

## HI 1633 (Pusa Vani): A bio-fortified bread wheat variety for late sown, irrigated conditions of Peninsular Zone of India

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**Article history:** Received: 11 Dec., 2020 Revised: 5 May, 2021 Accepted: 29 July, 2021

### Citation:

Prasad SVS, JB Singh, D Ambati, RM Phuke, TL Prakasha, AN Mishra, KC Sharma, AK Singh, GP Singh, JB Sharma, PK Singh, Harikrishna, RK Sharma, N Kumar, R Yadav, KB Gaikwad, S Kumar, PH Babu, K Raghunandan, VK Singh, M Sivasamy, TR Das, D Pal, Vinod, AM Singh, N Jain, M Kumar, P Jayaprakash, VK Vikas, M Madhu Patial, RN Yadav and KV Prabhu. 2021. HI 1633 (Pusa Vani): A bio-fortified bread wheat variety for late sown, irrigated conditions of Peninsular Zone of India. *Journal of Cereal Research* **13(2)**: 220-223. <http://doi.org/10.25174/2582-2675/2021/110863>

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### Abstract

A new bread wheat variety HI 1633 (Pusa Vani) has been released and notified by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, Government of India for commercial cultivation under irrigated and late sown conditions of Peninsular Zone of India. HI 1633 has average yield of 41.7 q ha<sup>-1</sup> and showed superiority over checks. The potential yield of HI 1633 is 65.8 q ha<sup>-1</sup> and found resistant to black and brown rusts. HI 1633 found to have excellent chapati quality (7.63), biscuit quality (7.08), high grain hardness (>80.0), test weight (80.3 kg hl<sup>-1</sup>) and sedimentation value (45.0 ml). It has high protein content (12.4 %) and presence of 5+10 subunit of *Glu-D1* reflecting higher gluten strength. It has good amount of micronutrients viz., iron (41.6 ppm) and zinc (41.1 ppm) content making it rich in nutritional qualities. This variety has been recommended for irrigated late sown conditions and would contribute to increasing wheat production and alleviate the socio-economic status of farmers of Peninsular zone in India.

**Key Words:** Biofortified wheat, disease resistance and quality

### Introduction

Wheat is the most important staple food crop of the world. It provides food to 36 % of the global population and 20% of the food calories. Wheat cultivated area in India is more than 30 million hectares with the production of nearly 108 million tonnes (IIWBR Director's Report, 2020). The late sown area of wheat

in peninsular zone is also in an increasing trend due to diverse crop cultivation practices and in this area needs wheat varieties resistant to black and brown rusts along with tolerance to terminal heat stress. However, improvement of quality traits and micro-nutrient content along with yield in wheat are the new objectives



of the breeding programmes to attain food and nutrition security in India.

**Development and Notification of HI 1633:** The variety HI 1633 was developed from the cross **GW 322/PBW 498** through modified pedigree method. HI 1633 developed by the ICAR-Indian Agricultural Research Institute, Regional Station, Indore was released by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops and notified vide S.O. 500 E, dated 29.1.2021 for commercial cultivation under irrigated, late sown conditions of the Peninsular Zone, which is the potential area for wheat crop and comprises states like Maharashtra, Karnataka and Plains of Tamil Nadu.

**Yield superiority and adaptability:** HI 1633 was advanced to national coordinated trials of late sown trials (NIVT 3B) during 2017-18 (ICAR-IIWBR, 2018). Under Co-ordinated trials of AICW&BIP (NIVT 3B, AVT I & AVT II), HI 1633 was evaluated at 30 locations during 2017-18 to 2019-20 out of which it appeared 21 times in the first non-significant group indicating its wider adaptability

and stable yield (Table 1, ICAR-IIWBR 2020). Evaluation of HI 1633 under late sown conditions along with the checks showed that HI 1633 had an average yield of 41.7 q/ha and performed superior over checks. The potential yield of HI 1633 is 65.8 q/ha in Pune during 2018-19 (ICAR-IIWBR, 2019) of Peninsular zone. It showed significant yield advantage of 6.4%, 6.4% and 4.3% over the checks HD 2932, Raj 4083 and HD 3090, respectively. HI 1633 was early to flower (55-60 days), maturity (100-105 days), and possessed bold grains (TGW 42.0g).

**Distinguishing morphological characteristics:** Wheat variety HI 1633 has semi-erect growth habit and green foliage colour and anthocyanin pigmentation was absent on coleoptile at boot stage. It has semi-erect, medium sized having green flag leaf, very strong waxiness on sheath and blade. Peduncle of HI 1633 is medium, with strong waxiness, white coloured, weak waxy tapering spike which bears white awn. The lower glume has narrow sloping shoulder with long straight beaks. It possesses amber coloured, oblong, medium sized, hard grain with medium germ width.

**Table 1:** Performance of HI 1633 and other checks in Peninsular Zone

Items	Year of testing	No. of trials/ location	Proposed variety				CD
			HI 1633	HD 2932	Raj 4083	HD 3090	
Mean yield (q/ha)	NIVT 3B (2017-18)	5	42.3	38.7			2.9
	AVT I (2018-19)	12	45.9	42.5	44.0	42.2	1.4
	AVT II (2019-20)	13	37.6	36.4	34.8	38.0	1.4
	Weighted Mean		41.7	39.2	39.2	40.0	-
% increase / decrease over the checks	NIVT 3B (2017-18)			9.3*	-	-	-
	AVT I (2018-19)			8.0*	4.3*	8.8*	-
	AVT II (2019-20)			3.3	8.0*	-1.1	-
	<b>Overall Weighted Mean</b>			<b>6.4</b>	<b>6.4</b>	<b>4.3</b>	-
Frequency in the first top non-significant group	NIVT 3B (2017-18)		4/5	3/5	-	-	-
	AVT I (2018-19)		9/12	6/12	7/12	8/12	-
	AVT II (2019-20)		8/13	6/13	3/13	7/13	-
	<b>Overall performance</b>		<b>21/30</b>	<b>15/30</b>	<b>10/25</b>	<b>15/25</b>	-

\* Significantly superior

**Performance in agronomical evaluation:** In the agronomical trials under irrigated and late sown conditions, HI 1633 was high yielding genotype (35.10 q/ha); and showed yield superiority in the range of 0.2 to 4.6 per cent over check varieties MACS 6478, Raj 4083 and

MACS 6222 and was on par with HD 2932. It showed significant increase (0.52 to 4.88% in overall mean) for 1000 grain weight over all the checks; and on par with Raj 4083 (Anonymous, 2020).



**Table 2:** Performance of HI 1633 and checks under various agronomic conditions

Experiment / Item	Sowing time	Proposed Variety HI 1633	Check Varieties			
			HD 2932	Raj 4083	MACS 6222	MACS 6478
Yield (q/ha)	Normal	37.61	38.81	37.42	35.46	40.66
	Late	35.85	36.86	34.86	34.32	36.59
	Very late	31.85	33.23	31.35	30.31	27.84
	Mean	35.10	36.30	34.54	33.36	35.03
% loss in comparison with Normal Sowing	Normal : Late	4.68	5.02	6.84	3.21	10.01
	Normal : Very late	15.32	14.38	16.22	14.52	31.53
	Late : Very late	11.16	9.85	10.07	11.68	23.91
% superiority over checks & qualifying variety	Normal		-3.09	0.51	6.06*	-7.50
	Late		-2.74	2.84	4.46	-2.02
	Very late		-4.15	1.59	5.08	14.40*
	<b>Over mean</b>		-3.31	1.62	5.22*	0.20

CD (P=0.05) :Sowing(A)=1.19; Genotypes(B)= 1.67; B within A= 2.88, A within B = 2.95

\* Significantly superior

**Table 3:** Quality performance of HI 1633

Quality Trait	HI 1633	Checks		
		HD 2932	Raj 4083	HD 3090
Protein %	12.4	12.4	12.2	12.4
Fe (ppm)	41.6	37.4	41.5	39.8
Zn (ppm)	41.1	37.2	38.4	40.2
Grain Hardness index	78.0	71.0	75.8	77.8
Sedimentation value (ml)	45.4	50.2	58.7	50.8
Phenol test (max score 10)	7.1	4.5	7.1	7.6
Wet Gluten (%)	34.4	32.7	34.4	34.2
Dry Gluten (%)	10.5	10.4	10.9	10.7
Gluten Index	58	81	76	61
Chapati quality	7.63	7.83	7.62	7.58
Bread Loaf Volume (ml)	548	543	563	573
Bread Quality	6.60	6.40	7.25	7.47
Biscuit Quality- Spread Factor	7.08	7.29	7.19	7.28
HMW subunits				
Glu-D1	5+10	2+12	5+10	5+10
Glu-A1	2*	2*	1	1
Glu-B1	7	17.18	7+8	7
Glu-1 Score	8	8	10	8



**Resistance to major disease and pests:** HI 1633 has high levels of field resistance to stem (ACI: Max.-2.0; Mean-1.9) and leaf (ACI: Max.-10.0; Mean-4.2) rusts under artificial inoculations. It showed seedling resistance (all stage resistance) to 27 virulent pathotypes each of stem and leaf rusts. The postulated stem rust resistance gene *Sr31* has been reported to be resistant to all Indian pathotypes of stem rust. It also showed high levels of adult plant resistance to prevalent and virulent stem rust pathotypes 40A and 117-6; and leaf rust pathotypes 77-5, 77-9 and 104-2 (ICAR-IIWBR, 2020b). It showed good levels of resistance to leaf blight, Karnal bunt, *Fusarium* head blight, loose smut, foot rot and flag smut. It was not affected by major insect pests.

**Grain quality:** HI 1633 is a bread wheat genotype with good quality *viz.*, good chapati quality (7.63), biscuit quality (7.08), high grain hardness (>80.0), test weight (80.3 kg/hl) and sedimentation value (45.4 ml). It has high protein content (12.4%) and protein quality (*Glu* score of 8/10) for high molecular weight subunits and presence of 5+10 subunit of *Glu-D1* reflecting higher gluten strength (ICAR-IIWBR,2020c). It has good amounts of essential micronutrients like iron (41.6 ppm) and zinc content (41.1 ppm) making it rich in nutritional qualities; and termed as **biofortified wheat**. It meets all desirable components for better biscuit, and chapati making qualities that makes it also favorable for industrial purpose.

In nutshell, the biofortified and high yield potential variety HI 1633 couples with stress tolerance to terminal heat and plasticity for sowing time with resistance to major insect pests, stem and leaf rusts makes this variety a suitable choice for the farmers of Peninsular Zone of the country.

### Acknowledgment

The article is based on the CVRC proposal and the authors are highly thankful to all Principal Investigators (Crop Improvement, Crop Protection, Quality & Resource Management) and all the cooperators of PZ for their contribution.

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