

DBW 296 (Karan Aishwarya):

A new high yielding wheat variety for cultivation under limited irrigation

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*DBW 296 (Karan Aishwarya) is a new high yielding bread wheat (*Triticum aestivum* L.) variety released in 2021 by CVRC for restricted irrigation in timely sown conditions of North-Western Plains Zone (NWPZ) of India. NWPZ is the largest wheat producing zone in India with productivity levels higher than other four zones. DBW 296 recorded a mean yield of 56.1 q/ha under limited irrigation with a potential yield level of 83.3 q/ha. This variety showed good levels of field resistance to yellow and brown rusts over 3 years of testing in national trials. It is also resistant to foliar diseases and Karnal bunt, and showed consistently higher yield in All India Coordinated Research Project (AICRP) wheat trials as compared to all the checks and exhibited good level of drought tolerance. DBW 296 features soft grains and a high biscuit spread factor (scoring 9.5/10), making it ideal for high-quality biscuits. Furthermore, this new variety is suitable for multiple end-use products as indicated by high bread quality, chapati-making, bread loaf volume and hectolitre weight. High quality and yield potential with low cost of production make DBW 296 a suitable variety for boosting farm economy and food security of the country.*

Keywords: DBW 296, Irrigation, Wheat variety, Yield

IN the North-Western Plains Zone of India, wheat (*Triticum aestivum* L.) is mostly grown under fully irrigated conditions. However, some areas in this zone, such as the western UP, Rajasthan, western Haryana and sub-mountainous parts of Punjab are experiencing irrigation water shortages. In addition, the level of ground-water is rapidly dwindling. Farmers here tend to sow their wheat crop in limited irrigation. But most of the farmers grow the wheat varieties under restricted irrigation conditions which were recommended for irrigated conditions. Few varieties however, have been recommended for limited irrigated conditions in the past. These varieties are not very high-yielding and slowly becoming susceptible to various diseases. Soil-moisture stress at any stage of growth decrease grain yield. When, wheat is subjected to moisture stress at the jointing stage, fewer heads per unit area and fewer seeds per head



Field view of bread-wheat variety DBW 296

results in reduced grain yield. When moisture stress occurs at the heading and dough stages, lower grain yield can be caused by less spike fertility and lighter seed-weight. Stress at the flowering and dough stages also accelerates maturity. Thus, there is a

need of variety suitable for restricted irrigation conditions in NWPZ. A new superior wheat variety DBW 296 has been developed for timely sown restricted irrigation conditions in this zone.

Potential of DBW 296

In addition to having a high production potential, varieties meant for the north-western plains of India should be disease-resistant and tolerant to terminal heat. Terminal heat stress in wheat occurs 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, highlighting its agronomic superiority. The features of the proposed variety DBW 296 with respect to yield, disease resistance and quality parameters are detailed as under.

Yield potential: DBW 296 has shown a superior and stable yielding ability under timely sown restricted irrigation conditions in various locations of North-Western India over 3 years of testing in the All India Coordinated Research Project (AICRP) for multi-location wheat trials as compared to the 5 checks, viz. PBW 644, HD 3043, WH 1142, NIAW 3170 and HI 1628. The frequency of occurrence of DBW 296 in the top non-significant group was 17/34 on overall basis of 3 years (6/8 in 2018–19, 7/13 in 2019–20, 4/13 in 2020–21). DBW 296 has registered a very high yield potential of 83.3 q/ha and showed a significantly higher average yield (56.1 q/ha) compared to the checks PBW 644 (50.1 q/ha), HD 3043 (47.5 q/ha), WH 1142 (50.6 q/ha), NIAW 3170 (51.6 q/ha) and HI 1628 (49.3 q/ha) under restricted irrigation-timely sown condition in NWPZ. DBW 296 is comparable to the checks PBW 644, HD 3043, WH 1142, NIAW 3170 and HI 1628 for flowering, maturity, plant height and 1000 grains weight (Table 1).

Adaptability to different agronomic conditions: DBW 296 has shown a better performance as compared to check varieties in the agronomical trials of NWPZ. The agronomical trial on number of irrigations indicates that DBW 296 has given a stable performance for yield, for all levels of irrigations given. This genotype has also shown minimum reduction in yield if no irrigation is given. Among other ancillary characteristics studied, DBW 296 has shown a stable



Flowering stage



Grain Characteristics

Some characteristic features of DBW 296

Table 1. Mean data of important characteristics of DBW 296 and check varieties under restricted irrigation conditions

Trait	DBW 296	PBW 644	HD 3043	WH 1142	NIAW 3171	HI 1628
Days to heading	103	103	104	104	97	96
Days to maturity	150	149	149	148	147	147
Plant height (cm)	102	107	105	103	106	106
1000 grain weight (g)	43	41	37	38	42	42
Biscuit spread factor	9.5	7.8	7.9	8.1	9.9	7.8
Bread quality	8.20	5.68	7.24	4.47	5.89	7.40
ACI yellow rust (average of three years)	5.7	20.8	14.2	10.5	24.1	12.9
ACI brown rust (average of three years)	4.4	16.8	32.3	13.3	2.9	3.4
Grain yield under restricted irrigation (q/ha)	56.1	50.1	47.5	50.6	51.6	49.3

performance for ear heads/metre, grains/spike and 1000-grains weight over different irrigation levels and minimum reduction in these traits when no irrigation was given. The package of cultivation practices of this variety are given in Table 2.

Better disease resistance: The genotypes were evaluated for the resistance under natural and artificial conditions to different diseases of wheat such as brown rust, yellow rust, stem rust and Karnal bunt. The disease reaction to brown and yellow rusts indicated that DBW 296 is fairly resistant to these diseases under field conditions. Under artificial inoculations also, this genotype performed better than the check varieties and showed good

level of resistance against the Karnal bunt compared to the checks. The race specific APR response indicated the resistance reaction in DBW 296 for brown rust races. Yellow rust is a major disease in this region and the race specific APR response to 2 major stripe rust pathotypes, viz. 238S119 and 46S119 was also analyzed under controlled conditions which indicated resistance reaction in DBW 296. The proposed variety DBW 296 has shown resistance to yellow and brown rusts under natural and artificial epiphytotic conditions over 3 years of testing. This genotype indicates presence of slow rusting genes for resistance to yellow and brown rusts as shown by low AUDPC values. The

Table 2. Package of cultivation practices for DBW 296

Suitability of the variety for the area	North Western Plains Zone (NWPZ) of India under restricted irrigation timely 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	25 October–05 November
Seed rate/sowing method	100 kg/ha. Line sowing with spacing of 20 cm between the rows.
Fertilizer doses	Under restricted irrigation, best performance can be achieved by applying 90:60:40 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-leaved weeds 2,4-D @500 g/ha or metsulfuron @4 g/ha or carfentrazone @20 g/ha can be sprayed using about 300 litres of water/ha; For the control of grasses isoproturon @1000 g/ha or clodinafop @60 g/ha or pinoxaden @50 g/ha or fenoxaprop @100g/ha or sulfosulfuron @25g/ha or pyroxasulfone @127.5 g/ha should be used. 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 broadleaved herbicide should be applied at 30–40 DAS at sufficient soil moisture
Pest and disease control	DBW 296 is resistant to stripe, leaf and stem rust and other diseases. However, for the control of rusts, Karnal bunt and powdery mildew, apply propiconazole/triadimefon/tebuconazole @0.1% (1 ml/litre) as foliar spray after disease initial appearance
Irrigation	Two irrigations. One pre-sowing and one irrigation at 45–50 days after sowing
Harvesting	Harvest and thresh as soon as crop is fully ripe. The grain should be thoroughly dried before storage
Mean yield	56.1 q/ha under restricted irrigation timely sown conditions
Potential yield	83.3 q/ha

gene postulation indicated that DBW 296 has Lr23 + 13 + 10 and Yr2 gene combinations for brown and yellow rusts and presence of some unknown resistance genes effective against all the three rusts. These gene combinations will lead to diversification and durability of resistance to the rust diseases.

Good quality: DBW 296, the new variety is suitable for multiple end-use products as indicated by high bread quality (score 8.2), chapati-making (score 7.6), bread loaf volume (615 ml) and hectolitre weight (78.6). It has higher protein content (11.5%) along with a perfect Glu-1 score of 10/10. The presence

of Glu-D1 subunit 5 + 10 in DBW 296 is indicative of strong gluten and hence better bread-making quality. In addition, it has higher extraction rate and gluten index than the check varieties. The amount of micronutrients available in the genotype was also comparable to the checks. All these traits indicated its suitability for industrial uses and highlighted its nutritional quality.

Economics: Since the new wheat variety is resistant to all major diseases which can reduce the wheat yield, farmers can save about ₹2200/ha by avoiding use of fungicides for disease control. Timely sown irrigated wheat

varieties requires on an average 6 irrigations whereas DBW 296 crop under restricted irrigations can save 4 irrigation which translates into saving of ₹4800/ha. Total cost of cultivation saving for this wheat variety is ₹7000 /ha.

SUMMARY

DBW 296 (Karan Aishwarya) is a new high yielding bread wheat cultivar developed by ICAR-Indian Institute of Wheat and Barley Research, Karnal and has been released for North-Western Plains Zone (NWPZ) of India. NWPZ covers Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Jammu and Kathua Distt.), parts of Himachal Pradesh (Una Distt. and Paonta Valley) and Uttarakhand (Tarai region). This variety is found to be tolerant to drought stress and has shown better performance as compared to check varieties in the agronomical trials of NWPZ. This new variety registered very high yield potential of 83.3 q/ha and average yield 56.1 q/ha with only 2 irrigations i.e. one pre-sown irrigation and thereafter 40–50 days after sowing. DBW 296 is having desirable plant architecture with robust stem and medium maturity duration. The grains are soft to semi hard, oblong, amber coloured with 1000-grain weight of ~43g. This variety has soft grains with a very high biscuit spread factor suitable for excellent biscuit quality. This new variety is also suitable for multiple end-use products like bread, chapati and naan. It is resistant to yellow, brown and black rusts and other foliar diseases. Because of disease resistance and tolerance to drought DBW 296 can give higher yield and economic benefit due to less input cost on fungicides and irrigation.

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