

DBW 316 (Karan Prema):

A new high yielding biofortified wheat variety

Hanif Khan*, Om Parkash, C N Mishra and Gyanendra Singh

ICAR-Indian Institute of Wheat and Barley Research, Karnal, Haryana 132 001

DBW 316 (Karan Prema), is a new biofortified high yielding bread wheat variety released and notified recently by the 'Central Sub-Committee on Crop Standard Notification and Release of Varieties for Agricultural Crops' Govt. of India vide gazette notification number SO 1056(E) of March 06, 2023 for commercial cultivation in North-Eastern Plains Zone (NEPZ) of India. NEPZ is the second largest wheat producing zone in India where wheat is subjected to the terminal heat stress due to late sowing after harvesting of long duration rice crop. The new variety DBW 316 is tolerant to various diseases such as wheat rusts, wheat blast and foliar blight, and has high heat tolerance (HSI 0.19) and drought tolerance (DSI 0.88) level. It has recorded a potential yield level of 68 q/ha under late sown conditions of NEPZ. DBW 316 is rich in zinc and contains high grain protein (13.2%) which categorizes it as a biofortified wheat variety. DBW 316 has other quality attributes such as high bread loaf volume and bread quality score, high chapatti quality score, high sedimentation value and good grain appearance. High end-use quality with biofortified value and high yield potential make DBW316 a suitable variety for boosting farm economy, food and nutritional security of the country.

Keywords: Biofortification, Climate resilience, DBW 316, Grain protein, Heat tolerance

India is the second largest producer of wheat globally and in 2023, country is aiming for more than 112 million tonnes of wheat production i.e. 5% higher than last year. The rice-wheat system in India's Indo-Gangetic Plains (IGP) is one of the most important cropping systems in the world. Major wheat growing states of wheat in India are Uttar Pradesh, Punjab, Haryana, Rajasthan, Madhya Pradesh, Gujarat, and Bihar. Total wheat area of India is divided into 5 agro-ecological zones namely; North-Western Plains Zone (NWPZ), North-Eastern Plains Zone (NEPZ), Central Zone (CZ), Peninsular Zone (PZ). Several wheat breeding programmes in India are working to develop improved cultivars for these agro-ecological zones, and candidate genotypes with the potential to be released to farmers are assessed across the country in coordinated multi-

location trials under AICRP wheat. Wheat is a sensitive crop to weather, making it regionally vulnerable to climate change and fluctuation. Despite the long-established advantages of sowing wheat by November 15th, many farmers throughout the NEPZ, especially those in the eastern IGP, sow their

wheat crop later than recommended time. Terminal heat tolerance is a very important trait for enhanced grain filling, in all wheat growing situations, particularly under late sowing conditions of areas like eastern India. This issue has been addressed through developing climate resilient wheat varieties.



Field view of bread-wheat variety DBW 316



Anthesis stage

Grain characteristics

Some characteristic features of DBW 316

Various studies have shown that there is genetic variability for terminal heat tolerance. A tall wheat variety C 306 developed by using indigenous germplasm in 1960s has excellent adaptation for heat prone areas. In last five decades several wheat varieties have been released for cultivation in NEPZ. DBW 316 (Karan Prema) is a latest wheat variety developed for late sown irrigated conditions of this zone.

Salient features of DBW316

Varieties intended for the North-eastern plains of India should be disease-resistant and tolerant to terminal heat in addition to having a high grain yield potential. Terminal heat stress affects wheat particularly the late sown crop when the mean temperature during the grain filling stage goes above 31°C. Besides this, the variety should perform better in the farmer's field, with agronomic and quality superiority. The features of the proposed variety DBW 316 with respect to yield, disease resistance and quality parameters are detailed as under.

Yield potential and adaptability to agronomic interventions: As compared to the checks DBW 316 has shown a superior yielding ability in late sown irrigated trials in terminal heat prone areas of Eastern Gangetic Plains over the 3 years of testing in the All India Coordinated multi-location wheat improvement trials. This variety has shown yield superiority over the checks HD

3118 (7.0%), HI 1621 (3.2%), HI 1563 (1.8%) and at par with DBW 107. The new variety has a high yield potential of 68.0 q/ha with an average yield of 41.0 q/ha under late sown conditions of NEPZ. In agronomic trials comparing performance under late sown (LS) and very late sown (VLS) conditions, DBW 316 showed least reduction (27.5) percentage in yield in VLS condition whereas yield reduction in other varieties was higher as PBW 833 (31.9%) PBW 835 (38.3%), HI 1563 (33.2%), HI 1621 (34.3%), HD 3118 (35.5%) and DBW 107 (37.3%). Its 1000-grain weight is highest (40.0 g) among all the test/check entries in late sown varietal trial.

This variety has desirable plant architecture with robust medium

stature (average plant height 90 cm under late sown conditions) and average maturity duration of 114 days for NEPZ late sown conditions. DBW 316 is comparable to the check varieties HI 1563, HI 1621, HD 3118, DBW 107, for days to heading, maturity and plant height (Table 1). The package of practices for DBW 316 are given in Table 2.

Better disease resistance: The variety was also evaluated for the resistance under natural and artificial epiphytotic conditions (PPSN) to the 3 rust diseases namely; yellow, brown, and stem rusts and other foliar diseases such as leaf blight and powdery mildew. The new variety DBW 316 has shown good level of resistance to all the 3 rusts of wheat. It also carries resistance against wheat blast disease, powdery mildew and foliar blights. In this variety an unknown *Lr* gene has been postulated conferring resistance against all the reported races of brown rust in India.

Good quality: DBW 316 has amber-coloured hard grains with a very high protein content (average 13.2%). High protein content along with good level of Zn (average 38.2 ppm) and Fe (average 38.2 ppm) make this variety superior in nutritional quality as compared to all the checks. Besides, the proposed variety is suitable for multiple products as indicated by high bread loaf volume (593 ml), high bread-quality (score 7.7), chapatti quality

Table 1. Mean data of important phenological and quality traits of DBW 316 and check varieties under late sown irrigation conditions of NEPZ

Trait	DBW 316	HI 1563	HI 1621	HD 3118	DBW 107
Days to heading	76	73	69	76	74
Days to maturity	114	113	105	107	112
Plant height (cm)	90	91	89	95	87
1000-grain weight (g)	40	37	37	37	38
Grain protein content (%)	13.2	11.6	11.9	11.7	12.3
Zinc (ppm)	38.2	36.2	35.7	35.5	35.7
Iron (ppm)	38.2	43.1	39.0	38.3	40.3
Sedimentation value (ml)	51.0	47.8	50.7	49.3	43.4
Bread quality score	7.7	4.5	7.4	6.7	6.4
Chapatti quality score	7.4	7.9	7.5	7.7	7.6
Bread loaf vol. (ml)	593	450	592	552	552
Biscuit spread factor	7.7	7.8	8.4	8.3	8.5
Grain yield under late sown irrigation (q/ha)	41.0	38.3	39.7	40.2	41.6

Table 2. DBW 316 (Karan Prema) package of practices along with attainable yield levels

Suitability of the variety for the area	North Eastern Plains Zone (NEPZ) of India under irrigated late sown conditions
Selection of field and/land preparation	Flat fertile soil, pre-sowing irrigation followed by ploughing with disc harrow, tiller and leveller at field capacity for optimum field conditions.
Seed treatment	Systemic and contact fungicide (carboxin 37.5% + thiram 37.5%) @2–3 g/kg seed.
Sowing time	5–15 December.
Seed rate/sowing method	125 Kg/ha. Sowing with seed drill keeping with spacing of 18 cm between the rows.
Fertilizer doses	Under restricted irrigation best performance can be achieved by applying 120: 60: 40 kg NPK/ha. Half dose of nitrogen at sowing and remaining ½ at first node stage should be applied.
Weed control	For the control of broad-leaf weeds 2,4-D @500 g/ha or metsulfuron @4 g/ha or carfentranzone @20 g/ha can be sprayed using about 300 litres of water/ha. In multiple herbicide resistant <i>P. minor</i> infested areas, use pre-emergence pendimethalin 1500 g/ha or pyroxasulfone 127.5 g/ha. For the control of complex weed flora combination of isoproturon with 2,4-D/metsulfuron or sulfosulfuron with metsulfuron or grass herbicide followed by broad-leaf herbicide should be applied at 30–40 DAS at sufficient soil moisture.
Pest and disease control	DBW 316 is resistant to stripe, leaf and stem rust and other diseases. However, for the control of rusts, powdery mildew, apply propiconazole/triademefone/tebucanazole @0.1% (1 ml/litre) as foliar spray after initial appearance of disease should be done.
Irrigation	3–5 irrigations depending upon moisture status and weather conditions.
Harvesting	Harvest and thresh as soon as crop is fully ripe. The grain should be thoroughly dried before storage.
Mean yield	41 q/ha under late sown irrigated conditions of Eastern Plains.
Potential yield	68 q/ha.

(score 7.4), biscuit spread factor (score 7.7), wet gluten (26.6%), dry gluten (8.8%) and sedimentation value of 51 ml. Grain hardness score of DBW 316 is 77.2, whereas, hectolitre weight is 74.0.

Economics and health benefits: Farmers can save roughly ₹2400

per hectare by forgoing the use of fungicides for disease control because the new wheat variety is resistant to all major diseases that might lower wheat grain yield. While DBW 316 has the highest grain protein (13.2%), this variety can fetch higher price for having

inherent biofortified value. The increased nutritional value for high protein and zinc content translates into huge health benefits at no extra cost to the poor strata of society.

SUMMARY

DBW 316 (Karan Prema) is a new nutritional value bread wheat cultivar developed by ICAR- Indian Institute of Wheat and Barley Research, Karnal, Haryana and has been released for North-Eastern Plains Zone (NEPZ) of India. NEPZ comprises Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa, West Bengal, Assam and Plains of North-Eastern States. This variety is found to be tolerant to terminal heat stress, has shown a better performance under very late sown conditions in the agronomical trials conducted in NEPZ. This new variety registered a high yield potential of 68 q/ha and average yield 41 q/ha under late sown conditions of Eastern Gangetic Plains. DBW 316 is having desirable plant architecture with a robust medium plant stature and medium maturity duration. The grains are hard, oblong having amber colour with 1000-grain weight of about 40 g. The grain protein content of this variety is highest (13.2%) among the varieties released for this zone. The variety has high zinc content as well as sedimentation value. High bread and chapatti quality score along with increased nutritional value makes this variety desirable for consumption as biofortified wheat.

*Corresponding author's e-mail: hanif.khan@icar.gov.in

Jai Kisan, Jai Vigyan

- A total of ₹ 788.33 crores have been sanctioned for opening six new agricultural colleges for eastern India under Central Agricultural University, Imphal, and a new Central Agricultural University in Meghalaya.
- For the establishment of two new agricultural research institutes in Asom and Jharkhand, a sum ₹ 100 crores is allocated.
- First academic session of the Rani Lakshmbai Central Agricultural University has been allocated for four new agricultural colleges in Ditiya and Jhansi.
- An Memorandum of Understanding was signed for transforming the Rajendra Central Agricultural University, Pusa, Samstipur, Bihar. A proposal of ₹ 400 crores is submitted in EFC.
- Post-Graduate Institute of Horticulture is being established in Amritsar, Punjab.
- Foundation stone of the Indian Institute of Agricultural Biotechnology is laid at Ranchi for promoting agricultural biotechnology.