Society for Advancement of Wheat and Barley Research
ICAR-Indian Institute of Wheat & Barley Research
Karnal - 132 001, India

Wheat and Barley Research
101): 40-44

Research Article

Homepage: http://epubs.icar.org.in/ejournal/index.php/JWR

WB 2: A high yielding bread wheat variety for irrigated timely sown conditions of North Western Plains Zone of India

Ravish Chatrath, Vinod Tiwari, Vikas Gupta, Satish Kumar, SK Singh, CN Mishra, K Venkatesh, MS Saharan, Gyanendra Singh, BS Tyagi, Ratan Tiwari, Indu Sharma, Om Parkash and Gyanendra Pratap Singh

ICAR-Indian Institute of Wheat and Barley Research, Karnal, India

Article history

Received: 12-02-2018
Revised : 26-04-2018
Accepted: 05-05-2018

Citation

Chatrath R, V Tiwari, V Gupta, S Kumar, SK Singh, CN Mishra, K Venkatesh, MS Saharan, G Singh, BS Tyagi, R Tiwari, I Sharma, O Prakash and GP Singh. 2018. WB 2: A high yielding bread wheat variety for irrigated timely sown conditions of North Western Plains Zone of India. *Wheat and Barley Research* **10**(1):40-44.

***Corresponding author**
Email: *ravish.chatrath@icar.gov.in*

© *Society for Advancement of Wheat and Barley Research*

Abstract

The bread wheat variety WB 2 was released by Central Sub-committee on Crop Standards, Notification and Release of variety, Ministry of Agriculture, Govt of India vide. S.O. 1007(E) dated: 30.03.2017 for cultivation in the North Western Plains Zone of the country. WB 2 has recorded average yield of 51.6q/ha and has shown yield superiority of 2.8% over the best check variety DPW 621-50 (50.2q/ha) over three years of testing under irrigated, timely sown conditions. It has shown resistance to prevalent yellow rust pathotypes 78S84 and 46S119. It is also resistant to virulent pathotype 104-2 of brown rust. It has *Lr*13+ genes for leaf rust which provides Adult Plant Resistance response and renders it resistant under field conditions. It has good quality characteristics like high grain protein content (12.4%), better grain appearance test weight and better suitability for chapati making. It also has higher sedimentation value reflecting its strong gluten which is indicative of superior bread making quality. WB 2 also has high grain Zn (42.0ppm) and Fe (40.0ppm) content. Thus, the high yield potential of the variety WB 2 coupled with high grain zinc content makes this variety a suitable choice for the farmers of the NWPZ.

Keywords: Wheat, WB 2, rust resistance, North Western Plains Zone, Biofortification

1. Introduction

Wheat (*Triticum aestivum* L) is one of the most important cereal crop grown worldwide serving as a major source of calorie intake (FAOSTAT, 2015). In India it is considered as the second important staple after rice, where wheat is cultivated on about 31mha area with a production and productivity of 97.44 million tonnes 31.72 q/ha respectively (Annonymous, 2017). The country is divided into five agroclimatic zonesdue to diverse production environments viz., Northern Hills zone (NHZ), North Western Plains Zone (NWPZ), North Eastern Plains Zone (NEPZ), Central Zone (CZ) and Peninsular Zone (PZ). Among all the zones, NWPZ of the country is the largest wheat producing zone with respect to area, production as well as productivity. This zone has been the base of the historical green revolution, and at present, it contributes over 60% of the total wheat production in the country. The demand for food grain production is increasing with the increase in population. The major challenge in this zone is to sustain the wheat production by higher yield potential coupled with disease resistance in the wheat varieties. To overcome this challenge, development of high yielding disease resistant varieties coupled with good quality features should be the aim of a sneeds programe. In this perspective, a zinc rich genotype WB 2 was developed at

the ICAR-Indian Institute of Wheat and Barley Research, Karnal- Haryana which was released by the Central Sub-committee on Crop Standards, Notification and Release of Varieties for Agricultural crops (CVRC) vide S.O. 1007 E dated 30th March, 2017 for the irrigated timely sown conditions of the North Western Plains Zone of the country.

2. Materials and methods

The bread wheat variety WB 2 was developed from selection in the 3rd HPYT (HarvestPlus Yield Trial) having pedigree T.DICOCCON CI9309/AE.SQUARROSA (409)/3/MILAN/S87230//BAV92/4/2*MILAN/S87230 //BAV92 at ICAR-Indian Institute of Wheat and Barley Research Karnal. The trial received from CIMMYT, Mexico as 3rd HPYT consisting of 50 genotypes; 49 test genotypes (including WB 2) and one local high yielding check variety DPW 621-50. The trial was planted following a randomised complete block design during rabi 2012-13. Genotypes were planted in plots (6 rows of six metre with a row spacing of 20cm). All the package of practices was followed for raising healthy a wheat crop. Data were recorded for the days to heading, days to maturity, plant height, grains/spike, thousand grain weight and yield. The data were subjected to statistical analysis and the promising genotypes then evaluated at 15 locations in the Special-wheat biofortification trial under AICRP on Wheat and Barley for three years (2013-2016). The data on grain yield, ancillary traits and diseases were recorded at ICAR-IIWBR Karnal and the characterisation of WB2 for specialtraits as per DUS guidelines was done.

3. Result and discussion

3.1 Yield evaluation and agronomic adaptability: The performance of WB 2 was assessed in the 3rd HPYT trial for grain yield and component traits during 2012-13. This genotype recorded average yield of 50.5q/ha which was at par with the local check DPW 621-50 (Table 1). It had good grain zinc and iron content along with resistance to stripe rust under field conditions. Based on the good grain yield and micronutrient content it was promoted for evaluation in the special wheat biofortification trial during 2013-14. The genotype alonmgwith other test entries and check varieties was evaluated for three year i.e. 2013-14, 2014-15and 2015-16. WB 2 shad an average yield of 51.6q/ha and had shown 2.8% yield superiority over the check variety DPW 621-50 (50.2q/ha) over three years of testing under irrigated, timely sown condition under coordinated trials(Table 2). It has shown superior performance across the zone by appearing 9 times out of 15 in 1st non-significant group as compared to the check variety DPW 621-50 (IIWBR Report 2014b, 2015b, 2016d).

The WB 2 along with check variety DPW 621-50 was evaluated under timely sown conditions at six locations (Delhi, Durgapura, Gurdaspur, Hisar, Karnal and Ludhiana). WB 2 showed an average yield of 51.99q/ha under timely sown conditions and 42.07 q/ha under late sown conditions. It had yield of 47.03 q/ha averaged under both timely and late sown conditions. WB 2 was highest yielding (51.9 q/ha) in agronomic trials and showed 4.4% higher yield than the check variety DPW 621-50 under irrigated timely sown conditions in North Western Plains Zone. It has highest grain number /spike under both timely (37.0) and late sown conditions (35.6) (IIWBR Report 2014a).

3.2 Disease resistance: WB 2 was free from yellow and brown rust in the 3rd HPYT during 2012-13. Under All India coordinated trials, it showed potential to resist the yellow rust pathogen as depicted from the average coefficient of infection (ACI) of 12.2, whereas the check variety DPW 621-50 had shown ACI of 22.5 under artificial inoculation conditions. Likewise, WB 2 has shown ACI of 8.1 under artificial inoculation of leaf rust. WB 2 had shown resistance to all the prevalent races of stripe rust in the seedling resistance test (SRT). The gene combination *Lr*13+ was postulated in WB 2 based on SRT data (IIWBR Report 2014a, IIWBR Report 2015a, IIWBR Report 2016c). WB 2 also possesses resistance to powdery mildew (Av. score= 2) disease of wheat.

3.3 Quality traits: WB 2 has a better grain appearance and test weight as compared to the check variety DPW 621-50. WB 2 has grain protein content (12.4%) which was at par with the check variety DPW 621-50 and showing better suitability for *chapati* making. A higher sedimentation value of 56.0 in WB 2 reflects its strong gluten and hence better bread making quality (IIWBR Report, 2016a). WB 2 has high grain Zn (42.0ppm) content, which is 18.6% higher than the check variety DPW 621-50 (35.4ppm). WB 2 also possesses more Fe (40.0ppm) content which is 5.2% higher than the check variety DPW 621-50 (38.1ppm).

3.4 Performance of WB 2 for agro-morphologic traits: Wheat variety WB 2 had an average plant height of 100cm with a range of 84-104 in the zone. Similarly, days to heading and maturity ranged from 84-104 and 129-157 with a mean of 95 and 142 days, respectively. Thousand grain weight ranged from 32-44g with a mean of 39g. The variety WB 2 is also having semi erect growth habit, dark green foliage colour and waxiness present on flag leaf, flag leaf sheath, ear and peduncle are the distinct traits under DUS criteria. It had tapering, white and intermediate earhead with short awns. The seeds are oblong in shape, amber coloured, hard in texture and are medium sized.WB 2 was released for cultivation in the NWPZ comprising Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur division), Western Uttar Pradesh (except Jhansi division), Jammu and Kathua district of Jammu & Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand. The high yielding ability coupled with resistance to rusts and better grain and product quality makes WB 2 a better choice for the farmers of the NWPZ under changing climate scenario.

Table 1. Mean performance of best genotypes for different traits in 3rd HarvestPlus yield trial during rabi 2012-13 at Karnal

Entry No.	DTH	PH	Yield (q/ha)	1000 grain wt.	Tillers/ m^2	Fe (mg/kg)	Zn (mg/kg)	Stripe rust score
HPYT 422	82	108	52.1	40	66.5	47.8	40.9	0
HPYT423	83	113	51.1	43	66.0	47.6	44.7	40S
HPYT 403	88	100	50.5	39	52.0	41.0	37.2	10S
HPYT 415	84	99	50.5	36	69.5	43.7	39.2	0
(WB 2)	83	100	50.4	39	66.0	44.4	36.1	10MR
HPYT 47	81	100	49.7	43	52.0	43.4	38.6	5MR
HPYT 450	85	112	49.5	42	55.0	46.3	40.3	0
HPYT40 5	84	103	49.0	36	69.5	49.2	43.9	0
HPYT 414	84	104	48.8	42	50.5	47.9	45.3	5MR
HPYT 407	86	100	30.8	35	75.0	42.9	40.4	5MR
HPYT 429	85	94	51.4	35	54.5	41.5	35.8	0
DPW 621-50 (C)	82	101.5	44.6	39.5	77.7	46.2	40.0	
Mean	1.21	6.87	7.6	4.8	18.7	1.52	ns	
CD								

Table 2. Performance of wheat variety WB 2 over check variety for grain yield under coordinated trials (breeding trials) from 2013-16

Item	Proposed variety	Check variety
	WB 2	DPW 621-50
Mean Yield q/ha (No. of trials 15)	51.6	50.2
% Increase over check variety		2.78
Frequency in top NS group	9/15	8/15

Table 3. Agronomic evaluation of WB 2 and check variety DPW 621-50 under timely and late sown conditions

Experiment	Sowing Conditions	WB 2		DPW 621-50	
		Yield	Rank	Yield	Rank
Yield (q/ha)	Timely	51.99	1	49.75	4
	Late	42.07	6	43.17	2
	Mean	47.03	1	46.46	3
Percentage gain or loss under late sowing		-19.08		-13.22	
CD (P=0.05): DOS =0.99, Variety = 1.32, Varieties within DOS = NS, DOS within Varieties = NS					
Earhead/ m^2	Timely	389	4	396	2
	Late	341	4	362	2
	Mean	365	4	379	2
CD (P=0.05): DOS = 15.37,Var. = 17.05,Var. within DOS = NS, DOS within Var. = NS					
Grains/ spike	Timely	37.04	1	34.57	4
	Late	35.57	1	32.92	5
	Mean	36.30	1	33.74	5
CD (P=0.05): DOS = NS,Var. = 1.72, Var. within DOS = NS, DOS within Var. = NS					
1000 grain wt. (g)	Timely	37.15	7	37.32	6
	Late	35.18	7	36.95	4
	Mean	36.16	7	37.14	5
CD (P=0.05): DOS = 0.69, Var. = 1.00,Var.within DOS = NS,DOS within Var. = NS					

Data based on Delhi, Durgapura, Gurdaspur, Hisar, Karnal and Ludhiana centres

Table 4. Disease reaction of WB 2 and the check variety DPW 621-50 under natural and artificial conditions during 2013-16

Disease/ Condition	WB 2		DPW 621-50	
	HS	ACI	HS	ACI
Yellow (Stripe) rust				
Natural condition	40S	10.2	20S	6.2
Artificial epiphytotics	60S	12.2	60S	22.5
Brown (Leaf) rust				
Natural condition	tR	ND	tR	ND
Artificial epiphytotics	60S*	8.1	10S	1.9

HS = Highest score, ACI = Average coefficient of infection, ND- Not developed

Table 5. Performance of WB 2 and Check variety DPW 621-50 for quality traits under coordinated testing

Quality traits	WB 2	DPW 621-50
Grain appearance (Max score 10)	6.4	6.3
Hectoliter weight (kg)	78.6	77.8
Protein content (%)	12.4	12.6
Sedimentation value (ml)	56.0	55
Grain hardness index	65.7	75
Grain Iron concentration (ppm)	40.0	38.1
Grain Zinc concentration (ppm)	42.0	35.4

Acknowledgement

The article is based on the variety release proposal of WB 2 submitted to the CVRC and the authors are highly thankful to all Principal Investigators (Crop Protection, Quality and Resource Management), IIWBR, Karnal and all the co-operators of NWPZ for their contribution. Authors also acknowledge the support from HarvestPlus for funding and breeding lines of wheat.

References

1. FAOSTAT, 2015. Organisation Des Nations Unies Pour L'alimentationEtLágriculture. Available at; http:/faostat.fao.org.
2. Annomymous. 2017. Director's Report of AICRP on Wheat and Barley 2016-17. ICAR-Indian Institute of Wheat and Barley Research, Karnal, Haryana, India. P. 87.
3. IIWBR, Report 2016a. Results of the All India Coordinated Wheat and Barley Improvement Project 2015- 16, Wheat Quality Vol. IV, Indian Institute of Wheat and Barley Research, Karnal (Eds) Gupta RK, D Mohan, Sewa Ram, S Narwal, V Pandey and GP Singh. pp226.
4. IIWBR Report 2014a. Results of the All India Coordinated Wheat & Barley Improvement Project 2013- 14, Crop Protection, Vol. III, Indian Institute of Wheat and Barley Research, Karnal, India (Eds). Saharan MS, S Kumar, R Selvakumar, S Katare and I Sharma. pp261.
5. IIWBR Report 2015a. Results of the All India Coordinated Wheat and Barley Improvement Project 2014-15, Crop Protection, Vol. III, Indian Institute of Wheat and Barley Research, Karnal, India (Eds) Saharan MS, S Kumar, R Selvakumar, S Katare, P Jasrotia and I Sharma. pp269.
6. IIWBR Report 2015b. Results of the All India Coordinated Wheat and Barley Improvement Project 2015-16, Resource Management, Vol. II, Indian Institute of Wheat and Barley Research, Karnal, India (Eds) Sharma RK, SC Tripathi, SC Gill, RS Chhokar, RP Meena, A Jha, K Prajapat, A Verma and GP Singh. 2016. pp179.
7. IIWBR Report 2016c. Results of the All India Coordinated Wheat & Barley Improvernent Project, 2015-16, Crop Protection, Vol. III, Indian Institute of Wheat and Barley Research, Karnal, India (Eds) Singh DP, MS Saharan, S Kurnar, S Katare, P Jasrotia, P Chandra and GP Singh. pp221.
8. IIWBR Report 2014b. Results of the All India Coordinated Wheat and Barley Improvement Project 2013-14, Crop Improvement, Vol. I, Indian Institute of Wheat and Barley Research, Karnal, India (Eds). Tiwari, V, R Chatrath, G Singh, R Tiwari, BS Tyagi, S Sareen, Raj Kumar, SK Singh, Satish Kumar, CN Mishra, K Venkatesh, Vikas Gupta and Indu Sharma. pp318.
9. IIWBR Report 2015b. Results of the All India Coordinated Wheat and Barley Improvement Project 2014- 15, Crop Improvement, Vol. I, Indian Institute of Wheat and Barley Research, Karnal, India (eds). Tiwari V, R Chatrath, G Singh, R Tiwari, BS Tyagi, S Sareen, Raj Kumar, SK Singh, Satish Kumar, CN Mishra, K Venkatesh, Vikas Gupta, Ajay Verma and Indu Sharma. , pp282
10. IIWBR Report 2016d. Results of the All India Coordinated Wheat and Barley Improvement Project 2015- 16, Crop Improvement, Vol. I, Indian Institute of Wheat and Barley Research, Karnal, India Tiwari V, R Chatrath, G Singh, R Tiwari, BS Tyagi, Raj Kumar, SK Singh, Satish Kumar, CN Mishra, K Venkatesh, Mamrutha HM, Vikas Gupta, Gopalareddy, Ajay Verma, Indu Sharma, RK Gupta and GP Singh. pp258.