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Yield and Gap analysis of Wheat (*Triticum aestivum*) Productivity in NCR of Delhi

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ABSTRACT

Krishi Vigyan Kendra, Delhi laid out demonstrations for replacement of yellow rust susceptible varieties PBW 343 and WH 711with the high yielding variety (HYV) HD 2967 of wheat with or without seed inoculation with bio-fertilizers viz. Azotobactor and Phosphate Solubilizing Bacteria (PSB) during 2012-13 and 2013-14. Twenty five and twenty four farmers were selected randomly for demonstrating the technology during 2012-13 and 2013-14, respectively. The soil of the demonstration field was sandy loam, low in nitrogen and medium in phosphorus and potash. The major crop rotation was pearl millet-wheat and paddy-wheat. The crop was sown in 1st fortnight of November. The average yield and economics of demonstration and check plots were calculated. During the year 2012-13 the highest average yield of variety HD 2967 was observed with bio-fertilizers 59.25 q./ha which was 5.46 per cent and 11.54 per cent more as compared to HD 2967 without bio-fertilizers (56.18q/ha) as compared to local check variety WH 711 (52.52 q/ha) under farmers practice, respectively. The average net returns of demonstrated plots under HYV HD 2967 with bio-fertilizers was ₹ 63179 and ₹ 58841 under HYV HD 2967 without bio-fertilizers which was 16 per cent and 10.5 per cent, respectively, higher than the local check variety.

Key words: Front Line Demonstration, economics, gap analysis, grain yield, wheat.

INTRODUCTION

Wheat (*Triticum aestivum*) is an important food grain crop of India and is the second largest producer of wheat in the world after China with about 12 per cent share in total world wheat production. Improvement in productivity of wheat crop has played a key role in making the country self sufficient in food production. However, in the past decade there has been marginal increase in the productivity of wheat (Nagarajan, 2005; Joshi *et al.* 2007). The average productivity of wheat during the study period in Delhi was 4.3 t/ha, which was substantially lower than the productivity of ~ 4.7 t/ha in adjoining states like Haryana and Punjab. In Delhi, wheat is a major *rabi* crop and the productivity level of wheat crop is low because farmers are generally not following the recommended package of practices in true sense. Therefore, on the basis of 'seeing is believing' principle it is very essential to demonstrate the latest technologies at farmers field so that the farmers see the results and adopt the technology in totality. A wide gap exists in wheat production with respect to use of available techniques and its actual application by the farmers which is reflected through poor yield of wheat crop on farmers' fields. There is tremendous opportunity for increasing the productivity of wheat crop by adopting the improved technologies. A high yielding variety of wheat, HD 2967 was developed by IARI, New Delhi and released by Central Sub Committee on crops standards and notifications and release of verity for agricultural crops for timely sown cultivation under and irrigated conditions of the North Western Plain Zone (NWPZ) of India during 2011. It has average yield of 50.4 q/ha with yield potential of 66 q/ha. The basic aim of Front Line Demonstrations (FLD) to develop location and need specific technologies such as better varieties, cultural practices etc and demonstrate them on the farmers' field for adoption by the farmers. In order to increase the productivity of wheat and get the feedback of farmers on the performance of new variety and technology, a study was conducted in rural area of NCT of Delhi, where FLDs have been conducted on wheat variety HD 2967 with or without seed inoculation with bio-fertilizers *viz*. Azotobactor and Phosphate Solubilizing Bacteria (PSB) during 2012-13 and 2013-14.

METHODOLOGY

The impact study was conducted in rural Delhi where Front Line Demonstrations (FLDs) on wheat at farmers' fields on the wheat variety HD 2967 with or without seed inoculation with bio-fertilizers *viz*. Azotobactor and Phosphate Solubilizing Bacteria (PSB) to was conducted during the two consecutive *rabi* seasons of 2012-13 and 2013-14. The impact assessment was done on comparative basis between FLD farmers and non-FLD farmers' field. Twenty five and Twenty four farmers were selected randomly for demonstrating the technology on their fields during 2012-13 and 2013-14, respectively.

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The soil of the demonstration fields was sandy loam with low in nitrogen and medium in phosphorus and potash and the major crop rotation was pearl millet-wheat and paddy-wheat. The crop was sown in 1st fortnight of November. Each demonstration was of one acre area and recommended package was adopted in the demonstration plots. The demonstrations on farmers' fields were regularly monitored from sowing till harvesting by scientists of Krishi Vigyan Kendra, Ujwa, Delhi. To spread the technology in large area, the outcomes of demonstration were depicted to nearly farmer through field days, Kisan gosties and trainings. The average yield and economics of demonstration and check plots was recorded and analyzed. Different parameters as suggested by Yadav *et al.* (2004) and Dayanand *et al.* (2012) were used for calculating gap analysis, costs and returns. The analytical tool used for assessing the performance of the FLD is as follows:

- Extension gap = Demonstration yield - Farmers' practice yield
- Technology gap = Potential yield - Demonstration yield
- Technology index = (Potential yield - Demonstration yield) x 100/Potential yield
- B:C ratio = Gross returns /Total cost

RESULTS AND DISCUSSION

Grain yield

During the year 2012-13 the highest average yield of variety HD 2967 was observed with bio-fertilizers (59.25 q./ha) which was 5.46% and 11.54% more as compared to HD 2967 without bio-fertilizers (56.18 q/ha) and local check variety WH 711 grown with farmer practice (52.52 q/ha), respectively (Table 1).

Table 1: Yield analysis of front line demonstrations of wheat on farmers' field

Year	No. of demonstrations	Technology demonstrated	Demonstration yield (q/ha)	Farmers Practice yield (q/ha)	Percent increase
2012-13	17	HYV- HD 2967	56.18	52.52	6.97
	08	HYV- HD 2967 with Bio-fertilizers	59.25	53.12	11.54
2013-14	14	HYV- HD 2967	49.80	45.20	10.17
	10	HYV- HD 2967 with Bio-fertilizers	50.48	45.00	12.17

Gap analysis

An extension gap ranging from 366 to 613 kg per hectare was found between FLD technologies and farmers practices during the different time line. The extension gap was lower under High Yielding Variety (HYV) HD 2967 without bio-fertilizer and it increased under the HYV with bio-fertilizers in both the year 2012-13 & 2013-14 (Table 2). Such gap might be attributed to adoption of improved technology in demonstrations which resulted in higher grain yield than that in the farmers' practice. Wide technology gap were observed during these years and this was lower (9.82 and 6.75) during 2012-13 than 2013-14 (16.20 and 15.52). The difference in technology gap during different years could be due to differential climatic conditions. The technological gap was lower in case of HYV coupled with bio-fertilizer technology as compared to the alone technology of HYV HD 2967. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap. Higher technology index reflected the inadequacy of technology and or insufficient extension services for transfer of technology. The results are in conformity with the findings of Singh and Kumar (2012).

Table 2: Gap analysis of front line demonstrations of wheat on farmers' field

Year	Technology demonstrated	Potential yield (q/ha)	Demonstration yield (q/ha)	Farmers Practice yield (q/ha)	Extension gap	Technology gap	Technology Index
2012-13	HYV- HD 2967	66.00	56.18	52.52	3.66	9.82	5.55
	HYV- HD 2967 with Bio-fertilizers	66.00	59.25	53.12	6.13	6.75	9.29
2013-14	HYV- HD 2967	66.00	49.80	45.20	4.60	16.20	6.96
	HYV- HD 2967 with Bio-fertilizers	66.00	50.48	45.00	5.48	15.52	8.30

Economic analysis

Different variables like seed, fertilizers, herbicides and pesticides were considered as cash inputs for the FLD demonstrations as well as for farmers practice. An additional investment of ₹ 100 per ha was made under bio-fertilizer demonstrations. Economic returns was observed to be a function of grain yield and Minimum Support Price (MSP) or sale price which varied along year. The average net returns of demonstrated plots under HYV HD 2967 with bio-fertilizers were ₹ 63,179 and ₹ 58,841 under HYV HD 2967 without bio-fertilizers which was 16 per cent and 10.5per cent higher than the local check variety respectively. The benefit:cost ratio of HYV variety with bio-fertilizers was highest (2.72) followed by HYV without bio-fertilizers (2.61) and local check (2.41) during the year 2013-13 (Table 3). The similar trend was observed during the year 2013-14. The results are in conformity with the findings of Yadav *et al.* (2004), Lathwal (2010), Dayanand *et al.* (2012), R.K. Verma *et al. (2014)* and Venkattakumar *et al.* (2012). The front line demonstration on wheat variety coupled with bio-fertilizers revealed 11.54 per cent (2012-13) and 12.17 per cent (2013-14) increase in yield (Table 1) and the respective additional return were ₹ 8713 and ₹ 9961

additional return (Table 3) over local check. This increase was with an extra expenditure of ₹100/ha which is very little amount which small and marginal farmers could also afford.

Table 3: Economic analysis of front line demonstrations of wheat on farmers' field

Year	Cost of cash input (₹/ha)	Gross returns* (₹/ha)		Net returns		Additional returns	Benefit Cost Ratio (Gross Returns/ total cost)	
		Demonstration	Farmers practice	Demonstration	Farmers practice		Demonstration	Farmers practice
2012-13	36375	95216	87888	58841	53013	5828	2.61	2.41
	36475	99454	89341	63179	54466	8713	2.72	-
2013-14	32000	91673	83656	59673	51656	8017	2.86	2.60
	32100	93196	83235	61196	51235	9961	2.90	-

*indicates returns from grain and straw

The kisan gosthies, trainings, field days and regular monitoring the fields by scientists was effective in changing attitude, skill and knowledge of farmers towards improved/recommended practices of wheat cultivation.

CONCLUSIONS

The increase in yield of wheat is quite encouraging to motivate the farmers to adopt the demonstrated technologies. The FLD at farmers' field acted as primary source of information about the improved practices of wheat cultivation. The concept of FLD may be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community and helps in improve the productivity and profitability of the farmers. This will help in the removal of the cross-sectional barriers among farming community. Hence the farmers were motivated to adopt new high yielding variety *viz*. HD 2967 and seed treatment with Azotobactor and PSB bio-fertilizers through transfer of technology centers like Krishi Vigyan Kendra and line department of state government.

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