

Impact of Participatory Varietal Selection on Varietal Diversification in Northern India

Randhir Singh¹, Ravish Chatrath², S.C. Tripathi³, Gyanendra Singh⁴, B.S. Tyagi⁵, S.K. Singh⁶, Jag Shoran⁷, Anuj Kumar⁸, Surendra Singh⁹, Divakar Rai¹⁰ and Sarvan Kumar¹¹

1. Senior Scientist (Agriculture Extension), 2, 4 & 7. Principal Scientist (Plant Breeding),
3. Principal Scientist (Agronomy), 5. Senior Scientist (Plant Breeding), 6. Scientist (SS), (Plant Breeding),
8. Scientist (SS) (Agriculture Extension), 9, 10 & 11. Research Associates,
Directorate of Wheat Research, Post Box 158, Karnal 132001, India

Corresponding Author E-mail: rsposwal@yahoo.com

ABSTRACT

The Department for International Development (DFID) Project carried out during 2002-03 to 2004-05 in the state of Haryana (India) aimed at increasing wheat productivity in a sustainable way, promoting resource conservation technologies (RCTs) for the north western India, increasing the profitability of farmers in rice wheat system and training the farmers on RCTs and seed production. This paper is based on the findings of base line survey, wheat crop evaluation by farmers before and at maturity, and survey of 100 farmers in the project area.

The project successfully achieved higher varietal replacement. Area under PBW 343 declined and other varieties of similar potential were being adopted. PBW 502 was ranked first by the farmers followed by PBW 343, HD 2687, UP 2338, WH 711, PBW 373, UP 2425, RAJ 3765 and WH 542. The year wise correlation between ranking of varieties was highly significant which supported the farmers' perception that the performance of the varieties was consistent over the years. Mean score of PBW 502 and PBW 343 showed superiority over other varieties. The farmers preferred PBW 502 for dense earhead, bold grain and more tillering. The farmers appreciated the concept of demonstration of all the improved varieties at one site.

Key words : Participatory varietal selection; Impact;

Wheat is an important cereal crop in the world trade grown on approximately 220 million ha area in the world. In the South Asian region, rice-wheat cropping system occupies 24 million hectares of area and India has 10 million hectares. India is the second largest producer of wheat after China contributing about 12 percent to the total global wheat (Anonymous, 2005). India produced 75.38 million tonnes of wheat from 28.34 million ha area during 2006-07. There had been a very rapid increase in area under wheat in India from 9.8 million ha in 1950 to 12.8 million ha in 1966 (30% increase), 24.6 million ha in 1984 (92% increase) and 28.34 million ha in 2006 (15 % increase). The wheat production increased from 827 kg/ha in 1965 to 2660 kg/ha in 2006-07. There is only two fold increase in the area under wheat since 1965, whereas productivity has increased more than three times. However, during the last few years, there is stagnation in wheat productivity and environmental issues are still posing challenge to the researchers and extension agencies. There is a need to diversify the area under different wheat varieties. The large area occupied by PBW 343

(Anonymous, 2005-06) is a major concern and other varieties need to be popularized for better production and profitability.

To deal with such issues and other related aspects such as dominance of a single variety in a region, slow varietal replacement, etc. an ad hoc research project "Participatory Research to Increase the Productivity and Sustainability of Wheat Cropping Systems in the State of Haryana, India" was implemented by the DFID through CIMMYT, South Asia Regional Office, Kathmandu, Nepal to increase wheat productivity and sustainability in this region.

METHODOLOGY

Nine wheat varieties viz. PBW 343, HD 2687, WH 711, WH 542, UP 2338, Raj 3765, PBW 373, UP 2425 and PBW 502 (included during 2004-05 only) were sown at farmers' fields. Additionally, four varieties under different tillage options like zero tillage, raised bed, rotary and conventional tillage were seeded with recommended package of practices at farmers' field in four villages viz. Darar, Janeshro, Mathana and

Kishangarh. To popularize the varieties other than PBW 343 in this area, farmers' days were organized in participatory mode before and after maturity in Mathana, Kishangarh, Janeshro and Darar villages during 2002-03 to 2004-05. Those farmers who had sufficient experience in agriculture, exposure to mass media and/or having contacts with experts were encouraged to attend the field days so that they can judiciously rank the varieties. The farmers were briefed by the social scientist about the coded varieties to facilitate ranking. Firstly, they were advised to have a look at all the wheat varieties grown and then to rank them as per their criteria and supporting reasons. The illiterate farmers were assisted by the team in doing this job. The ranks given by different farmers to a particular variety were added to calculate the average rank order to decide the final rank. The baseline survey which is one of the time tested tools in differentiating the pre and post changes was used to study the impact of Participatory Varietal Selection on varietal diversification. After the completion of the project in 2004-05, 100 farmers were randomly surveyed from Darar (Karnal), Janeshro (Karnal), Mathana (Kurukshetra) and Kishangarh (Kurukshetra) villages to study varietal diversification, in the area.

RESULTS AND DISCUSSION

Profile of the farmers : Most of the farmers were middle aged (67%) followed by young (18%) and old (15%) age. The findings show that 93 percent of the farmers were literate; however, in-depth analysis has indicated that about three-fourths of them were educated up to metric. From researcher's point of view, the literacy level was satisfactory and the farmers could follow the semi-technical language, therefore, the print material could be used to make the farmers aware of the latest technologies. All the farmers had agriculture as their main occupation. There were a few who had dairy (4%) and other subsidiary occupations. A trend was observed that those who had comparatively small holdings were having other subsidiary occupations to support their family. Majority (83%) of the farmers were having more than ten years experience in agriculture. Only 17 percent of them had up to 10 years experience in agriculture. Most of the farmers (42%) had 6-10 members in their family followed by up to 5 (38%) and more than 10 (20%). State agriculture officers, scientists from the research institutes and television were the main sources of information for new developments in agriculture. About half of the farmers were getting information from radio

and newspapers. About one-fourth read magazines/pamphlets to get the information on recent developments in agriculture, including wheat cultivation technologies.

Participatory varietal selection: Under the Participatory Varietal Selection, nine promising and newly released varieties were sown at farmers' field to provide an opportunity to the farmers to compare all the varieties at one site and select the desired varieties by farmers for their production conditions. Though, all these varieties were sown under timely sown conditions; three varieties namely PBW 373, Raj 3765 and UP 2425 were late sown varieties, whereas UP 2338 was recommended for both timely and late sown conditions. The varieties were evaluated by the farmers before and after maturity.

Economic importance of parameters : During farmer's days, they were asked to evaluate the varieties. First of all, the economic importance of various parameters was assessed on a three point continuum viz very important (3) somewhat important (2) and not important (1) by the farmers in Farmers' Group Discussion mode. The parameters used for evaluation were germination, number of effective tillers, days to maturity, plant height, lodging resistance, insect and disease resistance, ear head length, grains per ear head, grain yield, straw yield, grain type, etc. (Table1).

Table 1. Economic importance score of parameters (N=100)

S.No	Parameter	Score
1	Germination	3.00
2	Number of effective tillers	2.96
3	Days to flowering	1.88
4	Days to maturity	1.87
5	Plant height	2.72
6	Lodging resistance	2.84
7	Disease resistance	2.88
8	Insect resistance	2.31
9	Threshability	2.02
10	Grain colour	2.24
11	1000 kernel weight	2.73
12	Cooking quality	2.07
13	Chapati quality	2.35
14	Earhead length	2.51
15	Grains / earhead	3.00
16	Grain type	2.95
17	Grain yield	2.96
18	Straw yield	2.47

Evaluation of wheat varieties : All the varieties were evaluated by individual farmers in the field before and at maturity for various parameters on a three point continuum viz; very good (3), good (2) and not good (1) The varieties were ranked on the basis of economic importance of a parameter and its evaluation score (Table 2).

Table 2. Evaluation score of wheat varieties

Parameter	PBW 343	UP 2338	HD 2687	WH 542	PBW 373	UP 2425	WH 711	RAJ 3765	PBW 502
Germination	2.72	2.63	2.66	1.84	2.25	1.56	2.57	1.83	2.80
Number of effective tillers	2.77	2.45	2.50	1.91	1.96	1.58	2.41	1.82	2.74
Days to maturity	2.52	2.42	2.30	2.28	2.22	2.42	2.70	2.18	2.43
Plant height	2.76	2.58	2.61	2.43	2.54	2.33	2.52	2.23	2.90
Lodging resistance	2.65	2.26	2.39	1.73	2.02	1.90	2.51	2.02	2.72
Disease resistance	2.42	2.29	2.23	1.72	1.99	2.33	2.59	2.26	2.77
Insect resistance	2.91	2.91	2.92	2.88	2.81	2.92	2.90	2.90	2.96
Spike length	2.56	2.58	2.60	1.61	2.23	2.49	2.15	2.16	2.83
Grains/ spike	2.47	2.55	2.58	1.71	2.00	2.24	2.20	2.13	2.87
Grain type	2.83	2.26	2.67	2.41	2.30	2.12	2.57	2.39	2.89
Grain yield	2.17	2.14	2.16	2.02	2.40	2.69	2.18	2.28	2.64
Straw yield	2.72	2.69	2.92	2.13	2.05	1.80	1.75	2.04	2.75
Total score	31.50	29.76	30.22	24.67	26.77	26.38	29.05	26.24	32.97

Thereafter the scores of all the parameters were summed up for a variety to get a composite score.

Parameter Score = $M \times E$

M = Mean Economic Importance Score

E = Evaluation score of the same parameter

Composite Score of a Variety = Sum of the scores of all parameters for a variety

On the basis of composite score, PBW 502 was ranked first followed by PBW 343, HD 2687, UP 2338, WH 711, PBW 373, UP 2425, RAJ 3765 and WH 542 (Table 3).

Table 3. Matrix ranking of wheat varieties on the basis of evaluation score and economic importance score of parameters

Parameter	Varieties								
	PBW 343	UP 2338	HD 2687	WH 542	PBW 373	UP 2425	WH 711	RAJ 3765	PBW 502
Germination	2 (8.16)	4 (7.89)	3 (7.98)	7 (5.52)	6 (6.75)	9 (4.68)	5 (7.71)	8 (5.49)	1 (8.40)
Number of effective tillers	1 (8.20)	4 (7.25)	3 (7.40)	7 (5.65)	6 (5.80)	9 (4.68)	5 (7.13)	8 (5.39)	2 (8.11)
Plant height	2 (7.51)	4 (7.02)	3 (7.10)	7 (6.61)	5 (6.91)	8 (6.34)	6 (6.85)	9 (6.07)	1 (7.89)
Lodging resistance	2 (7.53)	5 (6.42)	4 (6.79)	9 (4.91)	6 (5.74)	8 (5.40)	3 (7.13)	7 (5.74)	1 (7.72)
Disease resistance	3 (6.97)	5 (6.60)	7 (6.42)	9 (4.95)	8 (5.73)	4 (6.71)	2 (7.46)	6 (6.51)	1 (7.98)
Insect resistance	4 (6.72)	5 (6.72)	3 (6.75)	8 (6.65)	9 (6.49)	2 (6.75)	6 (6.70)	7 (6.70)	1 (6.84)
Earhead length	4 (6.43)	3 (6.48)	2 (6.53)	9 (4.04)	6 (5.60)	5 (6.25)	8 (5.40)	7 (5.42)	1 (7.10)
Grains/ earhead	4 (7.41)	3 (7.65)	2 (7.74)	9 (5.13)	8 (6.00)	5 (6.72)	6 (6.60)	7 (6.39)	14 (8.61)
Days to maturity	2 (4.71)	5 (4.53)	6 (4.30)	7 (4.26)	8 (4.15)	4 (4.53)	1 (5.05)	9 (4.08)	3 (4.54)
Grain yield	2 (8.49)	8 (6.78)	3 (8.01)	5 (7.23)	7 (6.90)	9 (6.36)	4 (7.71)	6 (7.17)	1 (8.67)
Grain type	6 (6.40)	8 (6.31)	7 (6.37)	9 (5.96)	3 (7.08)	1 (7.94)	5 (6.43)	4 (6.73)	2 (7.79)
Straw yield	3 (6.72)	4 (6.64)	1 (7.21)	5 (5.26)	6 (5.06)	8 (4.45)	9 (4.32)	7 (5.04)	2 (6.79)
Over all rank	2 (85.24)	4 (80.28)	3 (82.60)	9 (66.19)	6 (72.21)	7 (70.78)	5 (78.49)	8 (70.71)	1 (90.45)

Figures in parenthesis are the composite score

Year wise ranking and spearman rank order correlation of varieties : The PBW 502 variety that was introduced during 2004-05 only, ranked first, whereas, no ranking in the preceding years could be made for this latest released variety. However, varieties PBW 343 and HD 2687 occupied 1st and 2nd rank, respectively during first two crop seasons (Table 4).

Table 4. Year wise ranking of varieties by the farmers

Varieties	Rank		
	2003	2004	2005
PBW 343	1	1	2
HD 2687	2	2	3
UP 2338	6	4	4
WH 542	7	8	9
PBW 373	3	5	6
UP 2425	4	6	7
WH 711	5	3	5
RAJ 3765	8	7	8
PBW 502	-	-	1

The ranking of varieties in three different years was subjected to Spearman Rank Order Correlation so that consistency in ranking of the varieties may be verified (Table 5).

Table 5. Spearman rank order correlation of varieties

Year	2003	2004	2005
2003	-	0.786*	0.762*
2004		-	0.976*
2005			-

The correlation between year wise ranking was found highly significant at 5% level which supported the farmers' perception that the performance of the varieties was consistent over the years.

Effect of Varieties : The data were subjected to two way analysis of variance (9 varieties against 12 parameters) to know the effect of varieties on different parameters and then the mean score was evaluated (Table 6). The results indicated that the mean score of PBW 502 was highest followed by PBW 343 and these showed superiority over others.

Table 6. Effect of varieties on parameters

Variety	Mean Score	Statistical Parameters
PBW 343	7.103	
UP 2338	6.690	SEM = 0.1880
HD 2687	6.883	CV % = 10.0937
WH 542	5.516	CD at 5 % = 0.5276
PBW 373	6.018	CD at 1 % = 0.6999
UP 2425	5.899	
WH 711	6.541	
Raj 3765	5.893	
PBW 502	7.537	

Impact on varietal diversification : The project succeeded in convincing the farmers that cultivation of outdated varieties was no longer profitable and it was always better to grow more than one variety. After three years of experimentation of the PVS at farmers' fields, the reduction in area under WH 542 and PBW 343 was noticed (Table 7). The farmers perceived that the grain size of WH 542 was small and it did not fetch better price though the yield was good. Many of the farmers felt to discontinue PBW 343 because of the attack of powdery mildew and possibility of yellow rust. Nevertheless, PBW 343 was still better than many other existing varieties. Farmers expected PBW 502 to replace it but the yield advantage of former was not significant. RAJ 3765 and UP 2338 could not get approval of the farmers due to low yield in case of former and rust diseases susceptibility in the latter. Moreover, wheat was grown under timely sown conditions in this area; therefore, there was little scope for late sown varieties like RAJ 3765. Though UP 2338 could be grown both under timely and late sown conditions but the farmers did not adopt it due to disease susceptibility. PBW 502 was sown for the first time during 2004-05, and the farmers appreciated the efforts made in introducing the latest variety under this programme. The main variety which made inroads in the study area was HD 2687 and to a lesser extent WH 711. The new variety WH 711 was found lodging resistant as well as thermal stress tolerant, particularly during 2003-04 crop season when terminal heat was experienced at the time of grain filling and maturity.

Table 7. Change in area under different varieties and their preferred characters by farmers

Varieties	%Area		Status	Preferred characters
	Pre	Post		
PBW 343	67.01	56.31	Decline	Dense earhead, bold grain, more tillering
HD 2687	22.40	28.38	Increase	Good yield, dense earhead, more tillering
WH 711	0.30	2.28	Increase	Dense earhead, less lodging, thermal tolerance, good grain
RAJ 3765	0.00	0.00	0	-
UP 2338	0.00	0.00	0	-
UP 2425	0.00	0.37	Increase	Bold grain
PBW 373	0.00	0.30	Increase	Dense earhead, good yield
WH 542	6.39	2.62	Decline	Dense earhead, good yield
HD 2329	2.78	0.52	Decline	Good yield
HD 2733	0.60	8.38	Increase	Good yield
HD 2009	0.53	0.00	Decline	Good yield
PBW 502	0.00	0.84	Increase	Dense earhead, bold grain, more tillering

The findings of the surveys conducted before and after the experimentation (2002-03 to 2004-05) have indicated that the area under PBW 343 declined due to the implementation of DFID project, HD 2687 occupied about 28.38 percent area and the newly released wheat variety PBW 502 was expected to occupy more area as reported by the farmers.

CONCLUSION

Evaluation of varieties by the farmers proved to be an effective tool in convincing them about potential of

recently released varieties. Group approach utilizing key resource farmers may be utilized while doing farmer participatory varietal selection. The project has successfully achieved higher varietal replacement. Area under PBW 343 has declined and other varieties of similar potential were being adopted. PBW 502 was ranked first by the farmers. The farmers preferred PBW 502 for dense earhead, bold grain and more tillering. The farmers appreciated the concept of participatory assessment of all the improved varieties at one site.

REFERENCES

1. Anonymous. (2005). Grain : World Markets and Trade, December 2005
2. Anonymous. (2005-06). Annual Report, Directorate of Wheat Research, Karnal-132001

□ □ □ •