

## HD 3059 (*Pusa Pachheti*): A new wheat variety for late sown irrigated conditions of north western plains zone of India

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### Abstract

A new bread wheat variety, HD3059 (*Pusa Pachheti*) 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 late sown irrigated conditions of North Western Plains Zone (NWPZ) of the country. HD 3059 has average yield of 4.25 t/ha with yield potential of 5.94 t/ha under late sown irrigated conditions and showed superiority over checks (PBW373, PBW 590 and WH 1021). It is resistant to yellow rust and brown rust. It has shown superior quality parameters with high protein content (13.6%), high sedimentation value (52ml), best Glu-1 Score (10/10) and good extraction rate (70.1%) meeting all the criteria for superior bread making qualities. This being an early maturing variety has promise for late sown irrigated planting areas following basmati rice/wheat; potato/wheat and sugarcane/wheat cropping systems and thus will contribute to increasing wheat production in Indo-Gangetic region in India.

**Keywords:** Bread wheat, late sown irrigated conditions, yield, rust resistance, quality traits

## 1. Introduction

India achieved a production of 92.3 million tons during 2012-13 (Anonymous, 2013) in which major contribution came from North Western Plains Zone. This zone contributes over 45% of the total wheat production in the country. Area of wheat cultivation under late sown, irrigated conditions in north western plains zone has gradually increased substantially due to adaptation of basmati rice/wheat; potato/wheat and sugarcane/wheat cropping systems due to enforcement of raising rice nursery only after June first week in Punjab and Haryana since 2009-10. Consequently, the planting of wheat is delayed beyond end of November up to mid to last week of December in large areas where non-basmati or long duration traditional basmati rice is grown the north western plains zone. Late harvesting of preceding crop delayed the wheat sowings leaving short period for wheat crop to mature coupled with high temperature during

grain filling stage affecting grain yield. This situation demands early maturing and thermo tolerant wheat varieties in these areas. Among the biotic stresses, leaf and stripe rusts are the major concerns in NWPZ. Targeting the necessity of rust resistance particularly yellow rust and tolerance to terminal heat stress, a semi-dwarf (83cm), rust resistant, early maturing (121 days) and thermo-tolerant wheat variety HD3059 having high yield and better quality was developed by Indian Agricultural Research Institute, New Delhi. HD3059 has been released and notified vide S.O. No. 312 E dated 1-2-2013 by the central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, Government of India for commercial cultivation under late sown irrigated conditions of North Western Plains Zone (NWPZ) of the country, the largest wheat producing zone with respect to area, production and productivity.

*Yield superiority and adaptability to changes:* HD3059 was tested in coordinated trials of AICW&BIP during 2009-10 to 2011-12 under irrigated, late sown conditions in NWPZ, On three years weighted mean basis it yielded 4.25 t/ha with potential yield of 5.94 t/ha at Bulandshahr during 2009-10 and figured significantly superior to all the three check varieties, PBW590, WH1021 and PBW373 for all the years of testing with mean yield increase of 5.8, 8.8 and 14.7 percent respectively (Table1).The HD 3059 has very wide adaptation across the zone. In 48 trials between 2009-10

and 2011-12, it appeared 24 times in first non-significant group as compared to all the three checks PBW373 (8/48), WH 1021 (9/40) & PBW 590(11/40). HD3059 has also shown significant superiority in yield over check varieties in agronomic trials of NWPZ conducted under late and very late sown conditions. Its mean yield under late and very late sown conditions are 3.51 t/ha and 4.39 t/ha respectively with minimum percentage yield reduction under very late sown conditions over all the checks reflecting its phenotypic plasticity and better tolerance to terminal heat stress (Table 2).

**Table 1.** Summarized yield data under coordinated trials over the three years (2009-12)

Item	Year of testing	No. of trials	Proposed Variety HD 3059	Checks			CD
				PBW373	PBW590	WH1021	
Mean Yield q/ha	2009-10	8	42.0	35.5*	-	-	2.9
	2010-11	20	43.2	37.4*	40.7*	39.3*	0.9
	2011-12	20	42.1	37.4*	39.7*	38.9*	1.0
	Weighted Mean	48	42.54	37.08	40.20	39.10	
Per cent superiority over mean		-	-	14.72	5.83	8.80	
Frequency in 1 <sup>st</sup> NS group			24/48	8/48	11/40	9/40	

**Table 2.** Adaptability of variety HD 3059 to changes in agronomic conditions

Experiment / Item	Agronomic Conditions	Proposed variety HD 3059		Checks					
		HD 3059		PBW373		PBW590		WH1021	
		Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk
Yield (q/ha)	Late sown	43.95	3	37.71	9	42.88	5	40.71	8
	Very late sown	35.13	2	29.86	9	32.62	5	31.04	8
	Mean	39.54	2	33.79	9	37.75	5	35.87	8
Percentage yield loss under very late sown		-20.07		-20.82		-23.93		-23.75	

CD ( $P=0.05$ ). SOWING(A) =0.69; VARIETY (B) = 0.83; (B within A) = 1.17; (A within B) = 1.30

*Morphological characteristics:* HD3059 is a semi-erect genotype with dark green foliage at boot stage and medium anthocyanin pigmentation of auricles. Semi-erect flag leaves are of medium size in length and breadth with presence of medium density of hairs on auricles and strong waxiness of leaf sheath and blade extending to peduncle and reducing its intensity on ear heads. This 93 cm tall semi-dwarf variety took 84 days to flower and 121 days to mature. Its white densely packed slightly tapering ear heads carry white, medium length awns. Average 1000 grain weight of this variety is 36g with hard, amber, ovate shaped grains with medium germ width and medium brush hairs.

*Reaction to major disease:* HD3059 displayed high degree of resistance during three years of testing against all the three rusts with maximum ACI of 2.8 for leaf rust, 6.4 for stripe rust and 6.7 for stem rust both under natural and artificial epiphytotic conditions. In NWPZ stripe rust is the major disease of concern and the checks PBW373, PBW 590 & WH 1021 has become susceptible to this pathogen with maximum ACI of 42.9, 22.2 and 15.5 respectively. Analyses of gene postulation (*Lr10+26+* and *Y79+*), pathogen survey report, Single Race Test (SRT) and PPSN (Plant Pathological Screening Nursery) data suggest the operation of combination of both vertical and horizontal resistance to brown and yellow rust in HD3059 which is

likely to be durable. Stem rust is a likely disease when wheat is planted late in the western plains and any variety for this situation should ideally possess stem rust resistance. The proposed variety HD3059 has shown resistance to both local pathotypes of stem rust and stem rust race Ug99 and its variants during testing at Njoro, Kenya (2011, CIMMYT data, NRJO No. 20026). HD3059 also showed high degree of foot rot disease resistance (10% infection) in comparison to all the checks (30-40% infection) and zero percent infection to flag smut in contrast to 31.7% in check variety WH1021.

*Superior quality:* The variety HD3059 possesses superior quality parameters in terms of highest sedimentation value (52ml) and highest (10/10) Glu-1 Score among all the three check varieties i.e. PBW373, PBW590 and WH1021. Sedimentation value >40 is a desired trait for bread quality and Glu-1 Score is the most desirable character for gluten strength. It also has good extraction rate (flour recovery)

of 70.1 percent. HD3059 has recorded an average grain protein content of 13.6% over three years. It meets all the criteria for superior bread making qualities and may find favour with bread making industries.

In conclusion variety HD3059 is having high yield potential along with early maturity, tolerance to terminal heat stress and flexibility for sowing time from late to very late making it a suitable choice for the farmers growing irrigated conditions wheat either late or very late in NWPZ under different wheat based cropping systems. Resistance to all the three rusts and superior quality characters are the added advantages meeting the needs of the farmers in this zone.

## **Reference**

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