

DBW 71: A new wheat variety for late sown irrigated conditions of north western plains zone of India

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ABSTRACT

A new high yielding bread wheat (*Triticum aestivum*) variety DBW 71 has been developed and released by Central Sub-Committee on crops standards and notifications and release of variety for agricultural crops for late sown cultivation under and irrigated conditions of the North Western Plain Zone (NWPZ) of India during 2013. It has average yield of 43.2 q ha⁻¹ with yield potential of 68.9 q ha⁻¹ and its plasticity for sowing period make it more suitable for cultivation after basmati rice, sugarcane, cotton, vegetable peas, potato, etc. Higher yielding ability of DBW 71 under very late sown conditions reflects its better tolerance to terminal heat stress. The race specific APR response analysis and SRT against 78S84 pathotype of stripe rust showed high level of resistance in DBW 71 at adult plant and seedling stages. Besides, DBW 71 possesses better quality traits as indicated by higher protein content (13.4%), perfect Glu-1 score (10/10), better grain appearance (score 6.2) and hectoliter weight (78.4 kg hl⁻¹).

Keywords: Bread wheat, yield, late sown irrigated condition, disease resistance, quality traits

India achieved a record wheat production of 94.88 million tons during 2011-12 (Anonymous, 2012) in which major contribution came from the North Western Plains Zone, wheat bowl of the country. Although majority of the wheat area of NWPZ falls under timely sown irrigated crop conditions, a sizeable area comes under various cropping systems such as basmati rice-wheat, cotton-wheat, sugarcane-wheat, potato-wheat, vegetable pea-wheat, etc. in these cropping systems, late harvest of preceding crops make wheat cultivation delayed resulting in shorter crop period. In all these areas, early maturing and high yielding varieties of wheat are required that can fit into prominent crop rotations and suitable for sowing during mid to late December. The late sown wheat at early stages of growth is prone to damage by low temperature and yellow rust. Further, high temperature during grain filling stage also affects grain yield. For ameliorating these problems, the short duration varieties having plasticity for sowing period, resistance to yellow rust and tolerance to terminal heat stress are required. At present, major varieties under late sown conditions are PBW 373, Raj 3765, WH 1021 and PBW 590. Among these, PBW 373 and Raj 3765 have become highly susceptible to the yellow rust and their yield potential is also low. Other two varieties namely WH 1021 and PBW 590 are not able to fulfill the needs of the farmers effectively. Hence, a new wheat variety having high yield potential coupled with resistance to rusts and tolerance to terminal heat stress is needed.

Development and notification of DBW 71: The variety DBW 71 was developed by the cross Prinia/UP 2425 following modified pedigree method.

Among the parents, Prinia (CM 90722-22Y-0M-0Y-3M-0Y) was selected from IBWSN during 1997-98 crop season as better agronomic base and UP 2425 was an early maturing indigenous variety. The shuttle breeding approach was followed between DWR-RS, Dalang Maidan and Karnal in the development process. The variety DBW 71, developed by the Crop Improvement division of the Directorate of Wheat Research, Karnal, was released by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops and notified vide S.O. 2817 (E) dated 19th September, 2013 for commercial cultivation under irrigated, late sown conditions of the North Western Plains Zone (NWPZ) which is the largest wheat growing zone of the country and comprises states of Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), West Uttar Pradesh (except Jhansi division), Jammu & Kathua districts of Jammu & Kashmir, Una district & Paonta valley of Himachal Pradesh and Tarai region of Uttarakhand.

Yield superiority and adaptability: This variety was entered in coordinated evaluation trial (NIVT 3) during 2009-10. Under coordinated trials of AICW&BIP, DBW 71 was evaluated at 48 locations during 2009-10 to 2011-12 out of which it occurred 23 times in 1st non-significant group indicating its wider adaptability and stable yielding feature (Table 1). DBW 71 has produced an average yield of 43.2 q ha⁻¹ and showed significant yield superiority over all the three checks namely PBW 373 (17.6%), WH 1021 (8.1%) and PBW 590 (5.1%). It recorded the yield potential of 68.9 q ha⁻¹ at Durgapura in 2009-10 under late sown conditions. DBW 71 was the earliest genotype in flowering (81 days) and maturity (119 days) and possesses boldest grains (TGW 37g) compared to all the checks varieties.

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Table 1. Yield performance of wheat variety DBW 71

Item	DBW 71	PBW 373	PBW 590	WH 1021
Grain yield (q ha ⁻¹)	43.2	36.8	40.2	39.1
% Increase over checks	-	17.4	5.12	8.06
Yield potential (q ha ⁻¹)	68.9	51.9	54.1	51.6
Frequency in 1 st NS group	23/48	8/48	11/40	9/40

Table 2. Yield performance (q ha⁻¹) of DBW 71 in agronomical evaluation

Agronomic condition	DBW 71	PBW 373	PBW 590	WH 1021
Late sown (LS)	42.90	37.71	42.88	40.71
Very late sown (VLS)	35.50	29.86	32.62	31.04
% decrease under VLS	17.25	20.82	23.93	23.75
CD (P=0.05).	0.69 (DOS), 0.83 (Var), 1.17 (Var. within DOS), 1.30 (DOS within Var.)			

Distinguishing morphological characteristics: Wheat variety DBW 71 has semi erect early 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, medium hairy auricles and waxiness was weak on sheath and blade. Peduncle of DBW 71 is medium long and straight in attitude. It has medium long, tapering, medium dense, white coloured non-waxy spikes which bear medium long white awns. The lower glume has narrow, elevated shoulders with medium-long, moderately curved beaks. DBW 71 possesses amber coloured, oblong, medium sized, semi-hard grains with medium germ width and grain crease.

Performance in agronomical evaluation: In the agronomical trials of NWPZ conducted under late sown conditions, DBW 71 showed superior performance (42.9 q ha⁻¹) over all the check varieties. DBW 71 was also the highest yielding genotype (35.5 q ha⁻¹) with significant yield advantage under very late sown condition over all the checks that reflects its better tolerance to terminal heat stress. The phenotypic plasticity of DBW 71 is evident from the minimum reduction in yield (17.25%) as observed under late and very late sown conditions compared to checks where reduction ranged from 20.1% to 24.2%. This endows DBW 71 as more suitable for different crop rotations followed in the zone, such as rice-wheat, cotton-wheat, sugarcane-wheat, potato-wheat, vegetable pea-wheat, etc. DBW 71 also had highest number of spikes/m² area and 1000-grains weight under late and very late sown conditions and showed least reduction for these traits under very late sown conditions compared to the late sown conditions.

Resistance to major diseases and pests: In the NWPZ, yellow rust is the main yield reducing biotic factor. DBW 71 has higher degree of resistance to yellow rust (ACI 5.5) as compared to the checks, PBW 343 (ACI 38.3), PBW 590 (ACI 20.6) and WH 1021 (ACI 13.8) during multilocation valuation in 2011-12. The race specific APR response analysis and SRT against 78S84 pathotype of stripe rust showed high level of resistance

in DBW 71 at adult plant and seedling stages. DBW 71 also showed resistance reactions to APR studies with brown rust pathotypes 77-5 and 104-2. In addition, DBW 71 also showed resistance response to black rust pathotypes 40A and 117-6 which makes it more suitable against any future threat from black rust in NWPZ.

Resistance to Karnal bunt is also crucial for trade related aspects and DBW 71 has shown better resistance to Karnal bunt than latest check variety PBW 590. It may be free from major pests under both natural and artificial conditions.

Grain quality: DBW 71 has quality parameters as indicated by better grain appearance (score 6.2), higher hectoliter weight (78.4 kg/hl) and perfect 10/10 Glu-1 score compared to the check varieties. It also possess high protein content (13.4%) and comparable sedimentation value of 39ml. It meets all desirable components of better bread and biscuit making qualities that makes it favourable for industrial purposes.

In nutshell, the high yield potential of the variety DBW 71 coupled with early maturity, terminal heat stress tolerance and plasticity for sowing time makes this variety a suitable choice of the farmers of the NWPZ under different wheat based cropping sequences, especially for farmers of western UP and other parts of NWPZ where sugarcane-wheat rotation is followed. The better disease resistance and quality traits are additional advantages fulfilling the requirements of the farmers.

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Reference

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