between biofortified wheat varieties over farmers practice. Biofortified Variety DBW-187 yielded 65.50 qt / ha with the net return of Rs. 175825.00 and benefit cost ratio of 3.60.

Key Words: Biofortified wheat varieties, yield performance, yield gap analysis and adoption.

1. INTRODUCTION

Regarding its age and significance as a staple sustenance for humans, wheat is the most important crop in the world. One of the most important and often farmed cereal crops, wheat accounts for about 30% of the country's food supply. To address food insecurity, alleviate poverty, and improve living conditions, it is essential to have access to the most important grain in terms of nutrition and agronomy. The green revolution's biggest success story, India, produces more than 12% of the world's wheat and is second only to China in terms of production. After rice, wheat is the second-most significant crop in India. According to Ministry of Agriculture & Farmers Welfare Government of India-2018, the crop has been cultivated over roughly 30 million hectares (14% of the world's land) with a record average productivity of 3371 kg/ha. The state of Uttar Pradesh alone is home to almost one-third of these. The state's productivity is on par with the national average because of the usage of outdated, low-yielding, disease-prone varieties and inferior wheat production techniques. The overall area planted with wheat in the Bijnor district ranges between 1,50,000 to 1,57,00 ha.

One of the key factors affecting wheat output is the selection of the proper variety. Due to farmers' ignorance of high yielding varieties and the lack of varieties with noticeably greater yields than the existing varieties under changing climatic circumstances, the yield and productivity of biofortified wheat varieties is lower or stagnant. The following biofortified wheat varieties were chosen for the current study's examination and acceptance of the increased yield gap.

WB 02: Rich in iron (40.0 ppm) and zinc (42.0 ppm), as contrasted with popular types' 28.0-32.0 ppm iron and 30.0-32.0 ppm zinc. Good for timely sown irrigated conditions.

HPBW 01: Iron and zinc content are high (40.0 and 40.6 ppm, respectively), in contrast to 28.0 and 32.0 ppm and 30.0 and 32.0 ppm, respectively, in common. varieties. Suitable for irrigated timely sown conditions

DBW-187: Rich in iron (43.1 ppm) in comparison to 28.0-32.0 ppm in popular varieties. Suitable for timely sown irrigated and high fertility conditions.

DBW-303: Rich in protein (12.1 %) in comparison to 8-10 % protein in popular varieties. Suitable for irrigated early sown and high fertility conditions.

Four Biofortified wheat varieties viz. WB-02, HPBW-01, DBW-187 and DBW-303, were selected for the analysis of yield performance, yield gap and their adoption in district Bijnor against Local Check DBW-17 in present study.

2. MATERIAL AND METHODS

The trial was conducted at farmer's field during Rabi 2019-20 to 2022-23. Four Biofortified wheat varieties WB-02, HPBW-01, DBW-187, DBW-303 and one Non Biofortified DBW-17, were used for evaluation. The seed yield and net returns data were analysed. For the estimation of technology gap, extension gap and technology index, the formulae were used as per method of Sagar and Chandra (2004).

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – farmers yield

Technology Index = [(Potential yield – Demonstration yield)/Potential yield] x 100

3. RESULTS AND DISCUSSION

It is evident from the statistics in Table 1 that for WB-02, HPBW-01, DBW-187, and DBW-303, respectively, the yield increase over local cheque FP (DBW-17) was 21.07, 18.00, 47.19, and 22.70 percent. In comparison to farmers' practises (44.50 qt per ha), the seed production improved dramatically in the biofortified wheat types, ranging from 52.50 to 65.50 qt/ha. According to Rana et al. (2002), this shows that field demonstrations are quite effective at closing the production gaps between improved and farmer practises. According to Singh and Rana's (2006) research, the PusaBarani type of mustard crop enhanced seed output up to 20.70 qt/ha. According to Singh et al. (2011), different varieties have different seed yields and yield gaps between new and old kinds.

The economics of demonstrations are depicted in Table-2, indicate that the additional net return of Biofortified wheat varieties over farmers practice ranged from 14900.00 to 44999.25 Rs/ ha. It is high in DBW-187 (Rs.44999.25). Singh *et al*

(2013) reported about the additional net return in analysis of timely sown wheat varieties. In 2019 Singh K K and Singh D P also reported that farmers get additional net return against fellow farmers. The gross return of timely sown wheat varieties ranged between Rs. 144875.00 to 175825.00/ ha and net return Rs.97075.00 to 126874.25/ ha also. The highest net return of Rs.126874.25/ ha of DBW-187 are in line with the finding. Singh and Rana (2006), who reported about Rs.13149.00 / haof net return in mustard crop. Singh et al (2018) also reported about Rs. 54595.52/ ha, of net return in wheat variety.

The biofortified wheat variety DBW-187 had the highest benefit-cost ratio (Table 2), followed by DBW-303 (3.15), WB-02 (3.13), HPBW-01 (303), and DBW-17 (2.70). According to Hedge (2006), mustard crops are resilient by nature and typically develop in rainfed conditions, which can contribute to the stability of a production system in difficult circumstances. In district Saharanpur of Uttar Pradesh, the benefit-cost ratio of HD-2967 was similarly greater in all the blocks compared to local check (K K Singh and P K Singh, 2015). Singh K K and Singh D P further noted that the farmers receive additional benefits at a lower cost per unit of local cheque in 2018.

The range of the technology gap (Table-1) was 4.93 to 42.30 at per ha, with a mean difference of 22.65 qt/ha. The analysis discovered this discrepancy between the minimum in WB-02 (4.93) and the maximum in DBW-303 (42.30). Climate, edaphic, socioeconomic, and management practises all contribute to the difference between prospective and front line demonstrations. According to Kadian et al. (1997), only location-specific technology-based recommendations can help close the technological gap. According to Verma et al. (2017), the technology gap in basmati rice ranged from 5.2 to 7.40 qt/ha, with a mean difference of 6.41 qt/ha overall. According to Singh K. K. and Singh D. P. (2019), technological gaps can be filled by timely supplies of high-quality seed at specific locations and location-specific technology-based suggestions.

According to Table 1, the extension gap varied between 8.5 and 21.00 qt/ha, with a mean difference of 12.20 qt/ha overall. Variety DBW-187 had the highest extension gap (21.00 qt/ ha), followed by DBW-303 (10.00), WB-02 (9.50), and HPBW-01 (8.50) qt/ ha. This suggests that farmers need to be educated using a variety of extension strategies. These findings were also validated by Gupta and Sharma (2005). According to K K Singh and P K Singh (2012), there is an expansion gap in the types of basmati rice. These findings were also supported by Singh et al. (2018). Between farmers' display fields and their practise fields, there is a definite and noticeable yield disparity. The choice of wheat type for late sowing is also a significant determinant that increases net return. The extension and technology gap can be bridged by sustained effort of extension agencies and by adopting location specific technologies.

The adoption rate of biofortified wheat cultivars in the district of Bijnor was displayed in Table 3. It significantly affects seed yield in relation to yield gap. The demonstration field's yield increased as a result of using the newly released variety. In different blocks of the district, the adoption level of the wheat variety DBW-187 varied from 3200 to 12500, with a mean of 66700 ha. Currently, 83565 acres of the district are occupied by wheat types that have been biofortified. It reaches its highest level in DBW-187 (66700 hectares), then in DBW-303 (6805 ha). According to Rana et al. (2002), the demonstration has been quite effective in farmer practise. Pusa Basamti-1401 adoption rates in the district increased, according to 2011 research by Singh et al. These findings were also supported by Singh et al. (2018). 2019 saw an increase in the adoption percentages of newly timely sown wheat varieties in the district, according to Singh K. K. and Singh D. P.

4. CONCLUSION

From the aforementioned data, it can be inferred that the employment of proper scientific methodologies and superior agricultural technology under front line demonstrations on a wide scale significantly decreased the technological gap, resulting in enhanced output. Better and more comprehensive extension programmes in the district are required to give farmers more technological support through demonstrations, training sessions, visits to other demonstration fields, and field day programmes that increase the horizontal distribution of technology among the greatest number of farmers in the area. Participatory seed production at farmer's fields is a result of the rising demand for high-quality seed of these varieties.

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Table: 1 – Productivity, yield gap, extension gap of Biofortified wheat varieties

Varieties	No. Of trials.	Avg. Yield (qt./ha)			% Yield increased	Technology gap (qt./ha)	Extension gap (qt./ha)	Technological index
		PY	DY	FP				
WB-02	40	58.80	53.87	44.50	21.07	4.93	9.30	8.38
HPBW-01	25	64.80	52.50	44.50	18.00	12.30	8.50	24.38
DBW-187	93	96.60	65.50	44.50	47.19	31.10	21.00	32.20
DBW-303	10	96.80	54.50	44.50	22.47	42.30	10.00	43.70
Mean	**-**	**-**	**-**	**-**	**27.18**	**22.65**	**12.20**	**27.16**
FP (DBW-17)	40	63.00	-	44.50	-	18.50	-	-

PY = Potential yield, DY= Demonstration Yield, FP = Farmers practice

Table: 2 – Economics of Biofortified wheat varieties

Varieties	Grain yield qt/ha	Cost of cultivation Rs/ha	Gross return Rs/ha	Net return Rs/ha	BCR	% of Additional yield over local check (qt/ha)	Additional net return over Local check (Rs/ha)
WB-02	53.87	47100.00	147820.00	100720.00	3.13	21.07	18545.00
HPBW-01	52.50	47800.00	144875.00	97075.00	3.03	18.00	14900.00
DBW-187	65.50	48950.75	175825.00	126874.25	3.60	47.19	44699.25
DBW-303	54.50	48500.50	152875.00	104375.00	3.15	22.47	22200.00
Mean	**56.59**	**48087.50**	**155173.75**	**107261.31**	**3.22**	**27.18**	**25086.06**
FP (DBW-17)	44.50	48500.00	130675.00	82175.00	2.70	--	---

Table: 3 – Adoption of Biofortified wheat varieties in district Bijnor (U.P.):

Block	Area under wheat crop (ha)	Area covered by varieties				
		DBW-187	WB-02	HPB W-01	DBW -303	Others
Kotwali	24500	12500	1150	1200	1500	8150
Jalilpur	13500	3200	250	350	380	9320
Budhanpur	14200	5500	680	550	480	6990
Najibabad	15800	7200	500	450	650	7000
Dhampur	8900	3600	480	490	430	3900
Kiratpur	9200	5500	210	370	510	2610
Haldaur	13775	6500	415	340	400	6120
Afjalgarh	18500	10500	545	650	880	5925
Devmal	11405	4200	150	250	550	6255
Nehtor	9500	3500	180	360	535	4925
Noorpur	15500	4500	240	250	490	10020
Mean	**154780**	**66700**	**4800**	**5260**	**6805**	**71215**