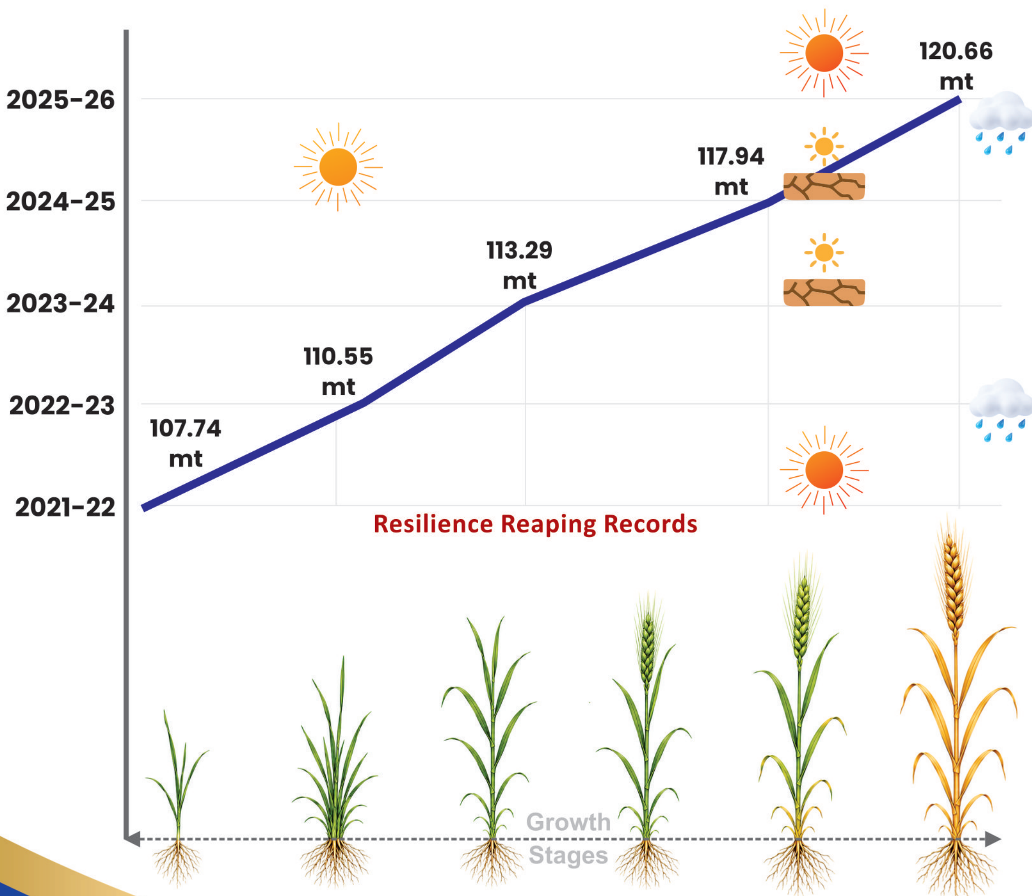
प्रगति प्रतिवेदन

PROGRESS REPORT

2025-26

निदेशक की रिपोर्ट

DIRECTOR'S REPORT



अखिल भारतीय समन्वित गेहूँ एवं जौ अनुसंधान परियोजना

AICRP on Wheat and Barley

भाकृअनुप-भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल

ICAR-Indian Institute of Wheat and Barley Research, Karnal

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AICRP
on
Wheat & Barley

DIRECTOR'S REPORT
2025-26

RATAN TIWARI
DIRECTOR

भा.कृ.अनु.प.–भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल
ICAR-Indian Institute of Wheat and Barley Research, Karnal

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I extend my heartfelt appreciation to every member of the wheat and barley research fraternity whose collective commitment and teamwork continue to strengthen the national coordinated research programme and contribute significantly towards ensuring the country's food and nutritional security.

RTiwari

(Ratan Tiwari)
Director

Place: Karnal
Date: August 19, 2026

DIRECTOR'S REPORT (2025-26)

Global Competitiveness of Indian Wheat and Barley Production Systems

Indian wheat and barley production systems possess several unique competitive advantages over temperate cereal production systems despite comparatively moderate per-hectare grain yields. *Unlike the long-duration winter cereals cultivated in Europe, China and North America, Indian wheat and barley are predominantly short-duration spring crops grown under irrigated sub tropical environments.* This production ecology enables rapid crop establishment, efficient utilization of favourable winter temperatures, and timely harvest, thereby facilitating higher cropping intensity and greater annual system productivity.

Although countries like China achieve higher grain yields (~6 t ha^{-1}) through longer crop duration and intensive management, India's wheat production system records the highest daily productivity (27.5 kg ha^{-1} day^{-1}), reflecting superior production efficiency per unit time. Similar advantages are evident in barley, whose shorter duration further enhances flexibility for crop diversification and efficient integration into intensive cereal-based cropping systems. Consequently, the Indian production system maximizes annual land-use efficiency rather than single-season productivity.

The comparative advantage of Indian wheat and barley also extends to resource-use efficiency. Moderate fertilizer inputs, coupled with comparatively lower fertilizer requirement per unit grain production than several major wheat producing countries, indicate efficient nutrient utilization. Likewise, high irrigation water productivity and widespread adoption of improved agronomic practices demonstrate the potential for sustaining productivity while reducing environmental footprints. Continued adoption of precision nutrient management, conservation agriculture, and climate-smart irrigation technologies is expected to further enhance resource-use efficiency in both crops.

Indian cereal production is further distinguished by exceptionally low dependence on chemical crop protection inputs. Pesticide consumption in India (0.3 to 0.6 kg ha^{-1}) is among the lowest globally, substantially lower than that of most developed cereal producing countries. This low input production system reduces cultivation costs, minimizes pesticide residues and environmental contamination, and contributes significantly to sustainable and environmentally responsible wheat and barley production.

Economic analyses further reinforce the competitiveness of the Indian cereal production system. Wheat consistently generated the highest net returns, benefit-cost ratio and profit margin among major *Rabi* crops during both 2024–25 and 2025–26, confirming its economic resilience under prevailing production and market conditions. Although barley generated comparatively lower returns than wheat, its shorter duration, lower production cost and adaptability to marginal environments make it an important component of diversified and climate-resilient production systems.

Overall, Indian wheat and barley production systems represent a unique combination of high temporal productivity, efficient utilization of land, water and nutrients, low chemical input intensity, and strong economic viability. Future productivity gains are therefore expected to arise primarily through genetic enhancement, precision crop management and digital agriculture rather than through increased resource inputs, thereby ensuring sustainable intensification under changing climatic conditions.

Global comparison of wheat production systems and production efficiency

Region/Country	Dominant wheat production system	Mean grain-filling temperature (°C)	Crop duration (days)	Grain yield (t ha^{-1})	Wheat productivity (kg ha^{-1} day^{-1})
India	Irrigated spring wheat	24–32	115-160	3.52	27.5
China	Irrigated winter wheat	18–25	180-300	5.94	25.3
European Union	Rainfed winter wheat	15–22	200-310	5.64	22.6

Decadal Dynamics of Wheat Varieties in India (2016–2025)

The replacement of older crop varieties with newly developed cultivars is fundamental to sustaining genetic gains, improving resilience to evolving biotic and abiotic stresses, and enhancing farm productivity. An analysis of variety-wise cultivated area from 2016 to 2025 revealed substantial changes in varietal composition across the major wheat growing zones of India. In the Northern Plains, the decade began with the dominance of HD 2967, PBW 550, DBW 17, and HD 3086, which together occupied a major share of the wheat area. These varieties gradually declined after 2020 and were rapidly replaced by recently released cultivars such as DBW 187, DBW 303, DBW 222, DBW 327, and WH 1270. Among these, DBW 187 emerged as the leading cultivar, reaching more than 7 million hectares during the study period, while DBW 303 showed exceptionally rapid adoption within only a few years of its release. The Central and Peninsular Zone exhibited a comparable but distinct pattern of varietal replacement. Traditional cultivars such as GW 322, GW 366, GW 273, and the long standing LOK 1 dominated the initial years of the study. These varieties were progressively replaced by intermediate cultivars including RAJ 4238 and HI 8759 (d), followed by rapid expansion of newer releases such as HI 1634 and MP 3382 during the final years of the decade. The Weighted

Average Variety Age (WAVA) declined markedly from 10.43 years in 2016 to 5.85 years in 2024, before increasing slightly to 6.88 years in 2025, reflecting a rapid replacement of older varieties with newer cultivars.

Meeting Government Schemes' Targets Regarding Nutrition Requirements of Zinc (Zn) and Iron (Fe): Strengthening Biofortified Wheat Procurement for National Nutrition Security and Scope for Segregated Procurement

India has achieved self-sufficiency in cereal production; however, micronutrient malnutrition ("hidden hunger") continues to pose a major public health challenge. According to NFHS-5 (2019–21), anaemia affects 67.1% of children (6–59 months), 57.0% of women, 52.2% of pregnant women and 25% of men, while the Comprehensive National Nutrition Survey (CNNS, 2016–18) reported zinc deficiency in 17–32% of children and adolescents. Since wheat contributes nearly one-third of daily calorie intake across northern and central India, improving its micronutrient density provides an effective food based approach to enhance dietary iron (Fe) and zinc (Zn) intake without changing existing food habits.

Biofortified Wheat: Scientific Progress and Deployment Potential

Biofortification has emerged as a sustainable and cost-effective strategy for addressing micronutrient deficiencies through plant breeding. During the past decade, ICAR, in collaboration with CIMMYT and HarvestPlus, has developed and released several high-yielding zinc-biofortified wheat varieties possessing competitive yield, disease resistance and wide adaptation. Continued breeding efforts are required to further enhance grain Fe and Zn concentrations while maintaining productivity, climate resilience and end use quality.

Country's extensive public food distribution and nutrition programmes-including PM POSHAN, Integrated Child Development Services (ICDS), Saksham Anganwadi, Public Distribution System (PDS), National Food Security Act (NFSA) and Anaemia Mukt Bharat-provide an established institutional platform for delivering biofortified wheat to nutritionally vulnerable populations. However, realizing this potential requires preservation of the nutritional identity of biofortified grain throughout the procurement and distribution chain.

Similar systems are already practiced internationally for seed, malting barley, durum wheat, organic grain and specialty cereals, demonstrating their technical feasibility. In biofortified wheat, grain iron and zinc concentrations become measurable quality attributes analogous to protein content in durum wheat or malting quality in barley.

Enabling Technologies and Implementation Requirements

Implementation of segregated procurement will require standardized grain Fe and Zn thresholds for procurement, rapid analytical methods for grain mineral estimation (e.g., X-ray fluorescence, XRF), quality assurance protocols, identity-preserved storage and logistics, and digital traceability from seed production to beneficiary distribution. Investment in grading laboratories, digital inventory systems and standardized quality certification will be essential. Pilot implementation may initially focus on major wheat procurement states such as Punjab, Haryana, Madhya Pradesh, Rajasthan and Uttar Pradesh, where biofortified wheat cultivation and procurement infrastructure are already well established. Integration with Farmer Producer Organisations (FPOs), procurement agencies, food processors and state governments will facilitate efficient aggregation and targeted distribution.

Priority areas for research and policy

Component	Priority Actions
Crop improvement	Enhance grain Fe and Zn density while maintaining yield, disease resistance and climate resilience
Quality assurance	Develop national standards for grain Fe and Zn; deploy rapid XRF-based testing
Procurement	Introduce segregated procurement protocols within existing MSP operations
Traceability	Establish digital identity-preserved systems from seed to beneficiary
Nutrition delivery	Integrate biofortified wheat into PM POSHAN, ICDS, PDS and NFSA
Impact assessment	Evaluate nutritional, economic and value-chain impacts of segregated procurement

Scientific Perspectives on Wheat Criticism: Implications of Celiac Disease and Other Gluten-Related Disorders

Beyond providing dietary energy, whole wheat is a rich source of protein, dietary fibre, B-complex vitamins, iron, zinc, selenium, and health-promoting bioactive compounds. Advances in biofortification have further enhanced its nutritional value by increasing iron, zinc, and protein content. Despite these benefits, wheat has faced growing criticism due to increasing awareness of gluten-related disorders, the expanding gluten-free market, and misinformation, even though celiac disease, wheat allergy, and non-celiac gluten sensitivity affect only a small proportion of the population.

Wheat-Related Disorders: Celiac Disease and Beyond

Among the disorders associated with wheat consumption, celiac disease (CD) is the only well established auto immune condition requiring lifelong adherence to a gluten-free diet. It develops in genetically susceptible individuals carrying the HLA-DQ2 (Human Leukocyte Antigen) and/or HLA-DQ8 haplotypes; however, although 30–40% of the population carries these genes, only about 1% develops the disease, highlighting the contribution of environmental and other genetic factors (Lebwohl *et al.*, 2018). A global metaanalysis estimated the seroprevalence of celiac disease at 1.4% and biopsy-confirmed prevalence at 0.7%, while in India the prevalence is approximately 1%, predominantly in the wheat consuming northern states (Singh *et al*., 2018; Makharia *et al.*, 2011). Besides celiac disease, wheat allergy, non-celiac gluten sensitivity (NCGS), and FODMAP (Fermentable oligosaccharides, disaccharides, monosaccharides and polyols)-related wheat intolerance are recognized but comparatively uncommon disorders. Wheat allergy is an IgE-mediated reaction affecting <1% of the population, whereas NCGS and FODMAP intolerance primarily present with gastrointestinal symptoms and require careful exclusion of celiac disease and wheat allergy. Collectively, these disorders affect only a small proportion of individuals, emphasizing that more than 95% of the population can safely consume wheat as part of a balanced diet.

Future Research Priorities

Growing public interest in wheat and health presents an opportunity to strengthen interdisciplinary research integrating genetics, grain quality, nutrition, food science, and clinical sciences. Future research is to focus on developing nutritionally superior wheat varieties with enhanced dietary fibre, resistant starch, bio available iron and zinc, improved protein quality, and lower glycaemic response, while maintaining yield and processing quality. Advanced genomics, proteomics, metabolomics and precision phenotyping help to understand gluten immunogenicity thus accelerates the development of health oriented cultivars. Equally important is the development of functional wheat based foods and effective science communication to address misconceptions surrounding wheat consumption. Although celiac disease, wheat allergy, and non-celiac gluten sensitivity are genuine clinical conditions,

Overview of wheat related health concerns, scientific evidence, and future research priorities

Aspect	Key Evidence
Global importance of wheat	Staple food for ~2.5 billion people; provides ~20% of global dietary energy and protein; annual production ~800 million tonnes
Nutritional value	Rich source of protein, dietary fibre, B-vitamins, iron, zinc, selenium, resistant starch and bioactive phytochemicals
Major wheat related disorder	Celiac disease is an autoimmune disorder affecting ~0.7–1.0% of the population; requires lifelong gluten-free diet
Other wheat related disorders	Wheat allergy (<1%), non-celiac gluten sensitivity (NCGS), and FODMAP intolerance occur in a relatively small proportion of the population
Whole wheat vs. refined wheat	Whole wheat is associated with reduced risk of cardiovascular disease, type 2 diabetes, colorectal cancer and premature mortality, whereas excessive intake of refined wheat products (maida) in ultra-processed foods is linked to adverse metabolic outcomes
Misconceptions	No convincing evidence that modern wheat breeding has increased gluten toxicity or made wheat inherently harmful
Future research priorities	Biofortification (Fe & Zn), resistant starch, dietary fibre, gluten immunogenicity, functional foods, precision genomics, and science communication
Key message	More than 95% of the population can safely consume wheat as part of a balanced diet

they affect only a small proportion of the population. Current scientific evidence strongly supports whole grain wheat as a safe and nutritious component of a balanced diet. Continued research and evidence based public outreach is essential to strengthen consumer confidence and reinforce wheat's indispensable role in global food, nutrition, and health security.

Hulless Barley: Advantages of Barley as Nutri cereal Crop

Hulless barley (*Hordeum vulgare* L. var. *nudum*) is an emerging nutri-cereal with superior nutritional quality and health benefits. Naturally hull-free after threshing, it offers higher edible grain recovery and lower processing losses. Rich in β-glucan, dietary fibre, resistant starch, protein, vitamins, minerals, and antioxidants, it helps lower LDL cholesterol, improve glycaemic control, promote gut health, and reduce the risk of chronic diseases. Its low glycemic index (GI) and high satiety value make it suitable for diabetes and obesity friendly foods. Hulless barley can be used in breads, chapatis, biscuits, noodles, breakfast cereals, snacks, and health beverages, supporting functional food and nutraceutical industries. Agronomically, its resilience to abiotic stresses and low input requirements make it a promising crop for climate-resilient agriculture, nutritional security, and value-added food systems.

Future-Ready India: Meeting the Growing Demand for Malt

India's malting and brewing industry is poised for sustained growth, driven by increasing consumer demand for premium beer, malt-based beverages, and Indian-made whisky. Although India's per capita beer consumption remains significantly lower than the global average, rising disposable incomes, urbanization, and changing consumer preferences are expected to accelerate malt demand over the coming decade. Correspondingly, the requirement for high-quality malting barley is expected to increase from the current 0.6–0.7 million tonnes to around one million tonnes by 2030, potentially necessitating an additional 300,000–400,000 tonnes of premium malting barley.

India's barley production is around 1.8–1.9 million tonnes per year, with Rajasthan, Haryana, Punjab, and Uttar Pradesh contributing the largest share. Despite largely meeting domestic demand, India imports 0.08–0.20 million tonnes of premium malting barley annually during the last two years to meet the growing requirements of the expanding malting industry, primarily from Australia, France, Argentina, and other major exporters. Although these imports account for a relatively small share of total demand, they represent avoidable foreign exchange outflow and highlight the need to strengthen domestic production of internationally competitive malting barley. This presents a major opportunity for Indian agriculture. Expanding domestic production of premium-quality malting barley can reduce imports, save foreign exchange, increase farmers' income through contract farming, and strengthen domestic value chains. This aligns with the Government of India's vision of "*Atmanirbhar Bharat*", by promoting self-reliance while supporting the growth of domestic food processing and beverage industries. Realizing this vision will require a coordinated research, development and value chain approach.

Future breeding programmes should prioritize high-yielding, climate-resilient malting varieties with superior quality traits, including high malt extract, low β-glucan, optimum grain protein, excellent enzymatic activity, and uniform bold grains. These varieties must also be resilient to terminal heat stress, drought and emerging diseases to ensure stable production under changing climatic conditions.

Barley offers an excellent diversification option in regions where wheat productivity is limited by terminal heat stress and water scarcity. Expanding barley into suitable irrigated and limited-irrigation ecologies across north-western and central India, can enhance climate resilience and production stability. At the same time, genomic selection, marker-assisted breeding, speed breeding, and high-throughput quality phenotyping will accelerate the development of industry-specific varieties while modern quality evaluation facilities and integrated genotype environment malting quality will further strengthen breeding efficiency and industry confidence.

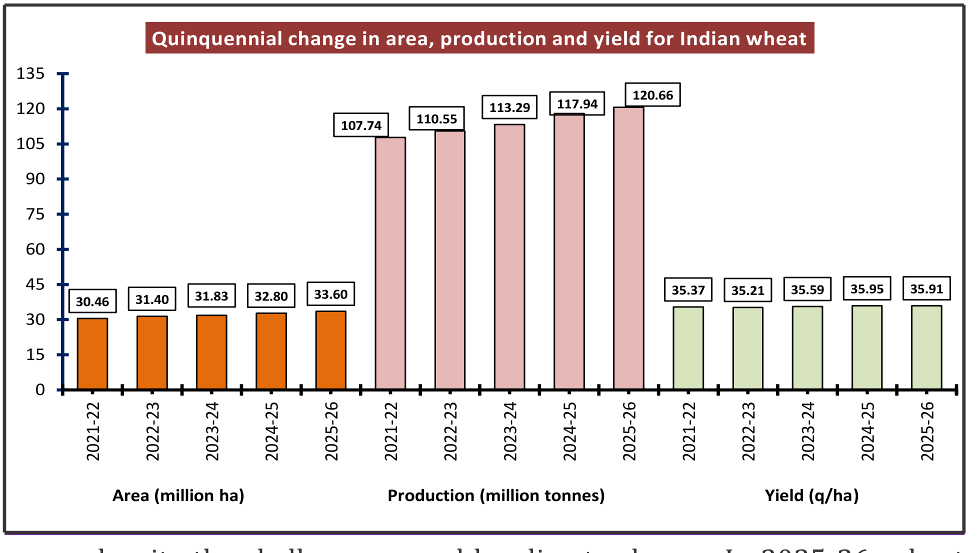
India possesses a strong scientific foundation, an established ICAR-AICRP barley improvement programme, and a close partnership with the malting industry. With strategic investments in research, quality seed systems, climate-smart production technologies and industry-farmer linkages, the country is well positioned not only to meet the projected demand of nearly one million tonnes of malting barley by 2030, but also to substantially reduce dependence on imported malting barley. This integrated approach will strengthen the domestic barley value chain, enhance farm profitability, reduce foreign exchange expenditure, support the expanding malt and brewing industry, and contribute meaningfully to the national vision of *Atmanirbhar Bharat*.

Status of Wheat and Barley Production in India for Last Five Years

Globally, wheat and barley are cultivated across a combined projected area of 264 million hectares (Wheat: 220.2 million hectares and Barley: 43.8 million hectares) yielding a record total production of 998.65 million metric tonnes, comprising 844.15 million metric tonnes of wheat and 154.5 million metric tonnes of barley during 2025-26. (Source: USDA). These cereals respectively hold the first and fourth position in terms of global cereals acreage for the period 2025-2026. In India, these cereals are cultivated across 34.17 million hectares, accounting for 24.01% of the total cropped area and contributing 32.52% to the country's total foodgrains production during 2025-26.

In the 2025-26 *Rabi* season, wheat was cultivated over 33.60 million hectares, while barley occupied 0.57 million hectares (Source: 3rd Advance Estimates, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, India). Wheat production is estimated at 120.66 million metric tonnes, with a national average productivity of 35.91 quintals per hectare. In comparison, barley production is estimated at 1.80 million metric tonnes, with an average yield of 31.71 quintals per hectare.

In India, wheat production has shown a consistent upward trend in recent



years, despite the challenges posed by climate change. In 2025-26, wheat output reached a record high of 120.66 million metric tonnes (Source: 3rd Advance Estimates, Directorate of Economics and Statistics, MoA & FW). This marks an increase of 2.71 million metric tonnes (2.30%) over the previous year. The growth in production is largely attributed to the adoption of superior, climate-resilient wheat varieties developed by wheat breeding institutions through the India Coordinated Wheat and Barley Improvement Programme, strengthened seed value chain, and efforts to bridge yield and information gaps. Notably, Madhya Pradesh followed by Rajasthan has recorded a significant increase in both wheat acreage and production.

Quantum change in the area, production and yield of wheat

State	2024-25 (Final Estimate)			2025-26 (Third Estimate)			Quantum Change in		
	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)
Assam	8.9	12.1	1349.0	9.0	12.3	1362.0	0.1	0.2	13.0
Bihar	2286.2	7189.1	3145.0	2284.5	6912.8	3026.0	-1.7	-276.3	-119.0
Chhattisgarh	146.9	234.9	1599.0	146.3	245.8	1680.0	-0.6	10.9	81.0
Gujarat	1281.6	3867.2	3017.0	1483.0	4612.7	3110.0	201.4	745.5	93.0
Haryana	2388.1	11399.9	4774.0	2446.9	11644.5	4759.0	58.8	244.6	-15.0
Himachal Pradesh	307.2	651.2	2120.0	307.2	647.5	2108.0	0.0	-3.7	-12.0
Jharkhand	249.8	549.7	2201.0	166.8	349.6	2096.0	-83.0	-200.1	-105.0
Karnataka	163.0	204.6	1255.0	172.0	225.5	1311.0	9.0	20.9	56.0
Madhya Pradesh	7748.7	24509.1	3163.0	8196.2	26443.1	3226.0	447.5	1934.0	63.0
Maharashtra	1188.9	2285.6	1922.0	1214.4	2388.1	1967.0	25.4	102.5	45.0
Odisha	0.3	0.5	1796.0	0.3	0.6	1724.0	0.0	0.0	-72.0
Punjab	3512.0	17993.2	5123.0	3458.6	17079.3	4938.0	-53.4	-913.9	-185.0
Rajasthan	3167.9	11274.7	3559.0	3353.7	12154.6	3624.0	185.8	879.9	65.0
Telangana	2.5	4.9	1973.0	3.4	6.8	2005.0	0.9	1.9	32.0
Uttar Pradesh	9598.8	35652.9	3714.0	9613.1	35877.1	3732.0	14.3	224.2	18.0
Uttarakhand	258.5	855.6	3310.0	254.0	817.8	3220.0	-4.5	-37.9	-90.0
West Bengal	181.4	567.7	3130.0	177.0	547.8	3095.0	-4.4	-19.9	-35.0
Others	495.1	1259.4	2543.9	490.7	1239.5	2526.1	-4.4	-19.9	-17.8
India	32804.4	117944.5	3595.0	33600.1	120657.4	3591.0	795.7	2712.9	-4.0

Source: Directorate of Economics and Statistics, MoA&FW, India

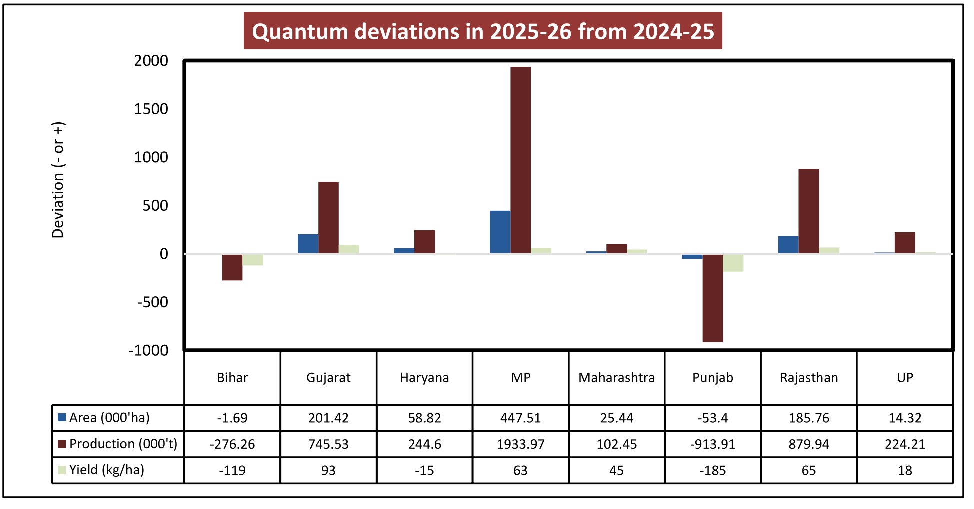
During 2025-26, among the major wheat-producing states, Uttar Pradesh recorded the highest output at 35.88 million metric tonnes (29.73%), followed by Madhya Pradesh with 26.44 million tonnes (21.92%), Punjab with 17.08 million tonnes (14.16%), Rajasthan with 12.15 million tonnes (10.07%), Haryana with 11.64 million tonnes (9.65%), and Bihar with 6.91 million tonnes (5.73%).

During the 2025-26 *Rabi* season, most states recorded an increase in production compared to 2024–25, with the exception of Bihar, Himachal Pradesh, Jharkhand, Punjab, Telangana, Uttarakhand, and West Bengal. The cumulative national output rose by 2.71 million tonnes, primarily due to expansion in cultivated area. Madhya Pradesh registered the highest absolute increase, adding 1.93 million tonnes (7.89%) to its increased output, followed by Rajasthan with 0.88 million metric tonnes (7.89%) and Gujarat with 0.75 million tonnes (19.28%). In contrast, Punjab recorded the sharpest decline, with production falling by 0.91 million tonnes (5.08%) followed by Bihar with 0.28 million metric tonnes (3.84%), the most significant reduction among major wheat producing states.

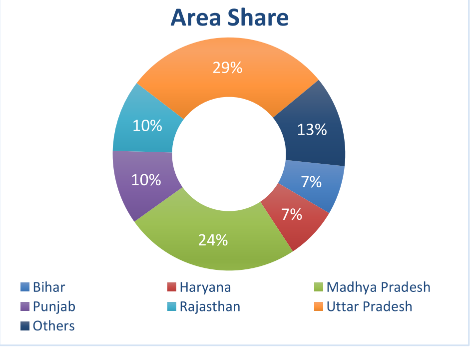
Contribution of yield and/or area to wheat production (2025-26)

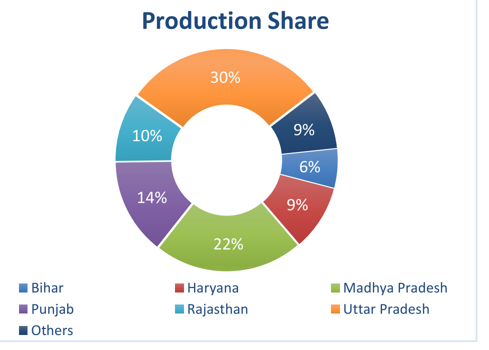
State/Country	Change in production in 2025-26 over 2024-25		% contribution by	
	Quantity (in '000 tones)	Deviation (in %)	Area	Yield
Assam	0.21	1.74	0.78	0.96
Bihar	-276.26	-3.84	-0.07	-3.78
Chhattisgarh	10.89	4.64	-0.41	5.07
Gujarat	745.53	19.28	15.72	3.08
Haryana	244.60	2.15	2.46	-0.31
Himachal Pradesh	-3.69	-0.57	0.00	-0.57
Jharkhand	-200.10	-36.40	-33.21	-4.77
Karnataka	20.93	10.23	5.52	4.46
Madhya Pradesh	1933.97	7.89	5.78	1.99
Maharashtra	102.45	4.48	2.14	2.34
Odisha	0.01	1.85	6.67	-4.01
Punjab	-913.91	-5.08	-1.52	-3.61
Rajasthan	879.94	7.80	5.86	1.83
Telengana	1.89	38.65	36.29	1.62
Uttar Pradesh	224.21	0.63	0.15	0.48
Uttarakhand	-37.87	-4.43	-1.74	-2.72
West Bengal	-19.90	-3.51	-2.41	-1.12
Others	-19.92	-1.58	-0.89	-0.70
India	2712.88	2.30	2.43	-0.11

Note: *indicate the third advanced estimate from the DES, Mo A&FW, India

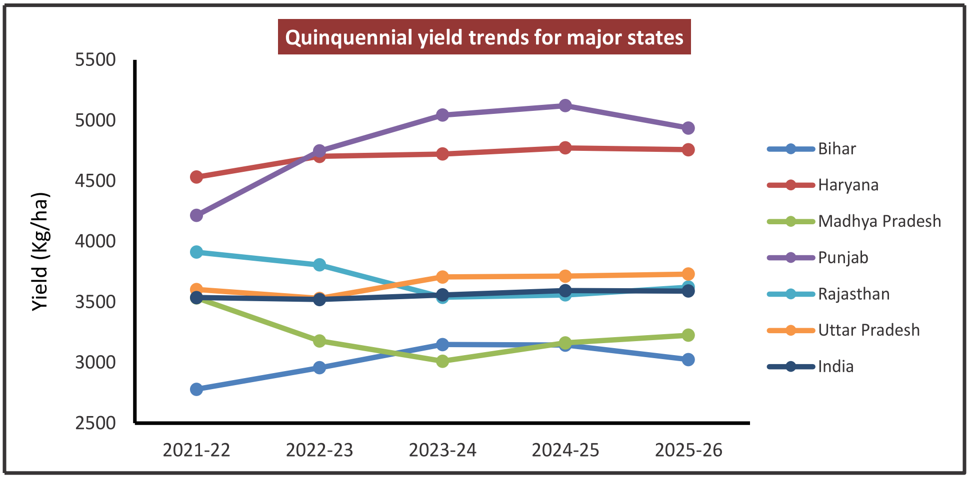


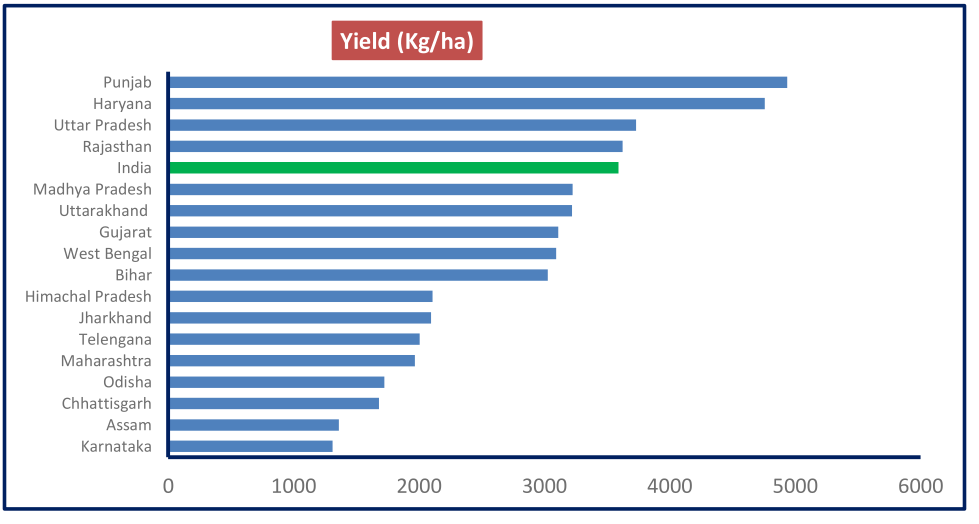
An analysis of the contributions of yield and/or area to overall wheat production during 2025-26 indicates a marginal decrease in national average productivity by 0.11%, equivalent to 4 kg/ha. Wheat yields varied significantly across states, ranging from a high of 4,938 kg/ha in Punjab to a low of 1,311 kg/ha in Karnataka. Punjab, Haryana, Rajasthan, and Uttar Pradesh recorded yield levels substantially above the national average of 3,591 kg/ha. The most notable increase in productivity was observed in Gujarat, with a gain of 93 kg/ha (3.08%), while Punjab experienced the steepest decline, with a reduction of 185 kg/ha (3.61%). A three-factor decomposition analysis for the last decade (2016–17 to 2025–26) reveals that the increase in total wheat production was primarily driven by yield improvement, contributing 54.36% to the overall growth. This was followed by the area effect (40.67%) and the interaction effect between yield and area (4.97%). These findings clearly indicate that the rise in wheat production in India over the past decade has been predominantly due to enhancements in yield.





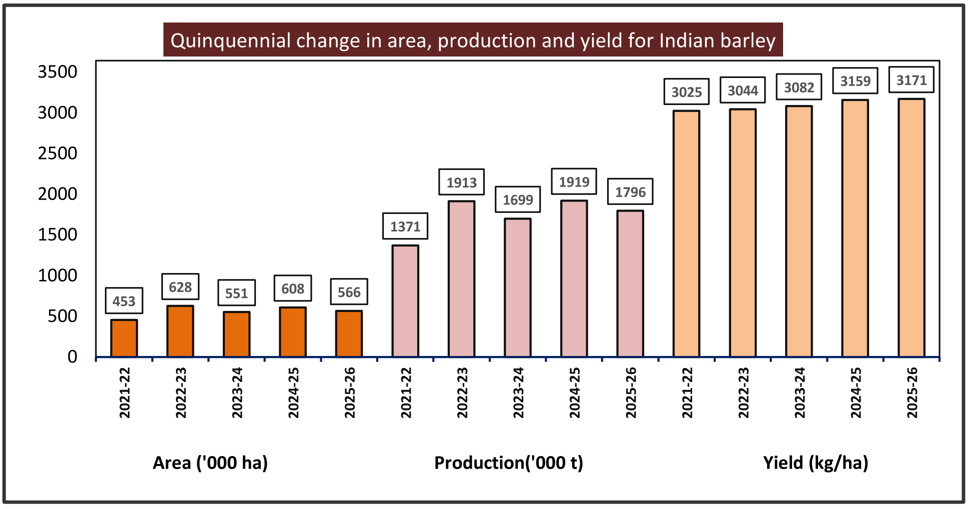
State-wise area under wheat cultivation exhibited notable regional variations, registering an overall increase of 0.80 million hectares (2.43%) in the 2025–26 *Rabi* season compared to the previous year. Madhya Pradesh recorded the highest increase in acreage, adding 4.48 lakh hectares (5.78%), followed by Gujarat with a gain of 2.01 lakh hectares (15.72%). In contrast, Jharkhand experienced the most significant decline, with a reduction of 0.83 lakh hectares (33.21%). Uttar Pradesh continues to lead in wheat acreage with 9.61 million hectares (28.61%), followed by Madhya Pradesh (8.20 million hectares; 24.39%), Punjab (3.46 million hectares; 10.29%), Rajasthan (3.35 million hectares; 9.98%), Haryana (2.45 million hectares; 7.28%), and Bihar (2.28 million hectares; 6.80%). Collectively, these six states account for 87.36% of the total wheat area and contribute 91.26% of the national wheat production. Among the 17 major wheat-producing states, six recorded a decline in area under wheat, while production increased in ten states. However, states such as Bihar, Haryana, Himachal Pradesh, Jharkhand, Odisha, Punjab, Uttarakhand, and West Bengal registered a negative trend in wheat yield. Overall, national average productivity showed a slight decline from 3,595 kg/ha in 2024-25 to 3,591 kg/ha in 2025-26.

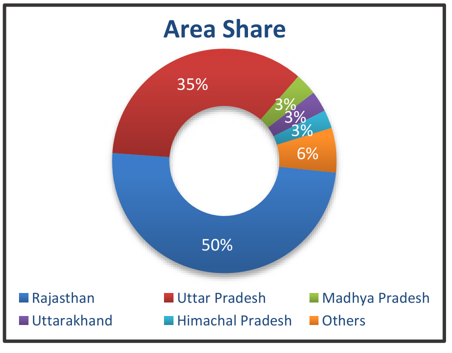


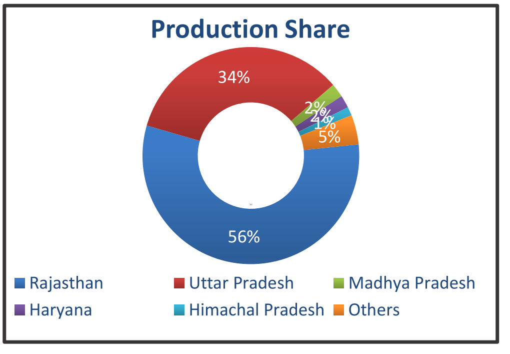


Scenario for Barley in India

Barley, a competing crop to wheat, has exhibited an opposite pattern of area and production dynamics, albeit with regional variations across states. During the *Rabi* 2025–26 season, barley production decreased by 1.24 lakh tonnes (Source: 3rd Advance Estimates, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, India). This decrease in output is primarily attributed to a 6.79% decline in sown area (0.41 lakh hectares), despite a marginal increase in yield by 0.38% (12 kg/ha). Although year-to-year fluctuations in barley acreage have been observed, the long-term downward trend in its cultivation area still remains a concern. This decline is closely linked to shifts in market demand, as well as the relative economic viability of barley compared to other *Rabi* season crops.







Quantum change in area, production and yield for barley

State	2024-25 (final estimate)			2025-26 (Third Estimate)			Quantum Change in		
	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)
Bihar	7.49	14.09	1881	8.00	14.97	1871	0.51	0.88	-10
Chhattisgarh	0.49	0.35	723	1.20	0.85	708	0.71	0.50	-15
Haryana	15.88	58.01	3653	8.57	33.75	3939	-7.31	-24.26	286
Himachal Pradesh	16.73	28.28	1690	13.74	23.04	1677	-2.99	-5.23	-13
Madhya Pradesh	24.00	42.14	1756	18.00	36.86	2048	-6.00	-5.28	292
Punjab	4.94	18.39	3723	4.70	17.30	3682	-0.24	-1.09	-41
Rajasthan	329.79	1222.53	3707	280.07	1007.96	3599	-49.72	-214.57	-108
Uttar Pradesh	177.00	489.99	2768	200.00	615.00	3075	23.00	125.01	307
Uttarakhand	14.32	21.08	1472	15.00	20.93	1395	0.68	-0.16	-77
West Bengal	0.05	0.14	3000	0.15	0.45	3000	0.11	0.32	0
Others	16.89	24.44	1448	16.89	24.44	1448	0.00	0.00	0
India	607.58	1919.46	3159	566.32	1795.57	3171	-41.26	-123.88	12

Source: DES, Mo A&FW, India

Contribution of Yield and/or Area to Barley Production (2025-26)

Among the major barley-growing states, Rajasthan leads in production with 1.01 million tonnes (56.14%), followed by Uttar Pradesh at 0.62 million tonnes (34.25%), Madhya Pradesh with 0.04 million tonnes (2.05%) and Haryana at

0.03 million tonnes (1.88%). Collectively, these four states contribute approximately 94.32% of the country's total barley production. Rajasthan also ranks first in terms of barley acreage during the 2025–26 season, covering 0.28 million hectares (49.45%), which largely explains its dominant share in production. During the 2025-26 *Rabi* season, Haryana recorded the highest average barley productivity at 3939 kg/ha, followed by Punjab (3682 kg/ha) and Rajasthan (3599 kg/ha), all surpassing the national average of 3171 kg/ha.

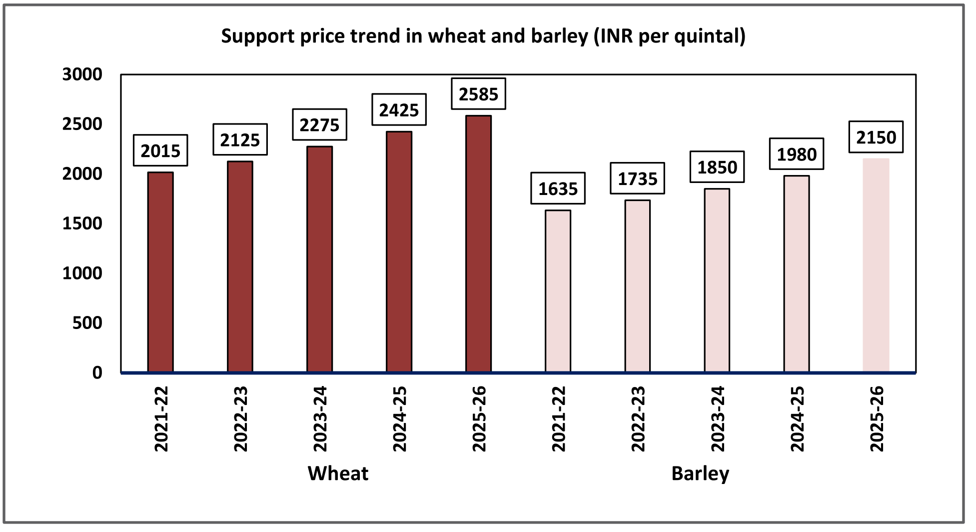
State/Country	Change in production in 2025-26 over 2024-25		% Contribution by	
	Quantity (in '000 tones)	Deviation (in %)	Area	Yield
Bihar	0.88	6.25	6.82	-0.53
Chhattisgarh	0.50	139.82	144.90	-2.07
Haryana	-24.26	-41.81	-46.03	7.83
Himachal Pradesh	-5.23	-18.51	-17.88	-0.77
Madhya Pradesh	-5.28	-12.53	-25.00	16.63
Punjab	-1.09	-5.91	-4.86	-1.10
Rajasthan	-214.57	-17.55	-15.08	-2.91
Uttar Pradesh	125.01	25.51	12.99	11.09
Uttarakhand	-0.16	-0.76	4.72	-5.23
West Bengal	0.32	233.33	233.33	0.00
India	-123.88	6.45	-6.79	0.38

Among barley growing states, considerable variation was observed in acreage, production, and productivity levels. Notably, productivity declined in states such as Bihar, Chhattisgarh, Himachal Pradesh, Punjab, Rajasthan, and Uttarakhand with reductions ranging from 10 to 108 kg/ha. Uttar Pradesh was the only state to exhibit positive growth in all three parameters *i.e.* area, production, and productivity. In terms of production, in the major barley producing states, West Bengal recorded highest increase in production (233.30%) largely driven due to three-fold increase in the area followed by Chhattisgarh (139.82%), Uttar Pradesh (25.51%), and Bihar (6.25%). Nationally, the average productivity increased by 12 kg/ha, with Rajasthan registering the steepest drop (108 kg/ha), while Uttar Pradesh recorded the highest gain in yield, improving by 307 kg/ha.

Price Scenario for Wheat and Barley

A comparison of the minimum support prices (MSP) for wheat and barley over the past five years (in nominal terms) reveals a consistent upward trend. In the present year, the government increased the MSP for wheat by 6.60% and for barley by 8.59% compared to the previous year. This policy decision provided farmers with greater price assurance, enabling them to make timely and informed sowing decisions.

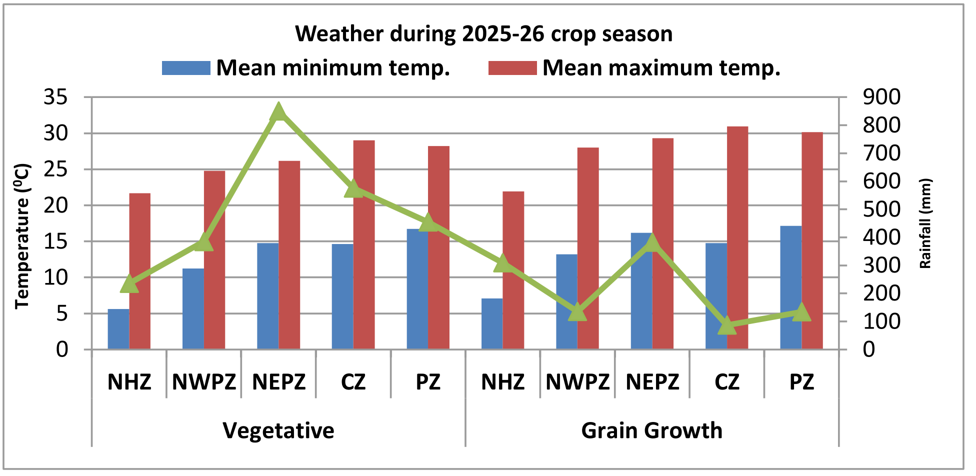
The change in support prices did not significantly influence the acreage of either crop. While the area under wheat increased by 0.8 million hectares, barley acreage declined marginally by only 0.04 lakh hectares. Quinquennial data further indicate that the MSP gap between wheat and barley has consistently ranged between ₹380 to ₹445 per quintal.



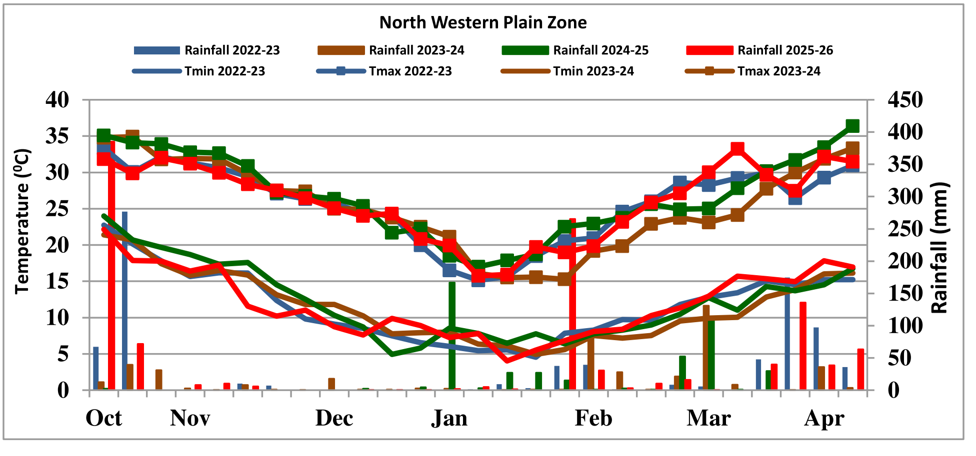
Weather Scenario during Wheat Crop Season 2025–26

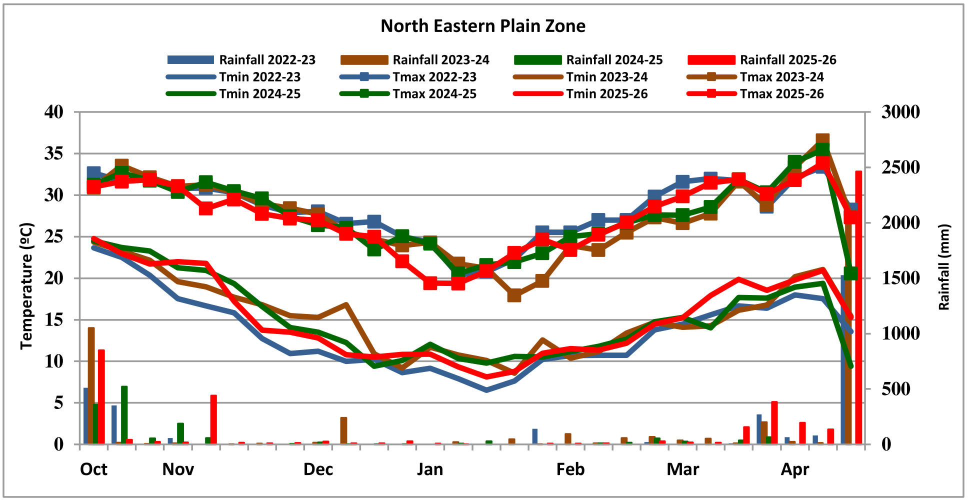
Meteorological observations from 51 centres representing the five wheat-growing zones (NHZ, NWPZ, NEPZ, CZ and PZ) indicated generally favourable weather conditions during the 2025–26 crop season. During the grain-filling period, mean minimum temperature was higher than the previous season across all zones, while mean maximum temperature increased only in the Central Zone. Importantly, maximum temperature remained below the critical threshold for terminal heat stress (<25°C in NHZ, <30°C in NWPZ and NEPZ, and <35°C in CZ and PZ) throughout most of the grain-filling period, providing conducive conditions for grain development.

Rainfall distribution was also favourable across all wheat-growing zones, with the highest seasonal rainfall recorded in NEPZ (1232 mm), followed by CZ (662.1 mm), PZ (589.2 mm), NHZ (545.1 mm) and NWPZ (520.6 mm). Compared with the previous season, rainfall increased in NWPZ and CZ, while it declined in the remaining zones. Across all zones except NHZ, rainfall was greater during the vegetative phase than during the reproductive phase, ensuring adequate soil moisture during critical crop establishment and canopy development.



Comparison with the preceding three crop seasons (2022–23 to 2024–25) revealed that mean maximum temperature during 2025–26 remained lower across all major wheat-growing zones than in 2024–25, whereas minimum temperature exhibited zone-specific variation, being higher in PZ, lower in NWPZ and CZ, and comparable in NEPZ. The combination of favourable thermal regime, adequate and well-distributed rainfall, and abundant solar radiation during early crop growth minimized terminal heat stress and created optimal conditions for crop growth and grain filling. These congenial weather conditions substantially contributed to the record wheat production achieved during the 2025–26 crop season.




North Eastern Plain Zone
Rainfall 2022-23
Rainfall 2023-24
Rainfall 2024-25
Rainfall 2025-26
Tmin 2022-23
Tmax 2022-23
Tmin 2023-24
Tmax 2023-24
Tmin 2024-25
Tmax 2024-25
Tmin 2025-26
Tmax 2025-26
Temperature (ºC)
Rainfall (mm)
0
5
10
15
20
25
30
35
40
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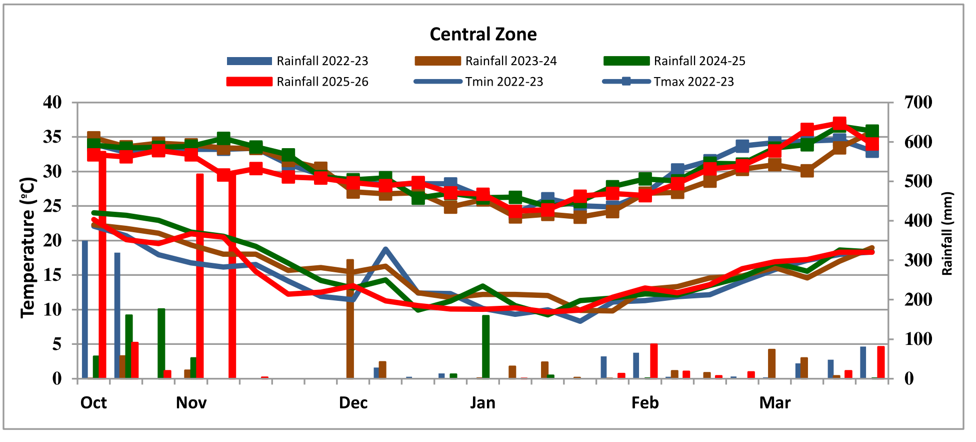
500
1000
1500
2000
2500
3000
Oct
Nov
Dec
Jan
Feb
Mar
Apr


Central Zone
Rainfall 2022-23
Rainfall 2023-24
Rainfall 2024-25
Rainfall 2025-26
Tmin 2022-23
Tmax 2022-23
Temperature (ºC)
Rainfall (mm)
0
5
10
15
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25
30
35
40
0
100
200
300
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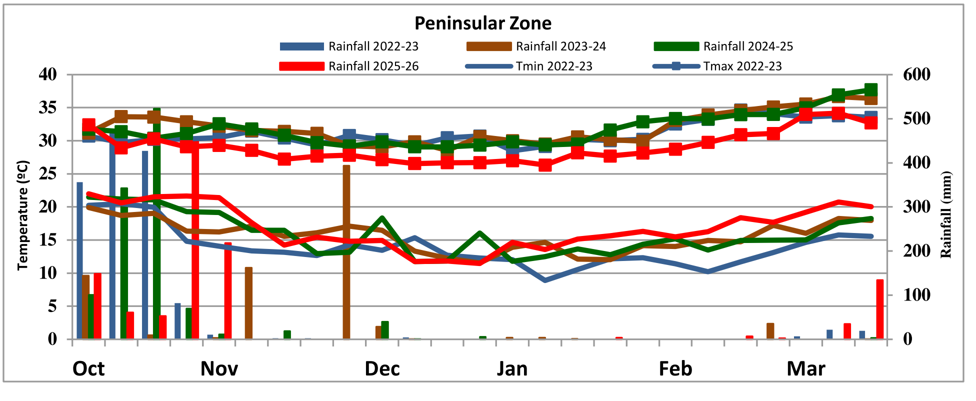
500
600
700
Oct
Nov
Dec
Jan
Feb
Mar


Peninsular Zone
Rainfall 2022-23
Rainfall 2023-24
Rainfall 2024-25
Rainfall 2025-26
Tmin 2022-23
Tmax 2022-23
Temperature (ºC)
Rainfall (mm)
0
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MAJOR RESEARCH ACHIEVEMENTS

CROP IMPROVEMENT

New Wheat Varieties Identified

A total of 23 wheat varieties, comprising 17 bread wheat and six durum wheat cultivars, were identified for release during 2025–26 for irrigated, restricted irrigation and rainfed production systems in different wheat-growing zones of the country, representing significant progress in the development of high-yielding, climate-resilient and nutritionally enriched wheat cultivars for diverse production environments. Several entries are biofortified with enhanced grain zinc, iron and protein content, while others possess improved processing quality and broad adaptation, thereby contributing to climate-resilient, nutritionally enriched and market-oriented wheat production.

Wheat varieties identified during 2025-26

SN	Variety name	Developed by	Zone/ state	Production condition	Grain yield (q/ha)		Special features
					Avg.	Pot.	
Bread wheat							
1	NICRA Pusa Wheat 3471 (HD 3471)	IARI, N. Delhi	NWPZ	Irrigated, Timely sown	60.19	74.6	Highly resistant to yellow and brown rust; Higher Sedimentation Value (60mL)
2	JW 1399 (MP1399)	Powarkheda	CZ	Irrigated, early sown, high fertility conditions	68.77	99.4	Good amount of Protein (12.15%), Iron (39.8 ppm) Content
3	DBW 426 (Karan Devika)	ICAR-IIWBR, Karnal	PZ	Irrigated, Late sown	44.7	69.8	Resistant to brown and black rust; Bio-fortified genotype with grain Zinc (44.9 ppm), Iron (45.6ppm) and Protein (13.4%) Content
4	PBW 906	PAU, Ludhiana	CZ	Irrigated, early sown, high fertility conditions	67.4	96	Resistant to brown rust and moderately resistant to black rust; good amount of Iron (40.3 ppm)
5	PBW 915	PAU, Ludhiana	NEPZ	Irrigated, Timely sown	52.5	65.4	Highly resistant to yellow and brown rusts; good amount of Protein Content (12.6%) and Iron (39.6)
6	GW 555 (Sorath Amber)	Wheat Research Station, JAU, Junagadh	CZ	Irrigated, Timely sown	58.3	76.9	Heat and Drought Tolerant (HSI (0.93) and DSI (0.84); High level of resistance to black rust (ACI: 6.8) and brown rust (ACI: 3.4); Zinc (40.8 ppm).
7	GW 556 (Sorath Ushma)	Wheat Research Station, JAU, Junagadh	CZ	Irrigated, Late sown	48.9	60.7	High level of resistance against brown rust (ACI: 4.0) and black rust (ACI: 8.9)

SN	Variety name	Developed by	Zone/ state	Production condition	Grain yield (q/ha) Avg.	Pot.	Special features
8	NIAW4267 (Phule Sampanna)	MPKV Agricultural Research Station, Niphad	PZ	Restricted irrigation, timely sown condition	34.8	40.8	Highly resistant to brown rust; Bio-fortifie with good amount of Protein (12.6%), Iron (45.5ppm) and Zinc (40.0ppm)
9	WSM 138	Wheat Research Unit, PDKV, Akola	CZ	Irrigated, Late sown	47.22	59.5	Highly resistant to brown and black rust, Resistant to all the pathotypes of black rust in SRT
10	MACS 6837 (MACS Vindhya)	ARI, Pune	CZ	Irrigated, Timely sown	56.7	72.8	Resistant to black and brown rusts; better grain quality (Protein 12.0%; Chapati score 7.7)
11	MACS 6830 (MACS Shivneri)	ARI, Pune	PZ	Irrigated, Late sown	45.8	65.4	Highly resistant to black and brown rusts; better grain quality (Protein 12.9%; Iron 44.5 ppm; and Zinc 40.9 ppm content)
12	HI 1683 (Pusa Biofortified Wheat Samrat)	IARI Regional Station, Indore	CZ	Irrigated, Timely sown	56.1	77.5	Moderately tolerant to heat (0.90) & drought (0.93); Resistance against black and brown rusts; good amount of Iron (40.4 ppm) and low Gluten Index (53)
13	HI 1687 (Pusa Biofortified Wheat Atal)	IARI Regional Station, Indore	PZ	Irrigated, Late sown	46.5	70.9	Resistant to black and brown rust; bio-fortified wheat with good amount of Protein (12.1%) and Iron (42.5 ppm) and Zinc (43.3 ppm) content
14	DBW 425	ICAR-IIWBR, Karnal	CZ	Irrigated, Late sown	47.9	59	Resistance to black and brown rusts; Protein 12.3%.
15	DBW 445 (Karan Gourav)	ICAR-IIWBR, Karnal	CZ	Irrigated, early sown, high fertility conditions	68.4	101.5	Highly resistant to black and brown rusts; low Grain hardness index (50.9) with high biscuit spread factor (8.9),
16	CG 1047 (Chhattisgarh Trombay Kumud)	IGKV BTC college of Agriculture Bilaspur and BARC, Trombay, Mumbai (MS)	PZ	Restricted irrigation, timely sown condition	32.14	37.6	Bio-fortified variety having Grain Protein (12.37%), Zinc (41.15 ppm) and Iron (41.7 ppm) Content
17	HD 3463	ICAR-IARI, N. Delhi	CZ	Irrigated, early sown, high fertility conditions	65.49	95.8	Highly resistant to black and brown rust; Grain Protein Content (12.1%) and Grain Iron Content (40.1 ppm)
Durum wheat							
18	JW1398 (MPO1398)(D)	Powarkheda	CZ	Restricted irrigation, timely sown condition	38.6	66	Good amount of Protein (12.0%), Iron (40.7) and Zinc(38.3) Content
19	UAS 484 (D)	UAS, Dharwad	CZ	Restricted irrigation, timely sown condition	38.4	80.3	Resistance to black and brown rusts; Yellow Pigment (7.3ppm), Iron Content (40 ppm)
20	HI 8849 (Pusa Biofortified Wheat Pusa Mangal) (D)	IARI Regional Station, Indore	PZ	Timely sown, Irrigated	51.9	71.8	High level of resistance against black and brown rust, Grain Zinc Content (41.1 ppm)

SN	Variety name	Developed by	Zone/ state	Production condition	Grain yield (q/ha) Avg.	Pot.	Special features
21	HI 8851(Pusa Biofortified Wheat Pusa Prachand) (D)	IARI Regional Station, Indore	CZ	Restricted irrigation, timely sown condition	39.3	61.8	Moderately tolerant to heat (HSI- 0.97), and drought stress (DSI 0.90) across the zones; Resistant to brown and black rust; Bio-fortified variety with Grain Zinc Content (44.3 ppm) and Iron Content (40.2 ppm)
22	HI 8850 (Pusa Biofortified Wheat Poshan Shakti (D)	IARI Regional Station, Indore	CZ	Irrigated, Timely sown	56.5	86.2	Moderately tolerant to heat (HSI- 0.90), and drought stress (DSI-0.98) across the zones; good amount of Grain Zinc Content (41.4 ppm), resistance to brown and black rust
23	MACS 4135 (MACS MAHABAL)	ARI, Pune	CZ, PZ	Irrigated, Timely sown	57.6(CZ), 51.5(PZ)	84.2 (CZ), 78.2 (PZ)	Better nutritional quality with good amount of Zinc (41.2 ppm) and Iron (41.3 ppm) in central zone

Registration of Wheat Varieties with PPV&FRA

Two bread wheat varieties, DBW 386 (Karan Khushboo) and DBW 443, were registered under the Extant Variety category by the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), New Delhi, during 2025–26 (Registration Nos. REG/2025/0944 and REG/2025/0945, respectively), strengthening intellectual property protection of AICRP-developed genetic resources.

Coordinated Multi-location Varietal Evaluation

The coordinated varietal evaluation programme was implemented across 73 testing centres, comprising 28 funded and 45 voluntary centres distributed over the five wheat-growing zones of India. During the 2025–26 crop season, 19 coordinated trial series comprising 6 Advanced Varietal Trials (AVTs), 9 National Initial Varietal Trials (NIVTs), 2 Initial Varietal Trials (IVTs) and 2 Special Trials (SPLs) were conducted under five major production environments, namely early-sown irrigated, timely-sown irrigated, late-sown irrigated, timely-sown restricted irrigation and timely-sown rainfed conditions.

A total of 398 test entries along with 72 check varieties were evaluated. Overall, 350 trial sets were supplied to participating centres, of which 347 trials (99.1%) were successfully conducted. Based on prescribed criteria for agronomic performance and disease screening, 295 trials (84.3%) qualified for final analysis. The main reasons for exclusion of trial data were rejection by the monitoring team (16 trials) and low site productivity (24 trials), reflecting the rigorous quality assurance measures adopted under the coordinated programme.

Zone-wise funded and voluntary centres of coordinated trials

Zone	Funded	Voluntary Centres	Total
NHZ	4	6	10
NWPZ	5	10	15
NEPZ	8	5	13
CZ	8	11	19
PZ	3	13	16
Total	**28**	**45**	**73**

Genotypes in Final-Year Advanced Varietal Trials

A total of 38 wheat genotypes completed the final year of evaluation in Advanced Varietal Trials during 2025–26. The Peninsular Zone evaluated the highest number of entries, followed by the Central Zone, indicating a strong breeding pipeline in these regions.

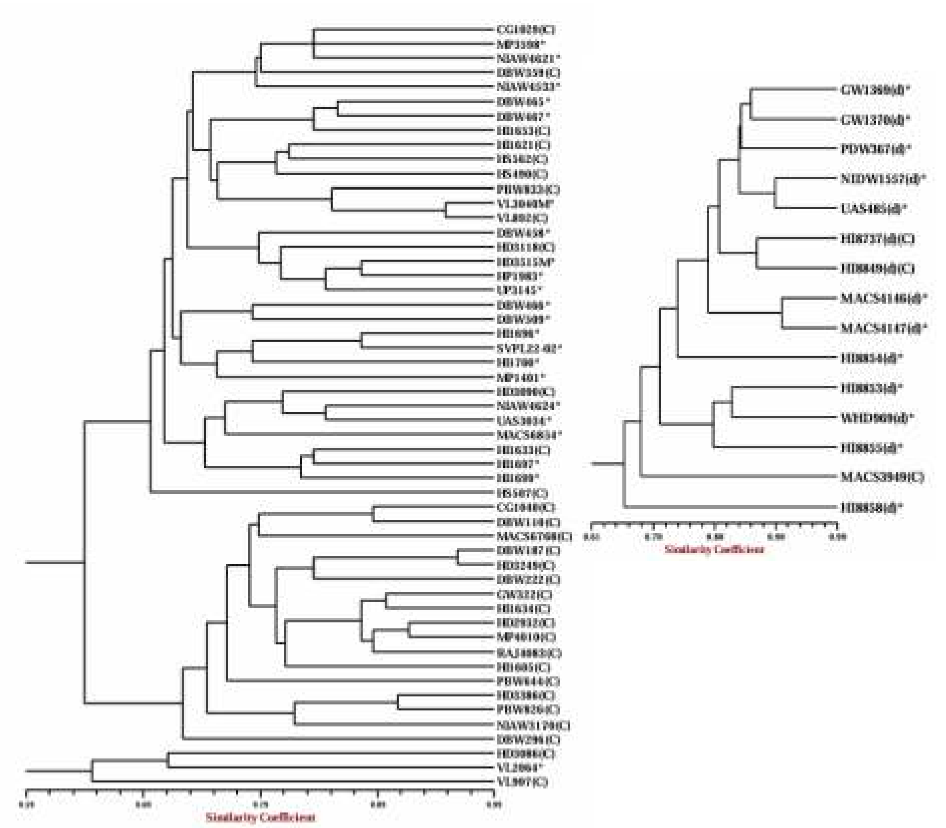
Three genotypes; VL2064, VL3040 and HD3515 were developed through marker-assisted backcross breeding, demonstrating successful integration of molecular breeding approaches into varietal development. Based on their multi-location performance, these entries will be considered by the Varietal Identification Committee during the 65th All India Wheat and Barley Research Workers' Meet.

Varieties in final year of evaluation in AVTs and SPL trials during 2025-26

Zone/Trial	Final Year Entries
Northern Hills Zone	
AVT-RF-TS-TAS	VL2064^{M}*
AVT-RI-LS-TAS	VL3040^{M}*
North Western Plains Zone	
AVT-RI-TS-TAS	DBW465*, DBW466*, DBW467*
North Eastern Plains Zone	
AVT-IR-TS-TAS	HD3515M*
AVT-IR-LS-TAS	HP1983*, SVPL22-02*, DBW458*, UP3145*
Central Zone	
AVT-IR-TS-TAD	MP1401*, DBW509*
AVT-IR-LS-TAS	NIAW4621*, MACS6854*, MP3598*
AVT-RI-TS-TAS	HI1700*, NIAW4533*
Peninsular Zone	
AVT-IR-TS-TAD	MACS4146(d)*, MACS4147(d)*, NIDW1557(d)*, GW1369(d)*, GW1370(d)*, PDW367(d)*, HI8853(d)*, HI8854(d)*, HI8855(d)*, HI8858(d)*, WHD969(d)*, UAS485(d)*
AVT-IR-LS-TAS	MACS6854*, NIAW4624*, NIAW4621*, HI1696*, HI1697*, HI1699, MP3598
AVT-RI-TS-TAS	HI1700*, UAS3034*

Molecular Marker Profiling of Advanced Varietal Trial Entries

To support genetic characterization and facilitate informed varietal identification, molecular profiling of final-year Advanced Varietal Trial entries was undertaken during 2025–26. The analysis included 53 bread wheat genotypes (22 AVT entries and 31 checks) and 15 durum wheat genotypes (12 AVT entries and three checks). Genotyping was carried out using 50 PCR-based molecular markers, comprising 40 SSR and 10 STS markers, enabling assessment of genetic diversity and distinctness among advanced breeding materials. Cluster analysis demonstrated clear genetic relationships among candidate entries and check varieties, providing valuable support for varietal characterization and future breeding strategies.



Clustering of bread wheat and durum wheat AVT final year entries and checks (2025-26)

Promising Genotypes in Advanced Varietal Trials

A total of 122 wheat genotypes, including entries evaluated under Advanced Varietal Trials (AVTs) and Special Trials, were assessed across different production environments during 2025–26. Based on multi-location evaluation for grain yield, adaptation and resistance to major rust diseases, 23 genotypes were identified as promising for advancement in the varietal development pipeline. Of these, 14 genotypes exhibited superior performance under late sown irrigated conditions, highlighting continued progress towards breeding climate-resilient cultivars suitable for terminal heat stress.

The promising entries identified under different production environments are presented in the following table.

Most promising varieties in AVTs

Zone	Irrigated, Timely Sown	Irrigated, Late Sown	Restricted Irrigation Timely Sown	Rainfed
NHZ	-	-	-	VL2061, VL2063
NWPZ	HI8859	HD3505, HD3507, WH1353, WH1355, PBW979, PBW980, DBW495, HD3508[Q]	-	-
NEPZ	-	HD3505, DBW491	-	-
CZ	GW569, HI8861, HI8865[Q],	-	GW573	-
PZ	HD3543	NIAW4649, DBW503, UAS3038Q, HI8862	-	-
SPL-Dic	MACS5069(dic)	-	-	-

Breeder Seed Indent and Production

A consolidated breeder seed indent of 20,241.84 quintals covering 141 wheat varieties was received from the Department of Agriculture & Farmers Welfare through the SATHI Portal for production during the 2025–26 crop season and supply during 2026–27.

The indent originated from 26 agencies, comprising nine Public Sector Organizations, 16 State Seed Corporations, and the National Seed Association of India (NSAI) representing the private seed sector.

Among the indenting states and agencies, Uttar Pradesh placed the highest demand (3,210 q), followed by BBSSL (3,045.47 q) and Madhya Pradesh (2,981.20 q).

The largest varietal demand was recorded for DBW 187 (Karan Vandana) (1,392.85 q), followed by DBW 303 (Karan Vaishnavi) (1,183.35 q) and DBW 327 (Karan Shivani) (1,144.85 q). Collectively, the top ten varieties accounted for approximately 45% of the total breeder seed indent, reflecting their widespread adoption and commercial importance.

Breeder Seed Allocation and Production

Against the consolidated indent of 20,241.84 q, breeder seed production of 20,133.43 q was allocated to 32 Breeder Seed Production Centres. These centres produced 22,413.64 q breeder seed, resulting in an overall surplus production of 2,280.21q (11.3%) over the allocated quantity.

Production was highly concentrated, with 12 centres contributing nearly 85% of the total breeder seed output (19,065 q). Among these, ICAR-IIWBR, Karnal was the leading producer with 5,048.00 q, exceeding its allocated target (4,137.67 q). Other major contributors included:

- ICAR-IARI Regional Station, Indore – 2,367.60 q
- ICAR-IARI Regional Station, Karnal – 2,062.00 q
- SDAU Wheat Research Station, Vijapur – 1,806.40 q
- Punjab Agricultural University, Ludhiana – 1,534.00 q

The top ten indented varieties together produced 10,419.4 q, representing 46% of the total breeder seed production. Major contributors included DBW 187, DBW 303, DBW 327, PBW 826, and DBW 222 (Karan Narendra). Although overall production exceeded the national requirement, deficits were observed for a few varieties, notably HI 1669 (−165.80 q), HI 1650 (−156.20 q) and LOK-1 (−148.25 q). Production shortfalls were also reported from a limited number of production centres, including ICAR-IARI, New Delhi, ICAR-IARI Regional Station, Indore, Agricultural University, Kota, and Lok Bharti Agricultural Research Centre, primarily because of lower seed realization.

SN	Variety	Year of Release	BS Indent (q)	BS Production (q)	Surplus / Deficit ±
1	DBW 187 (Karan Vandana)	2019	1392.85	1836.40	443.55
2	DBW 303 (Karan Vaishnavi)	2021	1183.35	1425.60	242.25
3	DBW 327 (Karan Shivani)	2021	1144.85	1240.00	257.40
4	PBW 826	2023	1020.45	1030.00	9.55
5	HI 1650 (Pusa Ojaswi)	2023	1006.20	850.00	-156.20
6	HD 3388	2024	804.80	818.00	13.20
7	DBW 386 (Karan Khushboo)	2025	691.00	750.00	59.00
8	DBW 222 (Karan Narendra)	2022	603.07	983.00	379.93
9	DBW 372 (Karan Varuna)	2023	602.50	660.00	57.50
10	HD 3386 (Pusa Wheat 3386)	2024	586.40	826.40	240.00
	Grant Total		9035.47	10419.4	1546.18
	Per cent Share		45%	46%	68%

Test Stock Multiplication of Newly Identified Wheat Varieties

To facilitate rapid seed multiplication and expedite varietal dissemination, the National Seed Corporation (NSC) undertook test stock multiplication of 12 wheat varieties identified during the previous AICRP workshop. During 2025–26, NSC produced 327.09 q of seed across its farms located at Hisar, Suratgarh, Jetsar and Sardargarh. The highest seed multiplication was achieved for DBW 445 (48.76 q), followed by HI 1683 (46.97 q), HI 1687 (46.00 q), DBW 425 (45.87 q), DBW 426 (37.60 q) and MACS 6830 (30.00 q), thereby ensuring timely availability of quality seed for subsequent breeder and foundation seed programmes.

Evaluation of National and International Nurseries

International Nurseries

Under international collaborative programmes during 2025–26, 168 sets comprising eight trials and eight nurseries containing 1,289 wheat lines (1,133 bread wheat and 156 durum wheat) were received from CIMMYT, Mexico. In addition, eight sets of two trials comprising 350 bread wheat lines were received from ICARDA, Morocco, while 220 facultative winter wheat lines were evaluated under the International Winter Wheat Yield Partnership (IWWYP), Turkey.

These materials were evaluated across diverse agro-climatic regions for grain yield, adaptation and resistance to major diseases. Promising germplasm possessing superior yield potential, thousand-grain weight and resistance to rusts and other diseases was identified for use in national wheat improvement programmes.

National Nurseries

To strengthen coordinated breeding efforts and facilitate genetic resource utilization, National Genetic Stock Nursery (NGSN), Segregating Stock Nursery (SSN) and Quality Component and Wheat Biofortification Nursery (QCBWN) were constituted and distributed to collaborating centres across the country. In addition, the Salinity/Alkalinity Tolerance Screening Nursery (SATSN), constituted by ICAR-CSSRI, was evaluated across salt affected environments in multiple wheat-growing zones.

These nurseries continue to serve as important platforms for identifying superior genetic resources, promoting germplasm exchange and accelerating the development of high-yielding, climate-resilient and nutritionally enhanced wheat varieties.

National Genetic Stock Nursery (NGSN): The National Genetic Stock Nursery (NGSN) comprising 100 wheat genotypes (86 bread wheat and 14 durum wheat) was constituted and evaluated at 33 centres during 2025–26. The nursery included released varieties, disease resistant genetic stocks and elite breeding lines representing diverse genetic backgrounds. All collaborating centres successfully conducted the nursery and submitted complete datasets. The nursery was evaluated in an augmented design using three bread wheat checks (Sonalika, HD 2967 and DBW 187) and one durum wheat check (DDW 47), with infector rows included to facilitate disease screening. Multi-location evaluation generated comprehensive data on grain yield and associated agronomic traits including phenology, plant height, tillering ability, spike characteristics and thousand-grain weight. Pooled analysis across locations enabled identification of genetically diverse and agronomically superior donor lines for utilization in national wheat breeding programmes.

Segregating Stock Nursery (SSN): The 29th Segregating Stock Nursery (SSN) comprised 210 F_2/F_3 segregating populations contributed by six collaborating breeding centres, namely ICAR-IIWBR, Karnal; VPKAS, Almora; PAU, Ludhiana; SDAU, Vijapur; GBPUA&T, Pantnagar; and UAS, Dharwad. The nursery was distributed to 23 wheat breeding centres representing all five wheat-growing zones. The utilization report indicated that all 210 crosses were effectively utilized by one or more centres for selection targeting grain yield, disease resistance, physiological traits, grain quality and other agronomically important characters. A total of 13,705 superior plants were selected across locations, corresponding to an overall utilization efficiency of 38.07%, demonstrating the effectiveness of the SSN as a national platform for broad-based germplasm utilization and population improvement.

Impact of the Segregating Stock Nursery: The Segregating Stock Nursery continues to make a significant contribution to wheat varietal development by providing genetically diverse breeding populations to both established and emerging breeding programmes. The bread wheat variety GW 555, recently identified for release, was developed through selection from SSN-derived material at Junagadh Agricultural University. Similarly, genotype AKAW 5304, selected by PDKV, Akola, has advanced to the final year of coordinated testing. In addition, three advanced breeding lines from MPKV, Parbhani and one line from RARI, Durgapura have entered the National Initial Varietal Trials. These achievements underscore the strategic importance of the SSN in accelerating varietal development and strengthening the national wheat improvement programme.

Salinity/Alkalinity Tolerance Screening Nursery (SATSN): The Salinity/Alkalinity Tolerance Screening Nursery (SATSN) was evaluated to identify wheat genotypes adapted to salt-affected environments and to generate potential entries for Special Variety Evaluation Trials under saline conditions. During 2025–26, the nursery comprising 25 test entries and three standard checks (KRL 210, KRL 19 and Kharchia 65) was evaluated at nine locations using an augmented experimental design. Data from eight locations were pooled to assess grain yield and adaptation under saline environments. The evaluation facilitated identification of superior salt-tolerant genotypes for their utilization in breeding programmes and future coordinated testing.

Quality Component and Wheat Biofortification Nursery (QCBWN): The QCBWN comprising 49 genotypes, including eight national check varieties, was evaluated across 15 centres representing four wheat-growing zones. Among the 41 test entries, QBP-25-12, GW 575 and HI 1726 demonstrated superior performance based on grain yield, resistance to rust diseases and nutritional quality. Consequently, these entries were recommended for inclusion in Advanced Varietal Trials of their respective zones. The nursery continues to serve as an effective platform for integrating nutritional quality with productivity and disease resistance in wheat improvement programmes.

Physiological Evaluation for Heat and Drought Tolerance

A Heat and Drought Tolerance Screening Trial (HDTST) was conducted to assess stress tolerance among advanced wheat genotypes under timely sown, late sown (heat stress) and managed drought environments. The trial comprised 49 entries, including standard checks, and was evaluated across 12 locations.

Under heat stress, genotypes HI1700, NIAW4624, PDW367, HD3515, MP3598, MACS4146, UAS3034, HI1696 and NIAW4621 recorded lower Heat Susceptibility Index (HSI) values than the best check (HI1605), indicating superior tolerance to terminal heat stress.

Similarly, under drought stress, HD3515 and HI1700 exhibited the lowest Drought Susceptibility Index (DSI), outperforming the national check and demonstrating enhanced resilience under moisture-deficit conditions. Evaluation under heat and drought environments identified 16 heat-tolerant and 19 drought-tolerant genotypes exhibiting susceptibility indices below unity, providing valuable donor sources for climate-resilient wheat breeding.The name of genotypes showing HSI /DSI lower than one are listed in table below.

Genotypes	
HSI	DSI
HI1700 (0.57), NIAW4624 (0.67), PDW367(d) (0.69), HD3515 (0.70), MP3598 (0.75), MACS4146 (d) (0.80), UAS3034 (0.84), HI1696 (0.87), NIAW4621 (0.87), HI8855 (0.89), HI1697 (0.91), NIAW4533 (0.93), GW1370(d) (0.94), WHD969(d) (0.97), DBW509 (0.97), HI8858 (0.99)	HD3515 (0.70), HI1700 (0.71), HI1699 (0.83), HP1983 (0.85), NIAW4533 (0.84), MACS4147(d) (0.88), UAS3034 (0.91), NIAW4621 (0.90), VL3040 (0.93), SVPWL22-02 (0.93), DBW509 (0.93), HI1696 (0.90), MACS6854 (0.93), NIAW4624 (0.95), VL2064 (0.97), HI1697 (0.97), DBW458 (0.99), DBW465 (0.99), HI8853 (0.96)

Commercialization of Technologies at IIWBR, Karnal

During the year 2025-26, Expression of Intent for commercialization of wheat and barley varieties and rotary disc drill was invited and a total of 180 companies have entered into agreement with ICAR-IIWBR. In this regards revenue of Rs. 1,23,07,850/- (excluding taxes) was generated through licensing of these technologies. Similarly, the companies which have entered in agreement with the institute during 2020-2025, were also provided breeder seeds of the varieties as per the agreement. Revenue of Rs 28,06,800/- was generated through royalty on sale of breeder seed sold to these companies. Thus, Net Revenue of Rs 1,23,07,850/- (Rs 9061250+ Rs 3246600) was generated through commercialization of wheat and barley varieties during 2025-26.

Variety wise total revenue generated during 2025-26

Name of Variety/ technology	Revenue from licensing during 2025 (including royalty (Rs)	Royalty on seed sales from licenses granted during 2020 – 2025 (Rs)	Total revenue (Rs)
DBW187	2100000	560100	2660100
DBW222	2150000	291600	2441600
DBW303	525000	428700	953700
DBW316	50000	7200	57200
DBW327	2450000	1263900	3713900
DBW332	-	7200	7200
DBW359	150000	-	150000
DBW370	50000	5400	55400
DBW371	150000	300000	450000
DBW372	700000	382500	1082500
DBW377	300000	-	300000
DBW386	300000	-	300000
DBW443	30000	-	30000
JKW261	6250	-	6250
DWRB223	100000	-	100000
Total	90,61,250	3246600	12307850

CROP PROTECTION

The crop protection programme aimed to minimize yield losses of wheat and barley caused by biotic stresses through strict surveillance, identification of resistance sources, strategic deployment of resistant cultivars and development of management strategies. Besides it works hand-in-hand with breeding programme to develop disease and insect pest resistant varieties.

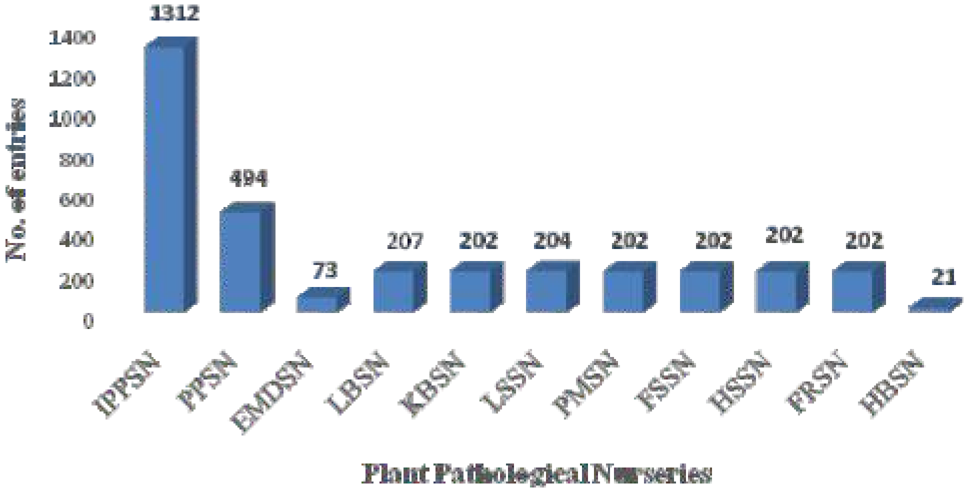
PATHOLOGY

Survey and Surveillance for Diseases

During 2025-26, to monitor the wheat and barley crop health, regular surveys were conducted with major emphasis on occurrence of yellow rust in NWPZ and surveillance for wheat blast. The surveys were conducted by the wheat crop protection scientists of different cooperating centres including ICAR-IIWBR, Karnal and information was shared through the *"Wheat Crop Health Newsletter",* Vol. 31 (Issues 1 to 5) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.org.in). The systematic surveillance of wheat and barley crops for rust diseases was carried out by multiple monitoring teams during the crop season 2025-26. Based on field observations and disease forecasts, timely advisories were issued by the ICAR-Indian Institute of Wheat and Barley Research (ICAR-IIWBR), Karnal, along with the State Departments of Agriculture and the Department of Agriculture, Cooperation and Farmers' Welfare (Government of India), to effectively manage and curb the spread of rust diseases and insect pests affecting the crop. During this season, wheat rusts were observed across multiple states in India. Disease intensity of leaf rust was more compared to stem and yellow rust. Survey conducted on 16 January, 2026 jointly by scientists from PAU, KVK, Ropar, CIPMC Jalndhar and state department of agriculture in Ropar district, of Punjab reported the first incidence of brown rust in Nanowal, Sh Anandpur Sahib block on variety HD3086. The severity was upto 20S. The first incidence of stripe rust (yellow rust) was detected in village Dukli of Sh Anandpur Sahib block, of district Ropar on 11 February, 2026 on varieties HD2967 (60S) and unknown local wheat variety with disease severity of 80S. Subsequently, a localized occurrence of yellow rust was detected in Budanpur area of Jind district in Haryana on 20.02.2026. During the crop season, the rise in temperature created conditions unfavourable for rust development. Consequently, disease severity and spread remained low, resulting in minimal losses, particularly in the NWPZ and NEPZ. Importantly, exotic diseases and pathotypes such as the *Ug99* race of stem rust and wheat blast were not reported from any part of the country. Overall, the crop health status across the country was excellent

Host Resistance

Wheat germplasm and advance breeding materials were evaluated against disease and insect pest resistance at various hot spot locations under artificially inoculated conditions. The major nurseries were: Initial Plant Pathological Nursery (IPPSN), Plant Pathological Nursery (PPSN), Elite Multiple Disease Screening Nursery (EMDSN), and disease specific nurseries like Leaf Blight Screening Nursery (LBSN), Karnal Bunt Screening Nursery (KBSN), Powdery Mildew Screening Nursery (PMSN), Loose Smut Screening Nursery (LSSN), Flag Smut Screening Nursery (FSSN), Head Scab Screening Nursery (HSSN), and Foot Rot Screening Nursery (FRSN). The numbers of entries tested across these nurseries is present in Figure below.



Number of different entries in different plant pathological screening nurseries during 2025-26

Rust resistance material in AVT entries (2025-26) with ACI upto 10.0 are given below

Stem, Leaf and Stripe rust

VL3042, HS507(C), PBW1012 [B], HI8737(d) (C), HI8627(d) (C), WHD969(d)*, DBW173 (C), HI8855(d)*

Stem and Leaf rust

DDK1071, DDK1029(C), MACS5069, HI1700*, HI1708, HI1699*, HW5308, HI8823(d)(C), HI1711, HI1634(C), HI1563(C), HW1098(C), GW569, VL2064M*, HI1697*, PBW723(C), HI8737(d)(C), HI8863(d), HI8713(d)(C), MACS6869, MACS6222(C), HI8853(d)*, RAJ4083(C), MACS6854[Q]*, NBPGR-DIC-01, VL907(C), HW5307, MACS5068, HI1696*, HI1709, GW572, GW573, HI8854(d)*

Leaf and Stripe rust

PBW976, VL3041, PBW979, PDW367(d)*, PBW970, HD3542[M], NIDW1557(d)*, DBW500, MACS6885, SVPL22-02*, HS722, MACS4158(d), VL2063, HD3504, DDW69, HD3499, NW8122, MACS4147(d)*, UP3145*, WHD943(C), MACS3949(d)(C), VL2061, DBW296(C), NIDW1149(d)(C), HPW521, UAS485(d)*, PBW757(C), HI8859(d), DBW467*, HP1987, PBW771(C), HD3515[M*], HP1986, PDW314(C), HI8737(d)(C), HS721, VL3043, HI1621(C), DBW377(C), UAS489(d), HI8849(d)(C), UAS478(d)(C), UP3156, GW1375, DBW493, DBW466*, Raj4595, PDW291(C), DBW495, BUDW03(d), PBW833(C), HI8865(d)^{B}, UP3157, HI8860(d), VL3039, DBW507[#], MACS6887 [Q], KRL2402 [$], WH1355, MACS4154(d), DDW71(d), NWS2247, K2407, UP3152, HPW520, NIAW4621*, DBW187(C), RAJ4597, HD3505, UP3163^{B}, PBW982, HD3249(C), HD3508

Stem and Stripe rust

DBW492

Identification of multiple disease resistant entries

Based on rigorous screening under Elite Multiple Disease Screening Nursery (EMDSN) at multi locations the following genotypes have been identified as confirmed sources of resistance for multiple diseases:

A. Resistant to stem, leaf and stripe rusts +

Resistant to all three rust+ KB+ FS: DDW67, MPO1398(d)*, MACS4125(d)*, HI8855(d)

Resistant to all three rust + FS: DDW65, DDW66, DDW67, MACS4146, UP3145, HD3463*,

Resistant to all three rust+ KB: MACS4135(D)*

Resistant to all three rust + FHB+ KB: MPO1398(d)*, HI8864B

B. Resistant to stem and leaf rust +

Resistant to stem rust + leaf rust + FS: HI8851(d)*, NIAW4533, UAS487(d), HI8850(d)*, DBW452, PBW935, HD3486

C. **Resistant to leaf and stripe rust +**

Resistant to leaf and stripe rust +KB: WHD969, PDW368, AKDW5520, NIDW1542, NIDW1557, MPO1403, HD3467*, MPO1395(d)*

Resistant to leaf rust and stripe rust + FHB +KB: NIDW1557

Incidence of Wheat and Barley Rusts in India and Nepal During 2025-26

Wheat crop health was monitored across major wheat-growing regions by multiple monitoring teams during the current cropping season. All wheat rust diseases appeared endemically in India. Surveillance revealed the occurrence of leaf (brown) rust and stripe (yellow) rust at several locations, whereas stem (black) rust was largely absent, detected only at a few locations in the Sehore and Narsinghpur districts of Madhya Pradesh, primarily on older genotypes and off-types. The first incidence of stripe rust was reported on 11 February 2026 in Dukli village, Sri Anandpur Sahib Block, Ropar district, Punjab. The disease affected variety HD2967 and local wheat cultivars, producing 3–4 disease foci with severity reaching 80S on local wheat and 60S on HD2967. Secondary spread was observed on variety PBW826. Lower disease severity (10–20S) was recorded in Chandpur and Hariyal villages on variety HD3086.

The first incidence of leaf rust during the 2026 wheat-growing season was recorded on 16 January 2026 at Nanowal village, Sri Anandpur Sahib Block, Ropar district, Punjab, on variety HD3086 with a severity of up to 20S. Subsequently, on 11 February 2026, leaf rust was observed again in Ropar on variety HD2967 with 20S severity. During the same period, surveys in Satara district, Maharashtra, detected leaf rust with severity ranging from trace levels to 10S. None of the isolates were virulent to *Sr31.*

Barley rust incidence was insignificant during 2025–26. Only a few sporadic cases of barley stripe rust were reported from Himachal Pradesh. Pathotype 0S0 (57) was identified in 4 samples of barley stripe rust collected from Himachal Pradesh. Likewise, two samples of barley leaf rust collected from Rajasthan produced pathotypes H2 (31H15) and H3 (55H7). Stem rust of barley was not reported from farmers' fields.

Pathotype distribution of *Puccinia* species on wheat and barley

A total of 491 samples of wheat and barley rusts were collected from twelve Indian states and Nepal were analyzed during 2025–26.

a. Stripe rust of wheat and barley (*Puccinia striiformis*)

During the current season, 140 stripe rust samples were analyzed from six Indian states (Himachal Pradesh, Punjab, Haryana, Uttarakhand, Rajasthan, Uttar Pradesh) and Nepal. Seven pathotypes of *Puccinia striiformis* f. sp. *tritici* (*Pst*, yellow rust of wheat) 238S119, 110S119, 46S119, T (47S103), P (46S103), 6S0, and 111S68, and one pathotype, 0S0 (57), of *Puccinia striiformis* f. sp. *hordei* (*Psh*, yellow rust of barley) were identified. *Pst* populations were avirulent to *Yr5*, *Yr10*, *Yr15*, *Yr16*, *Yr32*, and *YrSp*. During this cropping season, pathotype 238S119 occurred at the highest frequency (29.3%), followed by 46S119 (24.3%). Pathotypes 110S119 and 47S103 were identified with equal frequency. Pathotype 0S0 (57) was identified in 4 barley samples.

b. Stem rust of wheat (*P. graminis* f. sp. *tritici*)

Eight pathotypes (11, 15-1, 21, 21-1, 21A-2, 40A, 40-2, and 40-3) of *Puccinia graminis* f. sp. *tritici* (*Pgt*) were identified from the analysis of 49 stem rust samples. As in previous years, Pathotype 11 (79G31=RRTSF) virulent on *Sr2*, *Sr5*, *Sr6*, *Sr7b*, *Sr9a*, *Sr9b*, *Sr9c*, *Sr9d*, *Sr9f*, *Sr9g*, *Sr10*, *Sr13*, *Sr14*, *Sr15*, *Sr16*, *Sr17*, *Sr18*, *Sr19*, *Sr20*, *Sr21*, *Sr28*, *Sr29*, *Sr30*, *Sr34*, *Sr36*, *Sr38*, and *SrMcN,* was recorded at the highest frequency (34.7% of samples). Pathotypes 15-1 and 40-3 were identified in 28.5% and 24.4% of samples, respectively. Pathotype 40A was detected in two samples, while pathotypes 21, 21-1, 21A-2, and 40-2 were each identified in a single sample.

c. Leaf rust of wheat (*P. triticina*)

A total of 302 wheat leaf rust samples were analyzed from various wheat-growing regions in India and Nepal, yielding 25 pathotypes. The leaf rust population was dominated by pathotype 52-4 (101 isolates; 33.4%), closely followed by 52/77-9 (97 isolates; 32.1%), indicating that these two pathotypes remain the most prevalent across the Indian subcontinent. The next most common pathotype was 77-5 (36 isolates; 11.9%), while pathotypes 20-1, 77-1, and 179 were represented by 11, 7, and 7 isolates, respectively.

Seedling resistance test (SRT) against virulent pathotypes of wheat and barley rust pathogens and characterization of *Lr*, *Sr* and *Yr* genes in AVT material

a. Seedling resistance test (SRT) To identify sources of rust resistance, wheat AVT (202) and NBDSN (227) lines were evaluated at the seedling stage during the 2025–26. These genotypes were subjected to rigorous screening against multiple pathotypes under controlled environmental conditions of glasshouse.

Rust resistant advanced wheat lines (AVT)

Two wheat lines, PBW1012 and VL2064, exhibited resistance to all pathotypes of the three rust pathogens. Twenty-two AVT lines were resistant to all tested pathotypes of both stem and leaf rusts. No AVT entry showed combined resistance to all tested pathotypes of both leaf and stripe rust pathogens. However, UP3145 conferred resistance to both stem and stripe rusts. The details of resistant lines are presented below:

Rust resistant wheat lines in AVT (2025-26)

Rusts	No. of lines	Variety/line
Brown, Black and Yellow	02	PBW1012, VL2064
Brown and Black	22	CG1029 (C), GW569, GW572, GW573, HD3090 (C), HI1563 (C), HI1696*, HI1697*, HI1699, HI1700*, HI1708, HI1709, HI1711, MACS6222 (C), MACS6768 (C), MACS6869, MACS6870, NIAW4533, PBW723, PWU49, RAJ4083 (C), UAS3044
Black and Yellow	01	UP3145
Brown only	11	DDW71 (d), HD3508, HD3515, HD3541, MACS3949 (d)(C), MACS4146, MACS4147, MACS4154 (d), NIDW1557 (d)*, PBW833, PBW970
Black only	14	DBW110 (C), DBW303 (C), DBW377 (C), HI1633 (C), HI1634 (C), HP1983, HS507 (C), MACS6854, MACS6885, NIAW4649, PBW771 (C), RAJ4597, VL3042, VL907 (C)
Yellow only	15	DBW491, HD3495, HD3499, HD3507, HD3542M, HP1986, HP1987, HS721, HS722, PBW757, PBW976, PBW979, SVPL22-02*, VL3041, VL3043

Rust resistant lines in barley (NBDSN)

A total of 227 NBDSN lines were screened against different pathotypes of the three barley rust pathogens under controlled glasshouse conditions. These lines were evaluated against seven pathotypes of *P. striiformis* f. sp. *hordei* (M, Q, 57, 24, G, 6S0, and 7S0), five pathotypes of *P. graminis* f. sp. *tritici* (11, 21A-2, 40A, 117-6, and 122), and 11 pathotypes of *P. hordei* (H1 to H11). None of the NBDSN entries conferred resistance to all pathotypes across all three barley rust pathogens. The resistant lines are presented in table given below:

Rust resistant lines in NBDSN during 2025-26

Rust (s)	No. of lines	Lines
Leaf and stripe	16	BHS498, BHS516, BHS519, RD2715, RD3119, RD3120, RD3129, RD3137, RD3138, RD3139, RD3140, RD3172, RD3173, RD3180, RD3186, and RD3187
Stem and leaf	02	DWRB2532 and PL996
Stripe	31	BH1071, BH1080, BHS517, DWRB137, DWRB182 (C), DWRB2520, DWRB2548, DWRB2551, HUB113, PL955, PL982, PL994, RD2552, RD2794 (C), RD2899, RD2907 (C), RD3089, RD3102, RD3126, RD3128, RD3131, RD3168, RD3170, RD3175, RD3176, RD3178, RD3179, UPB1106, UPB1136, UPB1143, and UPB1145
Leaf	45	BHS380, BHS400, BHS502, BHS518, BHS519, DWRB223(C), DWRB238(C), DWRB244(C), DWRB2312, DWRB2507, DWRB2508, DWRB2510, DWRB2516, DWRB2522, DWRB2524, DWRB2526, DWRB2527, DWRB2531, DWRB2541, DWRB2542, DWRB2545, HBL118, HBL898, HBL900, HBL901, HUB304, HUB305, HUB307, HUB308, HUB309, KB2411, NDB1845, NDB1846, NDB1847, PL891 (C), PL978, PL999, RD3158, RD3163, RD3169, RD3177, UPB1121, UPB1147, UPB1151, and VLB118
Stem	4	BHS352 (C), DWRB2536, UPB1139, and UPB1150
Total	98	

b. Rust resistance genes in wheat and barley

Wheat

Among the 202 AVT lines, *Yr*, *Sr*, and *Lr* genes were confirmed in 115, 169, and 143 lines, respectively. Two *Yr* genes (*Yr2* and *Yr9*) contributed to stripe rust resistance in Indian wheat material. Among the postulated *Yr* genes, *Yr2* had the highest frequency and was characterized in 102 lines (88.7%), while *Yr9* was postulated in 13 entries. Additionally, 8 *Lr* genes (*Lr1*, *Lr2a*, *Lr3*, *Lr10*, *Lr13*, *Lr23*, *Lr24*, and *Lr26*) and 13 *Sr* genes (*Sr2*, *Sr5*, *Sr7b*, *Sr8a*, *Sr8b*, *Sr9b*, *Sr9e*, *Sr11*, *Sr13*, *Sr24*, *Sr28*, *Sr30*, and *Sr31*) were characterized in 143 and 169 AVT lines, respectively. *Sr31* linked with *Lr26* and *Yr9* and conferring resistance to all known *Pgt* pathotypes in the Indian subcontinent was postulated in 13 AVT entries [HD3090 (C), HI1633 (C), HI1634 (C), HI1699*, HS507 (C), MACS6768 (C), MACS6854*, NIAW4649, PBW723, PBW771 (C), RAJ4597, VL3042, and VL907 (C)], while *Sr24* (linked to *Lr24*) was characterized in 24 entries. *Lr13* was the most frequently postulated leaf rust resistance gene, characterized alone or in combination in 58 lines, followed by *Lr23* (43 lines) and *Lr10* (38 lines). The diversity of rust resistance genes in advanced wheat material (AVT) is presented in below.

Diversity of rust resistance genes in AVT lines (2025-26)

Rust	No. of lines	Number of genes inferred: Details of resistance genes
Stripe	114	Two: Yr2, and Yr9
Leaf	148	Eight: Lr1, Lr2a, Lr3, Lr10, Lr13, Lr23, Lr24, and Lr26
Stem	165	Thirteen: Sr2, Sr5, Sr7b, Sr8a, Sr8b, Sr9b, Sr9e, Sr11, Sr13, Sr24, Sr28, Sr30 and Sr31.

Barley

Using the gene-matching technique, the barley leaf rust resistance genes *Rph3* and *Rph19* were postulated in four NBDSN entries each. *Rph3* was confirmed in RD3162, RD3179, UPB1139, and UPB1144, whereas *Rph19* was postulated in KB2421, RD3088, UPB1148, and VLB195.

Wheat disease monitoring/ SAARC nursery

The 58th Wheat Disease Monitoring Nursery (WDMN) was planted at 36 strategic locations in the country, with an emphasis on border regions near neighboring countries. Data have been received from 29 locations. Neither wheat blast nor *Sr31* virulences *(Ug99-type pathotypes)* of the stem rust pathogen were reported from any wheat-growing zone in India. Stripe rust was observed at all locations in the NHZ and NWPZ except ICAR-IIWBR, RS, Shimla. Leaf rust was reported from eleven locations across NHZ and NWPZ: Almora and Pantnagar (Uttarakhand); Flowerdale (Himachal Pradesh); Rajouri and Kathua (Jammu); Hisar (Haryana); Abohar, Ropar, Langroya, and Ludhiana (Punjab); and Jaipur (Rajasthan). Stem rust was observed at Vijapur and Powarkheda in the CZ, and at Wellington in the SHZ.

The SAARC Wheat Disease Monitoring Nursery was planted at 28 locations across India, Bangladesh, Bhutan, Nepal, Afghanistan, and Pakistan. Disease data for the SAARC nursery have been received from all locations in India (except ICAR-IARI, RS, Pusa), Nepal, and Bangladesh. Data from remaining locations in Pakistan, Bhutan, and Afghanistan are awaited. The SAARC-WDMN was evaluated at six locations in Nepal. Brown rust was detected at Chitwan, Hardinath, and Sarlahi, while yellow rust was observed only at Khumaltar. Bhairahawa and Nepalgunj remained free from both brown and yellow rust. Sarlahi recorded the highest brown rust pressure, with 16 entries showing disease severity of ≥20MS. In contrast, brown rust incidence at Chitwan and Hardinath was limited to a few cultivars with generally low to moderate severity. Yellow rust affected all entries at Khumaltar, with severity ranging from 10MR in Faisalabad 85 to 80S in HD2189, indicating considerable variation in resistance among the tested entries.

In Bangladesh, nursery was assessed at five locations to monitor wheat rusts, blast, and other diseases. Wheat blast was absent across all locations and entries. Leaf rust occurred only at Jashore and Gazipur, while Dinajpur, Jamalpur, and Rajshahi remained disease-free. Most entries exhibited resistant to moderately resistant reactions with low disease severity. At Jashore, leaf rust severity ranged from 2MR to 20MS in the susceptible check, whereas at Gazipur, trace to moderately susceptible (TMSS) infections were observed on PBW343, HD2687, and RAJ3765. Overall, the tested entries demonstrated strong resistance to the prevailing wheat diseases, although PBW343 showed comparatively higher leaf rust severity than the other resistant entries.

National repository of pathotypes of *Puccinia* species on cereals

A national repository of 150 pathotypes of various rust pathogens affecting wheat, barley, oats, and linseed was maintained in cryopreservation. Of these, 105 pathotypes were also maintained on live hosts under controlled conditions. To facilitate artificial epiphytotics and support research on wheat rusts across India, nucleus and bulk inocula of individual pathotypes or pathotype mixtures were supplied to 44 scientists and researchers.

Advisory for stripe rust management

During the current season the weather remained uncongenial for diseases and pest therefore the sporadic occurrence of yellow rust has been reported from NWPZ. Need based advisory for stripe rust management was issued.

Awareness among farmers for stripe rust management especially in Punjab, Haryana and Jammu through social media like Whatsapp, facebook, internet, toll free number, newspapers, discussions and delivering lectures in farmers training programmes.

Preparedness to wheat blast

Survey was conducted in North and South West Bengal near Indo-Bangladesh border by team of scientists from BCKV and ICAR-IIWBR Karnal. No wheat blast disease was observed. An anticipatory breeding programme is already in place. Awareness was also created among farmers to take all preventive measures available against blast and to grow the resistant varieties identified.

Status of Karnal bunt during 2025-26

A total of 7,971 samples were collected from grain mandies of ten different states to assess KB disease occurrence and incidence. Overall, 15.36% of the samples were infected, with a mean disease incidence of 0.078%, while incidence across locations ranged from 0 to 23.3%. Rajasthan recorded the highest infection frequency (49.56%), with disease incidence varying from 0.1 to 23.3%, indicating marked spatial variability. Madhya Pradesh also exhibited a high infection frequency (46.54%), although the mean incidence was negligible (0.002%), with a narrow incidence range of 0.001–0.02%. Jammu showed a comparatively high infection frequency (25.7%) and the highest mean incidence (0.53%), with incidence ranging from 0.1 to 3.3%. Despite contributing the largest number of samples, Punjab (2,376 samples) and Haryana (3,977 samples) recorded relatively low infection frequencies of 5.32% and 4.54%, respectively. Punjab had a mean incidence of 0.048% (0–10.1%), whereas Haryana recorded a mean incidence of 0.197% (0–1.79%). No infected samples were detected in Karnataka or Maharashtra (214 samples), Uttarakhand, West Bengal, and Gujarat. Overall, the post harvest survey made in different grain mandies revealed pronounced geographical variation in disease occurrence across India.

Contribution of yield and/or area to wheat production (2025-26)

S. No.	Location	Total Samples	Samples Infected (%)	Mean Incidence (%)	Range of Incidence (%)
1	Jammu	225	25.7	0.53	0.1-3.3
2	Punjab	2376	5.32	0.048	0.0-10.1
3	Haryana	3977	4.54	0.197	0.0-1.79
4	Rajasthan	676	49.556	0.0051	0.1 - 23.3
5	Uttarakhand	153	-	-	-
6	Madhya Pradesh	159	46.54	0.002	0.001-0.02
7	Karnataka	40	0	0	0
8	Maharastra	214	0	0	0
9	West Bengal	80	-	-	-

S. No.	Location	Total Samples	Samples Infected (%)	Mean Incidence (%)	Range of Incidence (%)
10	Gujarat	71	-	-	-
	Overall	7971	15.36	0.078	0-23.3

Management of yellow rust of wheat

A new fungicide combination, Tebuconazole 50% + Trifloxystrobin 25% WG was evaluated in multilocation trials (Ludhiana, Jammu, Karnal, Bijaura, Pantnagar and Durgapura) against yellow rust of wheat during 2025–26. The results demonstrated that a foliar spray of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (0.6 g L^{-1} of water) applied at the first appearance of yellow rust symptoms effectively suppressed disease development and prevented further spread of the pathogen.

ENTOMOLOGY

Survey and surveillance of insect-pests and their natural enemies

Surveys conducted across Punjab during the 2025-26 crop season revealed that aphid populations remained below the economic threshold level during February–March. Pink stem borer incidence was generally low, with only sporadic infestations observed in some super seeder-sown fields of Sangrur district. Surveys in farmers' fields of Nashik, Ahilyanagar, and Dhule in Maharashtra recorded medium to heavy aphid incidence, along with the presence of natural enemies such as coccinellids and *Chrysoper lacarnea*. Shoot fly, stem borer and termite incidences were observed at low levels.

Screening of AVT entries against major insect pests

Shoot fly: A total of 202 advanced wheat entries were screened for shoot fly resistance at Dharwad, Ludhiana, Kanpur, and Niphad centres. The mean shoot fly incidence across locations ranged from 3.96% to 12.46%. HI8861(d) recorded the lowest mean shoot fly followed by DBW458*, NBPGR-DIC-01, DBW509*, NIAW4649, HD2932(C), HD3118(C), VL907(C), HI8627(d)(C), MACS6887Q, and HD3293(C), all of which exhibited comparatively lower infestation.

Brown wheat mite: The mite population ranged from 5 to 19 mites per 10 cm^2 leaf area. VL892(C) recorded the lowest mite population followed by SVPL22-02*, PBW644(C), MACS4158(d), HI8737(d)(C), MACS6854Q*, HD3541M, MACS6870, HD3249(C), and HD3171(C) suggesting comparatively better tolerance to brown wheat mite at Ludhiana.

Foliar aphids: Screening of AVT entries against foliar aphids revealed marked variation across centres. Overall, resistant sources were limited under high aphid pressure, highlighting the need for continued breeding for aphid resistance.

Root aphids: At Ludhiana 112 entries were classified as susceptible (Grade 4), while 90 entries were highly susceptible (Grade 5) for root aphid. No entries exhibited immune, resistant or moderately resistant reactions.

Screening against multiple pests (MPSN)

Across four different locations i.e. Dharwad, Ludhiana, Kanpur and Niphad the average shootfly infestation index was lowest (5%) in entry MACS4147(d) and the highest (13%) for HD3463. The lowest mean score for foliar aphids was recorded by MP01403 and DBW445^{Q} indicating comparatively lower susceptibility.

Integrated Pest Management (IPM) Studies

Early-sown wheat recorded the highest termite damage and root aphid infestation while both declined with delayed sowing. Foliar aphid incidence was also higher in early-sown crops, with peak infestation occurring earlier (11thstandard meteorological weeks (SMW) than in late-sown crops (12th SMW), indicating that delayed sowing reduced insect-pest incidence. The pink stem borer incidence was significantly higher in super seeder sown wheat as compared to all other tillage conditions. However, there was no difference in root aphid, foliar aphid incidence and their coccinellid predators among different tillage conditions.

Aphid management

Application of Thiamethoxam 25 WG@ 12.5 a.i. g/ha at the earhead emergence to milky grain stage effectively reduced aphid population and improved grain yield. In newer molecules, Dinotefuran 20 SG @ 80 g/ha was the most effective treatment, providing superior aphid control and recording the highest grain yield. Wheat plots with one or two rows of mustard or radish recorded significantly lower aphid populations than plots without border crops. Significantly higher number of coccinellids/m^2 was observed in wheat when mustard (2.30-2.82) or radish (2.15-2.57) is grown as border crop, indicating that border cropping can effectively suppress aphids, conserve natural enemies, and improve wheat productivity.

Management of lepidopterous pests (pink stem borer, army worm & cutworms) of wheat

Takumi 20 WG @ 60 g/ha, Fipronil 0.6 GR @ 8.75 kg/ha, and Coragen 18.5 SC @ 125 mL/ha effectively managed pink stem borer and armyworm in wheat.

Management of termites through seed treatment

Fipronil 0.6 GR @ 10 kg/ha recorded the lowest termite damage, while Fipronil 0.6 GR @ 8.75 kg/ha produced the highest grain yield (45.56 q/ha).

NEMATOLOGY

Survey and surveillance

A crop health survey was conducted to monitor the occurrence of cereal cyst nematode (*Heterodera avenae*) and other plant-parasitic nematodes in the wheat-growing regions of Rajasthan and Haryana. In Rajasthan, 44 out of 64 samples collected from five districts were infected with CCN, with Sikar recording 100% infestation, while Tonk remained free from CCN. In Haryana, 17 out of 40 samples collected from Hisar and Fatehabad were positive for CCN. Besides CCN, *Pratylenchus, Helicotylenchus, Hoplolaimus, Rotylenchulus, Tylenchorhynchus, Criconematids*, and *Dorylaimids* were detected, whereas *Anguina tritici* and *Meloidogyne graminicola* were not observed. The survey confirmed the widespread distribution of CCN in major wheat-growing areas, highlighting the need for regular surveillance and integrated nematode management strategies.

Evaluation of wheat genotypes for nematode resistance

A total of 202 wheat entries under CCSN and 58 barley entries under MDSN were screened against CCN at Hisar, Durgapura, and Udaipur. In CCSN none of the entries exhibited complete resistance across the three centres. Moderately resistant entries were identified at all three centres, with 11 at Hisar, 18 at Durgapura, and 32 at Udaipur, while the majority of the remaining entries were susceptible or highly susceptible to cereal cyst nematode.

In MDSN none of the entries exhibited complete resistance at any location. At Hisar, all entries were susceptible or highly susceptible. Udaipur recorded the highest number of moderately resistant entries (17), whereas Durgapura had only 3 moderately resistant entries, with the majority of entries classified as susceptible. Overall, the results indicated a predominance of susceptible reactions and limited availability of effective resistance sources against CCN in the evaluated wheat germplasm.

Management of cereal cyst nematode

Fluensulfone 2% GR @ 20 kg ha^{-1} was the most effective treatment, recording the lowest nematode population and highest grain yield. Among eco-friendly options, *Purpureocillium lilacinum* @ 2.5 kg ha^{-1} + 100 kg FYM consistently provided the best biological control, while neem cake showed moderate efficacy. Overall, integrated management significantly reduced CCN infestation and improved wheat productivity.

RESOURCE MANAGEMENT

The Resource Management Programme of the All India Coordinated Wheat and Barley Improvement Project (AICW&BIP) is aimed at developing, validating and refining resource-efficient, climate-resilient and location-specific production technologies for wheat and barley across diverse agro-ecological regions of the country. The programme integrates coordinated multi-location evaluation of advanced genotypes with agronomic interventions to enhance productivity, profitability, input-use efficiency and sustainability of cereal-based production systems. Emphasis is placed on developing technologies that address emerging production challenges, including water scarcity, nutrient-use efficiency, residue management, weed management and climate-induced abiotic stresses. In five wheat/barley growing zones, twenty varietal evaluation trial series were conducted at 114 locations under different growing conditions. The newly developed genotypes were evaluated against the existing varieties used as checks. In addition, eight special coordinated trials were also conducted to address the zone-wise problems and priorities.

Coordinated Varietal Evaluation

During 2025–26, twenty coordinated varietal evaluation trial series comprising wheat and barley were conducted across 114 locations representing five major wheat- and barley-growing zones of the country under diverse production environments. Of the 114 planned trials, 113 (99.1%) were successfully conducted, reflecting excellent programme implementation. Following technical scrutiny and monitoring, 17 trials were excluded from analysis owing to inadequate trial performance or failure to satisfy prescribed quality standards. In addition, eight special coordinated agronomic trial series were undertaken across locations to address region-specific production constraints and emerging resource management priorities.

The coordinated evaluation identified several promising wheat and barley genotypes exhibiting superior adaptation under specific production environments. In the North Western Plains Zone (NWPZ), wheat genotype DBW 465 recorded a significant yield advantage (5.52%) over the best check under restricted irrigation, while DBW 466 exhibited numerical superiority. Under irrigated timely sown conditions, hulless barley, RD 3089 showed numerical superiority over the best check. In the Central Zone (CZ), HI 1700 performed numerically better than the best check under restricted irrigation, whereas in the Peninsular Zone (PZ), durum wheat genotype HI 8853 recorded a significant yield superiority (3.88%) over the best check under irrigated timely sown conditions, demonstrating its potential for varietal advancement.

Zone-wise details of the coordinated varietal evaluation trials

Trial Series	Locations	Trials conducted	Trials not conducted Number	Trials not conducted Centres	Rejected Number	Rejected Centres
Northern Hills Zone						
RF-TS-TAS-LON	05	05	-	-	-	-
IR-LS-DOS-TAS	05	05	-	-	-	-
IR-TS-HLB-DOS (Barley)	02	02	-	-	-	-
IR-TS-DPB (Barley)	03	03	-	-	01	Almora
Total	**15**	**15**	**-**	**-**	**01**	
North Western Plains Zone						
RIR-TS-TAS	10	10	-	-	02	Delhi, Durgapura
IR-TS-MB-DOS (Barley)	06	06	-	-	-	-
IR-TS-HLB-DOS (Barley)	05	05	-	-	-	-
IR-TS-DPB (Barley)	05	05	-	-	01	Jammu
IR-SL-LON (Barley)	03	03	-	-	-	-
Total	**29**	**29**	**-**	**-**	**03**	
North Eastern Plains Zone						
IR-TS-DOS-TAS	10	10	-	-	03	Kanpur, Ranchi, Varanasi
IR-LS-DOS-TAS	10	10	-	-	03	Kanpur, Ranchi, Varanasi
IR-SL-LON (Barley)	03	02	01	Ranchi	-	-
IR-TS-HLB-DOS (Barley)	04	04	-	-	03	Kanpur, Ranchi, Varanasi
IR-TS-FB-DOS (Barley)	04	04	-	-	01	Varanasi
Total	**31**	**30**	**01**	**-**	**10**	
Central Zone						
IR-TS-DOS-TAS	08	08	-	-	02	Gwalior, Vijapur
IR-LS-DOS-TAS	08	08	-	-	-	
RIR-TS-TAS	06	06	-	-	-	-
IR-SL-LON (Barley)	01	01	-	-	-	-
IR-TS-HLB-DOS (Barley)	04	04	-	-	01	Jabalpur
Total	**27**	**27**			**03**	
Peninsular Zone						
IR-TS-DOS-TAD	04	04	-	-	-	-
IR-LS-DOS-TAS	04	04	-	-	-	-
RIR-TS-TAS	04	04	-	-	-	-
Total	12	12	-	-	-	
Grand Total	**114**	**113**	**01**	**-**	**17**	

Performance of new genotypes in various agro-climatic zones

Zone wise trial	Test entries	Entry sowing superiority Numerical	Entry sowing superiority Significant	Best check	Yield gain, %	Locations
Northern Hills Zone						
RF-TS-TAS-LON	VL 2064[M]	-	-	HS 562	-	04
IR-LS-DOS-TAS	VL 3040[M]	-	-	HS 490	-	04
IR-TS-HLB-DOS (Barley)	BHS 500	-	-	BHS 400	-	02
IR-TS-DPB (Barley)	BHS 502, BHS 498	-	-	BHS 380	-	02
North Western Plains Zone						
RIR-TS-TAS	DBW 465, DBW 466,		DBW 466	HI 1653	5.52	08
		DBW 467		DBW 465	0.62	

Zone wise trial	Test entries	Entry sowing superiority		Best check	Yield gain, %	Locations
		Numerical	Significant			
IR-TS-MB-DOS (Barley)	DWRB 2312	-	-	DWRB 238	-	06
IR-TS-HLB-DOS (Barley)	RD 3089, RD 3090	RD 3089	-	KARAN 16	1.01	05
IR-TS-DPB (Barley)	DWRB 2318	-	-	RD 2715	-	04
IR-SL-LON (Barley)	RD 3102, RD 3109	-	-	RD 2907	-	03
North Eastern Plains Zone						
IR-TS-DOS-TAS	HD 3515[M]	-	-	PBW 826	-	07
IR-LS-DOS-TAS	HP 1983, UP 3145, SVPL 22-02 DBW 458	-	-	PBW 833	-	07
IR-SL-LON (Barley)	RD 3102, RD 3109	-	-	RD 2794	-	02
IR-TS-HLB-DOS (Barley)	UPB 1121	-	-	KARAN 16	-	01
IR-TS-FB-DOS (Barley)	PL 955	-	-	HUB 113	-	03
Central Zone						
IR-TS-DOS-TAS	MP 1401, DBW 509	-	-	MACS 6768	-	06
IR-LS-DOS-TAS	NIAW 4621, MP 3598, MACS 6854	-	-	CG 1029	-	08
RIR-TS-TAS	NIAW 4533, HI 1700	HI 1700	-	CG 1040	0.38	06
IR-SL-LON (Barley)	RD 3102, RD 3109			RD 2907	-	01
IR-TS-HLB-DOS (Barley)	RD 3088, RD 3089	-	-	K 1149	-	03
Peninsular Zone						
IR-TS-DOS-TAD	GW 1369 (d), UAS 485 (d), MACS 4147 (d), GW 1370(d), HI 8858 (d), HI 8854 (d), MACS 4146 (d), WHD 969 (d), NIDW 1557 (d), PDW 367 (d), HI 8855 (d), HI 8853 (d)	-	HI 8853 (d)	HI 8849 (d)(I)	3.88	04
IR-LS-DOS-TAS	HI 1699, NIAW 4624Q, NIAW 4621, HI 1696, HI 1697, MP 3598, MACS 6854Q	-	HI 1696 HI 1697 HI 1699	HD 3090	6.48 5.16	04 0.98
RIR-TS-TAS	HI 1700, UAS 3034,	UAS 3034	-	NIAW 3170	3.67	03

In all, 105 special trials were proposed, out of which 96 were conducted and the conduct percentage was 91.4. The maximum numbers of special trials were conducted in NWPZ (40), CZ (23), NEPZ (22), PZ (07) and NHZ (04).

Zone-wise details of the special agronomic trials

Trial Series	Locations	Trials conducted	Trials not conducted	
			Number	Centres
Northern Hill Zone				
SPL-3: Nano and prilled urea application in wheat	02	01	01	Khudwani
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	02	01	01	Khudwani
SPL-6: Effect of sowing time and nitrogen on hulless barley productivity	02	02	-	-
Total	06	04	02	
North Western Plains Zone				
SPL-1: Effect of tillage, rice residue and microbial consortia management on wheat productivity	03	03	-	-
SPL-2: Effect of application timing and dose of CCC on wheat productivity	07	07	-	-
SPL-3: Nano and prilled urea application in wheat	06	06	-	-
SPL-4: Improving productivity of late sown wheat through GA3 and abscisic acid	07	07	-	-
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	04	04	-	-
SPL-6: Optimizing the sowing time and nitrogen dose in hulless barley	04	04	-	-

Trial Series	Locations	Trials conducted	Trials not conducted Number	Centres
SPL-7: Efficacy of of bixlozone + metribuzin against weeds in wheat	04	04	-	-
SPL-8: Effect of heat stress mitigators on wheat productivity	05	05	-	-
Total	**40**	**40**	**-**	
North Eastern Plains Zone				
SPL-1: Effect of tillage, rice residue and microbial consortia management on wheat productivity	02	02	-	-
SPL-3: Nano and prilled urea application in wheat	05	03	02	Kanpur, Ranchi
SPL-4: Improving productivity of late sown wheat through GA3 and abscisic acid	10	07	03	Ayodhya, Kanpur, Ranchi
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	04	03	01	Kanpur
SPL-6: Optimizing the sowing time and nitrogen dose in hulless barley	01	01	-	-
SPL-8: Effect of heat stress mitigators on wheat productivity	06	06	-	-
Total	**28**	**22**	**06**	
Central Zone				
SPL-2: Effect of application timing and dose of CCC on wheat productivity	05	05	-	-
SPL-3: Nano and prilled urea application in wheat	04	04	-	-
SPL-4: Improving productivity of late sown wheat through GA3 and abscisic acid	07	07	-	-
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	03	03	-	-
SPL-6: Optimizing the sowing time and nitrogen dose in hulless barley	01	01	-	-
SPL-8: Effect of heat stress mitigators on wheat productivity	03	03	-	-
Total	**23**	**23**	**-**	
Peninsular Zone				
SPL-4: Improving productivity of late sown wheat through GA3 and abscisic acid	04	04	-	-
SPL-8: Effect of heat stress mitigators on wheat productivity	04	03	01	Akola
Total	**08**	**07**	**01**	**-**
Grand Total	**105**	**96**	**09**	

Performance of Promising Wheat and Barley Genotypes

The coordinated multi-location evaluation of wheat and barley genotypes across diverse production environments enabled identification of several promising entries with improved productivity and adaptation. Performance varied across agro-climatic zones depending on production environments and prevailing climatic conditions, highlighting the importance of region-specific varietal evaluation.

Among bread wheat entries, DBW 465 emerged as the most promising genotype under restricted irrigation conditions in the North Western Plains Zone (NWPZ), recording a significant yield advantage of 5.52% over the best check. DBW 466 also exhibited numerical superiority under the same environment. In the Central Zone (CZ), HI 1700 performed numerically better than the best check under restricted irrigation, demonstrating its suitability for water-limited production systems. In the Peninsular Zone (PZ), HI 8853 (durum wheat) recorded a significant yield superiority (3.88%) over the best check under irrigated timely sown conditions, while HI 1699, HI 1696, HI 1697 and UAS 3034 exhibited encouraging performance under late-sown and restricted irrigation environments, indicating their potential for varietal advancement.

Under the Northern Hills Zone (NHZ) and North Eastern Plains Zone (NEPZ), although none of the evaluated wheat entries significantly outperformed the best checks, several advanced lines demonstrated stable performance across locations, providing valuable genetic resources for future varietal development and targeted adaptation.

Evaluation of barley genotypes across coordinated trials similarly identified several promising entries exhibiting competitive performance under specific production environments. Genotypes such as RD 3089, RD 3090, DWRB 2312, DWRB 2318, RD 3102, RD 3109, UPB 1121, PL 955 and RD 3088 demonstrated satisfactory adaptation across their respective target environments. Although none of the barley entries recorded statistically significant superiority over the respective national checks, their consistent performance across locations provides valuable breeding material for developing high-yielding and stress-resilient barley cultivars.

Development and Validation of Production Technologies

To address emerging challenges in wheat and barley production, coordinated multi-location agronomic trials were conducted across major agro-climatic zones to evaluate resource-conserving, climate-resilient and input-efficient production technologies. The programme focused on conservation agriculture, nutrient management, plant growth regulation, weed management, heat stress mitigation and crop management strategies for enhancing productivity and resource-use efficiency under diverse production environments. Of the 105 special trials planned, 96 (91.4%) were successfully conducted across the country, providing robust multi-location datasets for technology evaluation and refinement.

Conservation Agriculture and Crop Establishment

Studies on tillage, crop residue management and microbial consortia demonstrated that conservation agriculture practices can sustain wheat productivity while improving resource-use efficiency. Across production environments, strip tillage performed on par with conventional and zero tillage, whereas integration of crop residue retention with microbial consortia consistently enhanced system productivity, particularly in the North Eastern Plains Zone. These findings reinforce the potential of conservation agriculture for sustaining productivity while improving soil health and residue management in cereal-based cropping systems.

Crop Growth Regulation and Nutrient Management

Optimization of plant growth regulator application indicated that appropriate scheduling and dosage of chlormequat chloride (CCC) significantly improved wheat productivity in irrigated production environments of the North Western Plains and Central Zones. Similarly, studies on nitrogen management demonstrated that integration of recommended nitrogen fertilization with foliar application of 6% prilled urea or 0.4% nano urea maintained comparable grain yield while improving nitrogen-use efficiency, highlighting opportunities for enhancing fertilizer-use efficiency in wheat cultivation.

Climate Resilience and Heat Stress Management

Coordinated evaluation of growth regulators and heat stress mitigation strategies generated promising recommendations for minimizing yield losses under delayed sowing and terminal heat stress. Foliar application of GA_3 and abscisic acid significantly improved wheat productivity under late-sown conditions. Likewise, timely sowing remained the most effective strategy for maximizing productivity, while foliar application of 2% KNO_3 proved to be an effective heat stress mitigation measure, producing significantly higher grain yield than the untreated control under terminal heat stress conditions.

Weed Management

The coordinated weed management studies identified effective herbicide options for controlling complex weed flora in wheat and barley. Ready-mix formulations containing bixlozone + metribuzin in wheat and halauxifen-methyl + fluroxypyr in barley effectively reduced weed density and biomass while maintaining excellent crop safety and grain yield comparable to weed-free conditions. These findings provide effective chemical weed management options for improving productivity under diverse production systems.

Resource Management in Barley

Special agronomic investigations in barley identified optimum sowing windows and nitrogen management strategies for enhancing productivity of hulless barley across production zones. Early November sowing was found optimum in the Northern Hills and North Western Plains Zones, whereas relatively later sowing was more suitable under Central Zone conditions. Nitrogen application in the range of 80–100 kg ha^{-1} consistently produced optimum grain yield across environments. In addition, coordinated herbicide evaluations identified effective broad-leaved weed management options capable of substantially reducing weed competition and improving barley productivity.

Major Outcomes

The coordinated resource management programme generated robust scientific evidence for improving productivity, resource-use efficiency and climate resilience of wheat and barley production systems across diverse agro-ecological regions of the country. Multi-location evaluation facilitated identification of promising wheat and barley genotypes with superior adaptation to specific production environments, while coordinated agronomic investigations validated improved technologies for conservation agriculture, nutrient management, crop establishment, weed management and mitigation of terminal heat stress.

The programme generated location-specific recommendations on conservation tillage, crop residue management, nitrogen-use efficiency, plant growth regulation, weed control and optimum crop management practices that have significant potential for enhancing farmers' productivity and profitability while reducing production risks under changing climatic conditions. The coordinated efforts of the resource management group continue to strengthen the scientific basis for sustainable intensification of wheat- and barley-based production systems and provide valuable decision support for varietal deployment and technology dissemination across the country.

WHEAT QUALITY

The Quality Component of the All India Coordinated Research Project on Wheat and Barley (AICRP-W&B) undertakes systematic evaluation of coordinated trial material for end-use quality, processing characteristics and grain nutritional parameters to support varietal evaluation and identification of product-specific cultivars. During 2025–26, quality analysis was carried out on 214 Advanced Varietal Trial (AVT) entries, 269 National Initial Varietal Trial (NIVT) entries, 49 Quality Component and Wheat Biofortification Nursery (QCWBN) entries, 25 Initial Varietal Trial (IVT) entries, 10 Durum Wheat Entries and four Agronomic Special Trials (ASTs), comprising nearly 4,000 samples received from different agro-climatic zones. Grain quality evaluation included grain appearance score, hectolitre weight, protein content, sedimentation value, grain hardness, wet and dry gluten, gluten index, yellow pigment, phenol reaction, high molecular weight glutenin subunits (HMWGS), and grain iron and zinc concentrations. Product-specific evaluation was undertaken for chapati, bread, biscuit and pasta quality.

Advanced Varietal Trials (AVT)

All second-year AVT entries, including checks, were evaluated for product-specific quality and nutritional parameters. Evaluation identified promising entries suitable for chapati, bread, biscuit and pasta making across different production environments. Simultaneously, physico-chemical and nutritional analyses revealed considerable variability for grain appearance, hectolitre weight, protein content, sedimentation value, gluten characteristics, grain hardness, iron and zinc concentrations. The overall mean values for *Triticum aestivum* AVTs were 77.1 kg hl^{-1} hectolitre weight, 13.2% protein, 50.3 ml sedimentation value, 40.7 ppm iron and 34.5 ppm zinc, while *T. durum* AVTs recorded 80.1 kg hl^{-1} hectolitre weight, 12.9% protein, 41.5 ppm iron, 39.7 ppm zinc and 6.8 ppm yellow pigment, indicating substantial variation among entries evaluated across agro-climatic zones.

The promising entries identified for individual quality traits are presented in the subsequent tables.

Promising *T. aestivum* genotypes for different end product quality

Parameter	Zone	Condition	Genotypes
Biscuit (Spread Factor ≥10.0)	**NHZ**	RF-LS	HS490(C) (11.8)
	NWPZ	RITS	NIAW3170 (C), DBW296 (C), HI1653 (C)
	NEPZ	ILS	DBW458*, SVPL-22-02*
	PZ	ILS	HI1697*, HI1696*
		RITS	NIAW3170 (C)

Promising genotypes for various nutritional quality parameters

Parameter	Zone	Condition	Genotypes
			(T. aestivum)
Protein (≥12.5%)	**NHZ**	RF-TS	VL2063, VL907(C)
		RF-LS	VL3040M*, VL3041, VL3038, VL3043, VL3042, VL3039, HS720, HPW521, HS721, HPW520, VL892 (C)
	NWPZ	ITS	RAJ4595, PBW970, HD3499, HP1986, HD3086 (C), HD3386 (C)
		ILS	HD3508, HD3541, DBW492, DBW493, HD3542, BUBW1, PBW980, UP3156, WH1353, NW8122, PBW979, DBW495, HD3505, WH1355, HD3507, JKW261 (C), HD3059 (C), PBW771 (C), DBW173 (C)
		RITS	DBW465*, DBW467*, DBW466*, DBW499, NIAW3170 (C), DBW296 (C), HI1653 (C)
	NEPZ	ITS	HD3515M*, DBW487, HD3249 (C), DBW187 (C), PBW826 (C), HD3086 (C)
		ILS	UP3145*, HP1983*, DBW458*, SVPL22-02*, HD3505, DBW492, PBW976, HD3508, DBW491, DBW493, UP3156, WH1353, K2407, NW8104, BRW3975, UP3157, DBW493, HD3507, HD3504, HD3506, PBW980, WH1355, RAJ4597, HD3118 (C), HI1621 (C), HI1563 (C), PBW833 (C)
		RITS	K2410, K1317 (C), HD3293 (C)
	CZ	ITS	DBW509*, MP1401*, GW569, GW322 (C), MACS6768 (C)
		ILS	NIAW4621*, MACS6854*, MP3598*, PBN2023-19, HI1709, MACS6885, MACS6869, GW572, HD3509, HI1708, HI1634 (C), CG1029 (C), HD2932 (C), MP4010 (C)
		RITS	NIAW4533*, HI1700*, GW573, DBW110 (C), CG1040 (C), DBW359 (C)
		IRES	DBW507, MP1399 (C), DBW303 (C), DBW377 (C), DBW187 (C), DBW327 (C)
	PZ	ITS	HD3543, UAS3044, PWU49, UP3163, PBW1012, MACS6887, GW322 (C), MACS6222 (C), DWR162 (C)
		ILS	MP3598*, HI1697*, NIAW4621*, MACS6854*, NIAW4624*, HI1696*, MP1409, MACS6869, NIAW4741, RAJ4083 (C), HD2932 (C), HD3090 (C), HI1633 (C)
		RITS	UAS3034*, DBW503, NIAW4649, MACS6877, UAS3038, MACS6870, NIAW3170 (C), HI1605 (C)
Sedimen-tation value (> 60 ml)	**NHZ**	RF-LS	VL3043, HS720
	NWPZ	ILS	DBW493, HD3542, UP3156, WH1353
	NEPZ	RF-TS	HD3249 (C), DBW187 (C)
		ILS	UP3145*, HD3505, DBW495, UP3156, WH1353, BRW3975, DBW493, PBW980, WH1355
	CZ	IRES	DBW187 (C)
Hardness Index (< 35)	**PZ**	ITS	UP3163
		RITS	NIAW3170 (C)
Iron (≥40ppm)	**NHZ**	RF-TS	VL2064M*, VL907 (C), HS507 (C), HS562 (C)
		RF-LS	VL3040M*, HPW522, VL3041, VL3038, VL3043, VL3042, VL3039, HS720, HPW521, HS721, HPW520 VL892 (C)
	NWPZ	ITS	RAJ4595, UP3152, PBW974, PBW970, PBW826 (C), HD3086 (C), HD3386 (C)
		ILS	HD3508, DBW492, BUBW1, PBW980, NW8122, WH1355, PBW771 (C)
		RITS	NIAW3170 (C), PBW644 (C)
	NEPZ	ITS	HD3515M*, DBW487, PBW826 (C), HD3086 (C)
		ILS	UP3145*, HD3508, NW8104, DBW493, HI1621 (C), HI1563 (C)
		RITS	DBW500
	CZ	ITS	DBW509*, MACS6768 (C)
		ILS	PBN2023-19, HI1709, MACS6885, MACS6869, HD3509, HI1634 (C), CG1029 (C), MP4010 (C)

Parameter	Zone	Condition	Genotypes
		RITS	NIAW4533*, HI1700*, DBW359 (C)
		IRES	DBW507, MP1399 (C), DBW377 (C)
	PZ	ITS	HD3543, UAS3044, PWU49, UP3163, PBW1012, MACS6887, GW322 (C), MACS6222 (C), DWR162 (C)
		ILS	MP3598*, HI1697*, NIAW4621*, MACS6854*, NIAW4624*, HI1696*, HI1699*, GW572, UAS3037, MP1409, MACS6869, NIAW4741, RAJ4083 (C), HD2932 (C), HD3090 (C), HI1633 (C)
		RITS	UAS3034*, HI1700*, DBW503, NIAW4649, MACS6877, UAS3038, HI1711, MACS6870, NIAW3170 (C), HI1605 (C)
Zinc (≥ 40ppm)	**NHZ**	RF-TS	HS507 (C)
		RF-LS	VL3041
	NWPZ	ILS	DBW493, WH1355, PBW771 (C)
	CZ	ITS	DBW509*
		ILS	MP3598*, PBN2023-19, HD3509, HI1634 (C), MP4010 (C)
	PZ	ILS	GW572
		RITS	NIAW4649
			(T. durum)
Protein (>13.0%)	**CZ**	ITS	MACS4158(d), HI8861(d), HI8860(d), MACS4154(d), HI8865(d), UAS489(d), HI8737(d) (C)
		RITS	UAS490(d), DDW71(d), BUDW3(d), HI8862(d), HI8863(d), HI8823(d) (C), HI8627(d) (C)
	PZ	ITS	PDW367(d)*, GW1375(d), MACS3949(d) (C)
		RITS	HI8863(d), BUDW03(d)
Sedimentation	**NWPZ**	ITS	HD3386 (C)
value (≥ 40 ml)	**CZ**	RITS	DDW71(d)
Yellow Pigment	**NWPZ**	ITS	DDW69, WHD943 (C)
(>7.0ppm)	**CZ**	ITS	MACS4158(d), HI8860(d), MACS4154(d), UAS489(d), HI8859(d), HI8713(d) (C)
		RITS	UAS490(d), DDW71(d), HI8863(d), HI8823(d) (C), HI8627(d) (C)
	PZ	ITS	PDW367(d)*
		RITS	UAS490(d), HI8863(d), UAS478(d) (C)
Iron (≥ 40ppm)	**NWPZ**	ITS	MACS4154, GW1375, DDW69, PDW291 (C), WHD943 (C)
	CZ	ITS	MACS4158(d), HI8860(d), MACS4154(d), HI8865(d), HI8859(d), HI8737(d) (C), HI8713(d) (C)
		RITS	UAS490(d), BUDW3(d), HI8862(d), HI8863(d), HI8823(d) (C)
	PZ	ITS	WHD969(d)*, MACS4146(d)*, HI8854(d)*, HI8853(d)*, HI8858(d)*, PDW367(d)*, MACS4147(d)*, GW1370(d)*, UAS485(d)*, NIDW1557(d)*, HI8855(d)*, HI8849(d) (C), MACS3949(d) (C), HI8865(d), GW1375(d)
		RITS	UAS490(d), HI8863(d), BUDW03(d), HI8862(d), UAS478(d) (C), NIDW1149(d) (C)
Zinc (≥ 40ppm)	**NWPZ**	ITS	GW1375
	CZ	ITS	MACS4158(d), HI8861(d), HI8860(d), MACS4154(d), HI8865(d), UAS489(d), HI8859(d), HI8737(d) (C), HI8713(d) (C)
		RITS	UAS490(d), BUDW3(d), HI8862(d), HI8863(d), HI8823(d) (C)
	PZ	ITS	HI8854(d)*, HI8858(d)*, PDW367(d)*, HI8865(d), HI8849(d) (C)
		RITS	HI8863(d), BUDW03(d), HI8862(d), UAS478(d) (C)

Variability in the quality parameters of *T. aestivum* in AVT's

Parameter	NWPZ	NEPZ	CZ	PZ	NHZ	Overall
GAS (Max. 10.0)	6.3 (5.9-6.7)	5.9 (5.2-6.3)	6.6 (5.9-7.3)	6.3 (5.9-6.9)	6.7 (6.1-7.1)	6.3 (5.2-7.3)
Hectolitre weight (kg/hl)	75.9 (72.2-79.0)	71.7 (67.5-75.1)	78.6 (73.0-82.7)	78.8 (75.5-82.5)	80.3 (76.5-82.1)	77.1 (67.5-82.7)
Protein content (%)	13.2 (12.2-15.3)	13.0 (11.9-14.7)	14.2 (13.0-15.1)	13.1 (12.0-14.1)	12.6 (11.1-14.4)	13.2 (11.1-15.3)

Parameter	NWPZ	NEPZ	CZ	PZ	NHZ	Overall
Sedimentation value (ml)	53.6 (36.1-65.7)	54.9 (42.7-66.4)	47.0 (37.6-60.5)	44.6 (34.9-55.6)	51.3 (40.0-70.2)	50.3 (34.9-70.2)
Phenol test (Max. 10)	6.0 (3.3-7.0)	6.0 (3.0-7.5)	4.5 (1.8-6.4)	4.7 (2.2-6.8)	5.1 (3.2-7.5)	5.3 (1.8-7.5)
Grain hardness index	58.0 (43.0-73.5)	61.7 (49.5-76.5)	70.9 (63.5-78.0)	68.3 (16.5-82.5)	67.0 (56.5-78.0)	65.2 (16.5-82.5)
Iron (ppm)	39.8 (37.6-41.9)	39.3 (36.6-43.0)	40.2 (37.5-43.8)	43.2 (40.4-49.4)	41.0 (37.9-44.0)	40.7 (36.6-49.4)
Zinc (ppm)	33.9 (26.4-43.7)	29.5 (24.3-36.7)	37.7 (31.6-48.9)	35.9 (28.8-42.6)	35.6 (28.4-44.7)	34.5 (24.3-48.9)
Wet gluten (%)	24.7 (20.3-27.4)	26.2 (21.3-28.3)	31.7 (27.5-35.3)	26.8 (20.1-31.3)	28.3 (20.9-37.0)	27.5 (20.1-37.0)
Dry gluten (%)	8.1 (6.7-8.7)	8.8 (7.1-9.4)	10.3 (8.8-11.4)	8.9 (6.7-10.2)	9.0 (6.6-11.9)	9.0 (6.6-11.9)

Variability in the quality parameters of *T. durum* in AVT's

Parameter	NWPZ	CZ	PZ	Overall
Grain appearance score (Max. 10.0)	6.9 (6.7-7.2)	7.5(7.0-8.0)	7.2(6.5-7.9)	7.2(6.5-8.0)
Hectolitre weight (kg/hl)	78.7 (77.4-80.4)	80.9 (78.1-83.1)	80.7 (77.6-83.3)	80.1 (77.4-83.3)
Protein content (%)	12.2 (10.9-12.8)	13.9 (12.7-14.8)	12.6 (11.3-14.0)	12.9 (10.9-14.8)
Sedimentation value (ml)	34.0 (25.4-48.6)	33.1 (23.7-45.4)	32.3 (21.4-39.2)	33.1 (21.4-48.6)
Phenol test (Max. 10)	0.8 (0.0-6.6)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.3 (0.0-6.6)
Grain hardness index	67.1 (57.0-76.0)	83.3 (78.0-89.0)	79.5 (67.0-91.0)	76.6 (57.0-91.0)
Iron (ppm)	40.5 (37.9-44.0)	41.3 (39.1-44.7)	42.7 (38.8-46.1)	41.5 (37.9-46.1)
Zinc (ppm)	38.2 (34.4-40.2)	41.1 (31.8-48.1)	39.8 (31.1-46.4)	39.7 (31.1-48.1)
Yellow pigment (ppm)	6.7 (5.5-8.8)	7.6 (5.3-10.2)	6.0 (3.6-8.2)	6.8 (3.6-10.2)
Yellow berry (%)	6.5 (0.0-21.7)	0.4 (0.0-5.0)	8.5 (0.0-26.7)	5.1 (0.0-26.7)

National Initial Varietal Trials (NIVTs)

Quality evaluation of NIVT entries was carried out across the respective production zones using standard analytical procedures. Considerable variation was observed among trials for end-use quality and nutritional parameters. In bread wheat, overall mean protein content ranged from 11.3 to 14.3%, sedimentation value from 39.1 to 57.3 ml, iron concentration from 38.5 to 42.7 ppm, and zinc concentration from 32.7 to 40.8 ppm. In durum wheat, overall mean protein content ranged from 11.3 to 14.3%, iron concentration from 41.3 to 42.1 ppm, zinc concentration from 38.4 to 40.0 ppm, and yellow pigment from 6.4 to 6.5 ppm. The detailed trial-wise results are presented in the respective tables.

Average values of different quality parameters in NIVT trials

T. aestivum

Trial	Zone	GAS (Max 10)	Hectolitre Weight (Kg/hl)	Protein (%)	Sedimentation value (ml)	Phenol test (Max 10)	Yellow Berry (%)	Yellow Pigment (ppm)	Fe (ppm)	Zn (ppm)
NIVT 1A	NWPZ	6.3	75.0	11.2	57.0	4.5	-	-	39.0	36.1
NIVT1A	NEPZ	5.1	68.8	12.1	57.8	4.9	-	-	42.5	29.5
NIVT1A	Overall	5.9	72.9	11.5	57.3	4.7	-	-	39.9	34.5
NIVT1B	NWPZ	6.5	75.7	12.5	47.8	4.9	-	-	39.9	36.6
NIVT1B	NEPZ	6.0	69.2	13.4	49.0	5.3	-	-	43.1	30.0

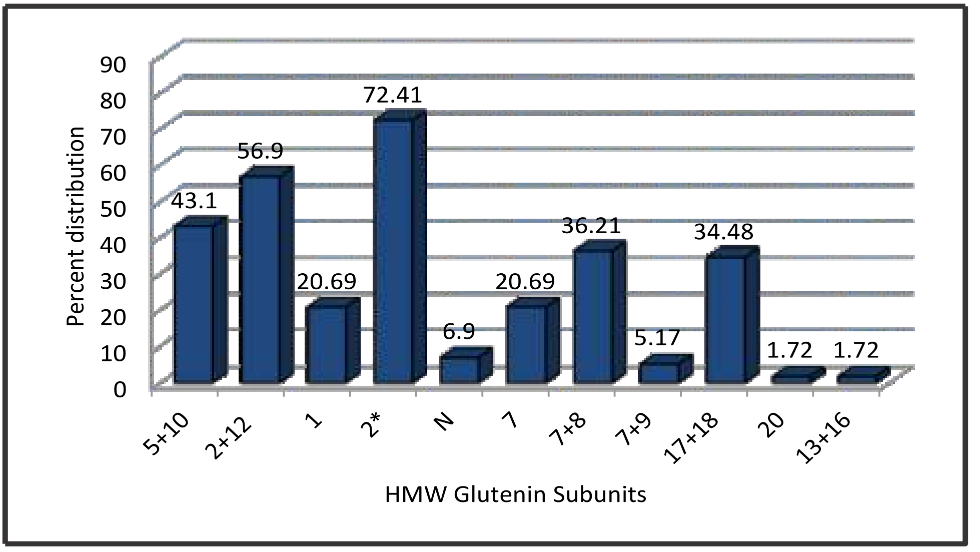
Trial	Zone	GAS (Max 10)	Hectolitre weight (Kg/hl)	Protein (%)	Sediment ation value (ml)	Phenol test (Max 10)	Yellow berry (%)	Yellow pigment (ppm)	Fe (ppm)	Zn (ppm)
NIVT1B	Overall	6.4	74.1	12.7	48.1	5.0	-	-	40.4	35.7
NIVT2	CZ	5.6	79.4	13.6	39.0	5.8	-	-	40.8	41.7
NIVT2	PZ	5.8	79.6	13.2	39.2	6.0	-	-	41.7	37.3
NIVT2	Overall	5.7	79.5	13.4	39.1	5.9	-	-	41.2	39.8
NIVT3A	NWPZ	6.2	74.9	13.4	50.3	5.2	-	-	38.9	34.9
NIVT3A	NEPZ	5.7	70.5	13.0	48.7	5.5	-	-	37.4	28.7
NIVT3A	Overall	6.1	73.4	13.3	49.8	5.3	-	-	38.5	33.4
NIVT3B	CZ	6.0	78.3	12.6	49.6	5.2	-	-	40.8	41.9
NIVT3B	PZ	5.6	77.7	11.7	48.8	5.6	-	-	42.6	39.2
NIVT3B	Overall	5.8	78.1	12.2	49.2	5.4	-	-	41.4	40.8
NIVT 5A	NWPZ	6.0	74.5	11.2	54.7	4.4	-	-	40.4	34.4
NIVT 5A	NEPZ	5.8	70.5	12.3	52.4	5.8	-	-	42.1	30.5
NIVT 5A	Overall	5.9	73.2	11.6	53.9	4.9	-	-	41.0	32.7
NIVT 5B	CZ	6.4	81.8	14.7	47.1	6.5	3.1	3.9	42.4	37.5
NIVT 5B	PZ	6.8	81.6	13.8	45.1	7.0	4.9	4.0	43.2	40.0
NIVT 5B	Overall	6.6	81.7	14.3	46.3	6.7	3.9	4.0	42.7	38.6
NIVT 6	NWPZ	6.5	74.4	13.3	48.0	5.7	-	-	39.4	36.0
NIVT 6	CZ	6.2	79.8	14.2	40.9	6.0	-	-	41.7	39.5
NIVT 6	Overall	6.3	76.8	13.7	44.8	5.8	-	-	40.5	37.6

T. durum

Trial	Zone	GAS (Max 10)	Hectolitre weight (Kg/hl)	Protein (%)	Sed. value (ml)	Phenol test (Max 10)	Yellow Berry (%)	Yellow Pigment (ppm)	Fe (ppm)	Zn (ppm)
NIVT 4	NWPZ	6.8	77.6	12.5	38.3	-	5.8	7.2	41.7	36.9
NIVT 4	CZ	5.0	78.7	10.7	31.6	-	0.4	6.0	41.2	42.6
NIVT 4	PZ	4.4	78.6	10.2	29.9	-	7.4	5.6	40.6	36.0
NIVT 4	Overall	5.6	78.2	11.3	34.0	-	4.4	6.4	41.3	38.4
NIVT 5B	CZ	7.0	83.0	14.9	24.7	0.4	5.2	6.6	41.9	38.8
NIVT 5B	PZ	7.1	83.5	13.5	25.3	0.3	6.2	6.4	42.3	41.6
NIVT 5B	Overall	7.1	83.2	14.3	25.0	0.3	5.6	6.5	42.1	40.0

High molecular weight glutenin subunits (HMWGS) of *T. aestivum*

High molecular weight glutenin subunit (HMWGS) composition was determined for 58 second-year AVT entries, including checks. Subunit 2+12 was observed in 56.9% of entries, followed by 5+10 in 43.1%. Among Glu-B1 alleles, 7+8 (36.2%) and 17+18 (34.5%) were the predominant subunit combinations. Glu-1 quality scores of 8 and 10 were recorded in 58.6% and 24.1% of entries, respectively. The distribution of HMWGS alleles among coordinated trial entries is presented in Figure.



Percent distribution of High Molecular Weight Glutenin subunits (HMWGS) of *T. aestivum*

Quality Component and Wheat Biofortification Nursery (QCWBN)

During 2025–26, 49 QCWBN entries were evaluated at 13 locations representing four agro-climatic zones for grain appearance score, hectolitre weight, protein content, sedimentation value, and grain iron and zinc concentrations. Evaluation was undertaken to identify entries satisfying the minimum qualification criteria prescribed for QCWBN during the 63rd AICRP-W&B Workshop (2024), namely protein (≥13%), iron (≥42 ppm) and zinc (≥42 ppm).

Zone	Entries meeting two quality criteria	Entries meeting all three quality criteria
NWPZ	DBW 443 (C), MACS6222 (C), UASQ342, CRPQK25-01, GW-2025-1047, HI1726	Nil
NEPZ	Nil	Nil
CZ	DBW 443 (C), MACS6222 (C), UASQ342, GW-575, NIAW-4871, QYT2522, WBL4234, HI1727, GW-2025-1047, HI1726, WBL4231, QBP-25-12	UASQ340, GW-576, MACS-6949, HI8871, BHU3
PZ	DBW 443 (C), HI8737 (d) (C), UASQ340, GW-575, GW-576, NIAW-4871, CRPQK25-01, WBL4232, K2403, HI8871, HI1726, WBL4231, RWP-2456, GRU22/30, QBP-25-10, QBP-25-12	MACS6222 (C), QYT2522, HI1727, GW-2025-1047, BHU3

Quality evaluation during 2025–26 generated comprehensive information on end-use quality, processing attributes, grain nutritional parameters and HMWGS composition of coordinated trial material across diverse production environments. The data provide quality profiles of experimental entries and support quality-based assessment during varietal evaluation, recommendation and release.

BARLEY NETWORK

During the *Rabi* 2025–26 season, barley occupied about 5.66 lakh hectares with an estimated production of 17.96 lakh tonnes and an average productivity of approximately 3.1 t ha^{-1} (3rd Advanced Estimates, 2025-26). Rajasthan remained the leading barley-producing state, followed by Uttar Pradesh, Madhya Pradesh, Haryana, Himachal Pradesh, Uttarakhand, Punjab, and Bihar. The crop benefited from generally favourable weather conditions during most of the growing season, which supported the good crop establishment, grain filling, and overall productivity.

Crop Improvement

Barley varieties identified by the variety identification committee during 64th All India Wheat and Barley Workers' Meet, 2025

Variety	Developed by	Zone	Production condition	Avg. yield (q/ha)	Pot. Yield (q/ha)	Special features
BHS 497 (Pusa Shakuntala)	IARI-RS, Shimla	NHZ	Rainfed, timely sown	21.90	31.80	Hulless Barley
DWRB 244	ICAR-IIWBR, Karnal	NWPZ	Irrigated, Timely Sown	40.84	57.51	Hulless Barley
DWRB 235	ICAR-IIWBR, Karnal	NWPZ	Irrigated, Timely Sown	56.23	77.58	Malt Barley
DWRB 238	ICAR-IIWBR, Karnal	NWPZ	Irrigated, Timely Sown	56.44	82.08	Malt Barley
RD 3064 (Karan Barley 1)	SKNAU, Durgapura	NWPZ	Irrigated, Timely Sown	56.22	91.67	Malt Barley

Registration of Genetic Stocks

During 2025-26, three novel barley genetic stocks namely, BHS 490, DWRBG 28 and DWRBG 34 were registered for their unique traits such as resistance to leaf and yellow rust, extra early maturity and hulled barley with higher limit dextrose activity with ICAR-NBPGR.

Genetic stocks registered with ICAR-NBPGR, New Delhi during 2025-26

SN	Name	INGR No.	Year	Parentage	Trait	Institute
1	BHS 490 (BBM 879)	25007	2025	HBL 704 / BHS 369	Seedling resistance to all the pathotypes of leaf rust. Adult plant resistance to yellow rust with ACI less than 10 (1.5) and highest susceptibility score of 5S. Adult plant resistant to leaf rust (highest susceptibility score=0).	ICAR-IARI RS, Shimla, HP
2	DWRBG 28	25008	2025	DWRB 123 /EB 921	Extra early maturity (112 days). High protein content (14.2%).	ICAR-IIWBR, Karnal, Haryana

SN	Name	INGR No.	Year	Parentage	Trait	Institute
3	DWRBG 34	26007	2026	DWR 17/ PL 172	Hulled barley with higher limit Dextrinase activity (0.375 U/ml, 34% higher than best check) suitable for malting quality	ICAR-IIWBR, Karnal, Haryana

Trials for Crop Improvement

Coordinated Yield Evaluation Trials

During *Rabi* 2025–26, a total of 232 test entries from 14 centres, along with 51 check varieties, were evaluated through 17 barley yield evaluation trial series across four agro-ecological zones: the Northern Hills Zone (NHZ), North Western Plains Zone (NWPZ), North Eastern Plains Zone (NEPZ), and Central Zone (CZ). These trials represented diverse production environments, including rainfed, saline, and alkaline conditions. Of the 174 trial sets scheduled, 164 were conducted and reported. Following scrutiny by the Zonal Monitoring Teams and data quality assessment, 137 trial sets qualified for zonal pooled analysis. Data from the IVT-IRTS-DPB-NEPZ trial were available from only one location and were therefore considered insufficient for decision-making regarding the advancement of test entries.

Promising Entries in AVTs/IVTs during 2025-26

A total of 52 test entries exhibited statistically significant superiority in grain yield over their respective best check varieties in one or more trial series, indicating their high yield potential and broad adaptability across diverse production environments. In addition, 33 entries showed numerical superiority over the best checks. Based on field observations by the Zonal Monitoring Teams, six test entries (UPB1141, BH 1078, DWRB 2510, DWRB 1139, NDB 1851, and DWRB 2534) were recommended for discontinuation due to deficiencies such as poor genetic purity, severe disease incidence, and/or poor germination.

Promising entries in different barley yield evaluation trials during 2025-26

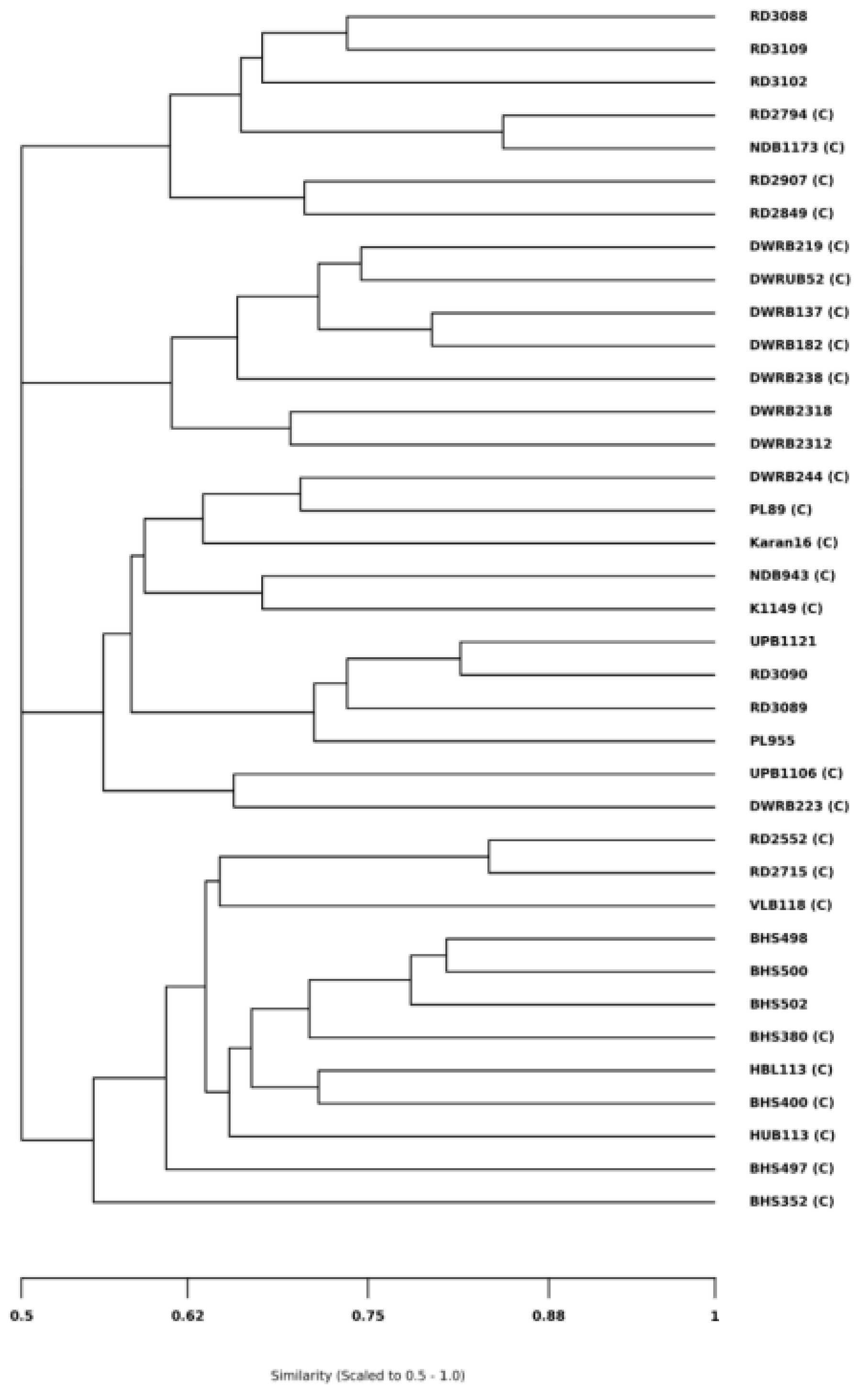
SN	Trial Name	Zone	Significantly superior in grain yield over the best check
A.	**Feed Barley (Plains)**		
1.	IVT-IRTS-FB	NWPZ	DWRB 2501, RD 3178 and DWRB 2547
2.	AVT-IRTS-FB	NWPZ	RD 3128, PL 965, RD 3126, PL 968, and PL 978
3.	IVT-IRTS-FB	NEPZ	PL 986, RD 3176, DWRB 2501, BH 1076 and DWRB 2543
4.	AVT-IRTS-FB	NEPZ	-
5.	IVT-IRTS-FB	CZ	PL 986
6.	AVT-IRTS-FB	CZ	BH 1065 and RD 3126
B.	**Dual Purpose Barley (Plains)**		
7.	IVT-IRTS-DPB	NWPZ	KB 2407 and PL 994

SN	Trial Name	Zone	Significantly superior in grain yield over the best check
8.	AVT-IRTS-DPB	NWPZ	DWRB 2318*
9.	IVT-IRTS-DPB	NEPZ	-
10.	IVT-IRTS-DPB	CZ	RD 3166, DWRB 2504 and RD 3169
C.	**Malt Barley (Plains)**		
11.	IVT-IRTS-MB	NWPZ	DWRB 2515
12	AVT-IRTS-MB	NWPZ	DWRB 2312*
D.	**Hulless Barley (Plains)**		
13.	IVT-IRTS-HLB	NWPZ	DWRB 2523, RD 3158, DWRB 2539, DWRB 2527, PL 999, RD 3161, DWRB 2530
14.	AVT-IRTS-HLB	NWPZ	DWRB 2436, DWRB 2442 and RD 3089*
15.	IVT-IRTS-HLB	NEPZ	-
16.	AVT-IRTS-HLB	NEPZ	DWRB 2436, PL 976, DWRB 2408 and DWRB 2410
17.	IVT-IRTS-HLB	CZ	DWRB 2523 and DWRB 2539
18.	AVT-IRTS-HLB	CZ	RD 3089*, RD 3088*, and PL 976
E.	**Rainfed Trial (Hills)**		
19.	AVT/IVT-RF-FB	NHZ	-
20.	AVT/IVT-RF-DPB	NHZ	-
21.	AVT/IVT-RF-HLB	NHZ	UPB 1134* and HBL 902
22.	Rainfed Trial (Plains)		
23.	AVT/IVT-RF	NEPZ	RD 3131, NDB 1841, DWRB 2518, DWRB 2519, RD 3187, DWRB 2520, and UPB 1143
F.	**Salinity-Alkalinity Stress Trials**		
24	AVT/IVT-SAL/ALK	Plains	-

***AVT-II entries**

Molecular Characterization of Barley AVT Final-Year Entries (2025–26)

During 2025–26, molecular profiling of 37 barley genotypes (12 AVT entries and 25 checks) was conducted using 44 SSR/STS markers distributed across chromosomes 1H–7H. The markers detected 98 allele-size classes, with moderate polymorphism (mean PIC: 0.402), indicating useful genetic variation among the evaluated genotypes. UPGMA-based clustering revealed genetic diversity among the entries, with no two genotypes showing complete molecular similarity. The marker profiles supported genotype identification, assessment of genetic relatedness, comparison of AVT entries with checks, and selection of diverse parents for future barley improvement programmes.



UPGMA-based dendrogram of barley AVT final-year entries and checks (2025–26).

Breeder Seed Allocation and Production (2025-26)

During 2025–26, a total of 720.20 q breeder seed of 28 barley varieties was allocated to nine Breeder Seed Production (BSP) centres located in seven states under BSP-I. Among the varieties, the highest breeder seed demand was recorded for DWRB 219 (106.0 q), followed by DWRB 137 (105.10 q) and DWRB 223 (96.0 q). Against an allocation of 680.20 q covering 23 varieties, a total of 745.75 q breeder seed was produced, resulting in a surplus of 65.55 q. The major contributions came from ICAR-IIWBR, Karnal (222.50 q), BISA, Ludhiana (205.0 q), and RARI, Durgapura (200.0 q).

Test Stock Multiplication of Newly Identified Barley Varieties

For rapid seed multiplication of newly identified barley varieties, National Seed Corporation (NSC) was assigned the target for test stock multiplication of five varieties identified during the 2025 workshop. NSC produced a total of 32.56 q seed of these varieties during 2025–26 at its farms located at Hisar, Suratgarh, Jetsar, and Sardargarh. The production included RD 3064 (12.80 q), DWRB 238 (11.25 q), DWRB 235 (6.08 q), DWRB 244 (2.08 q), and BHS 497 (0.35 q), facilitating the availability of initial seed stock for future varietal dissemination. DWRB-219 indented the highest (106 q), followed by DWRB-137 (105.10 q) and DWRB-223 (96 q). RD-2899 (77 q) and DWRUB-52 (50 q) had comparatively lower indent quantities, indicating a stronger demand and preference for DWRB-219 and DWRB-137 among stakeholders.

Barley Germplasm

During 2025–26, 6 AVT final-year barley entries were characterized for 32 DUS traits as per barley DUS guidelines. A total of 261 germplasm accessions were rejuvenated and evaluated, identifying promising materials for earliness, early maturity, and higher thousand grain weight. 642 germplasm accessions were supplied to national indenters, and two accessions were received through germplasm exchange. The barley germplasm repository at ICAR-IIWBR, Karnal maintained 8,543 accessions under medium-term storage, with addition of 56 new accessions including 45 wild *Hordeum spontaneum* accessions.

ICARDA-Preliminary Yield Evaluation Trials

Two ICARDA Preliminary Yield Trials (PYTs), comprising 400 lines each, were evaluated at ICAR-IIWBR, Seed and Research Farm, Hisar. The trials included ASAPYT for arid and semi-arid conditions under limited water availability and

FFMPYT for feed, fodder, and malt purposes under full irrigation. Grain yield evaluation identified promising entries, with yield levels obtained as high as 5681 kg ha^{-1} in ASAPYT and 5768 kg ha^{-1} in FFMPYT. The check variety 'Khnata' performed well, ranking fourth in ASAPYT with a yield of 4985 kg ha^{-1}.

Crop Protection

Plant Pathology

Status of barley diseases and insect pests

To assess the status of the barley crop health, a survey was conducted in Jammu and Samba districts on 30^{th} December 2025 and reported no incidence of yellow rust, although a minor infestation of pink stem borer was observed at Bhagwanai Chak (Samba district). During December 2025 and January 2026, cereal cyst nematode (CCN) infestation was observed in parts of Jaipur and Sikar districts, while no CCN infection was detected in samples collected from ARSS, Diggi, Tonk. No yellow rust incidence was observed in barley fields in Sitarganj and Kalsi, Uttarakhand as well as Uttar Pradesh during February 2026. However, aphids, covered smut, and mild leaf blight were observed in a few locations in UP. Overall, barley crop health remained satisfactory throughout the survey period, with no yellow rust occurrence and only localized incidences of insect pests and diseases. There was no report from any centre for presence of any of quarantined pests (disease / insect pest) in their respective areas during the crop season 2025-26.

Status of resistance in breeding lines and advanced entries

Adult Plant Resistance (APR)

A total 751 barley breeding lines were screened during the crop season 2025-26 under various nurseries (IBDSN, NBDSN and EBDSN) for resistance against various diseases, aphid and CCN at different cooperating centres. There were 512 entries under IBDSN, 227 were under NBDSN and 12 under EBDSN. Seedling Resistance Test (SRT) for NBDSN entries was conducted at IIWBR, Regional station, Flowerdale, Shimla.

Initial Barley Disease Screening Nursery (IBDSN) 2025-26

During 2025-26, total 512 entries contributed by 14 breeding centres under IBDSN were screened for resistance against major diseases *viz*., stripe rust and leaf blight at various coordinating centres. The screening of stripe rust was done at Almora, Bajaura, Ludhiana, Durgapura, Karnal and Jammu and for leaf blight at Ayodhya, Pantnagar, Kanpur, Kalyani, Coochbehar and Varanasi.

Among 512 entries, 41 were found free from yellow rust (ACI = 0) and 349 entries showed resistant reaction having ACI ≤ 10. In case of leaf blight screening, no entry was found even moderately resistant with an average score 14-35 and HS ≤ 57.

National Barley Disease Screening Nursery (NBDSN) 2025-26

The NBDSN entries were screened for stripe rust resistance at hot spot centres that include Almora, Bajaura, Hisar, Ludhiana, Durgapura, Karnal, and Jammu. Leaf rust screening was done at Ludhiana and Jammu. The leaf blight screening was done at Ayodhya, Pantnagar, Dharwad, Kanpur, Varanasi, Coochbehar and Kalyani. CCN screening was done at Durgapura, Hisar and Udaipur centres. In case of stripe rust data of Hisar; and in case of leaf rust data of Ludhiana were not considered due to low disease development on the infectors.

Out of 227 entries, 32 were found free from stripe rust, 169 entries showed resistant reaction having ACI ≤ 10. In case of leaf blight screening, no entry was found even moderately resistant with an average score 14-35 and HS ≤ 57.

Area Under Disease Progress Curve (AUDPC) of Leaf Blight for NBDSN Entries

A convenient option of identifying lines that allow slow disease development is the estimation of the AUDPC which takes into account all the factors collectively leading to manifestation of disease progress in a genotype. The AUDPC was calculated and on the basis of mean, the entries with AUDPC score less than 100 are categorized as resistant and from 101 to 500 are categorized as moderately resistant. The performance of entries based on average of cumulative AUDPC is given below:

All Centre Average AUDPC	Entries
Up to 100	Nil
101 - 500	BH 1077, UPB 1134

Elite Barley Disease Screening Nursery (EBDSN, 2025-26)

The nursery was constituted with entries showing resistance to different disease in previous years in NBDSN and EBDSN. During 2025-26, total 12 entries were screened in EBDSN. The screening of stripe rust was done at Bajaura, Hisar, Ludhiana, Durgapura, Karnal, Almora and Jammu. Leaf rust screening was done at Ludhiana and Jammu. The leaf blight screening was done at Ayodhya, Pantnagar, Kanpur, Kalyani, Coochbehar and Varanasi. Data of Hisar (stripe rust) and Ludhiana (leaf rust) was not considered due to low disease development on infector(s). CCN screening was done at Durgapura, Hisar and Udaipur centres.

Confirmed Sources of Resistance

Out of 12 entries screened in EBDSN, the following entries were confirmed for resistance against the particular disease.

Yellow rust, ACI = 0	IC138034, IC138058, IC138069, IC138079, IC445756
Yellow rust, ACI > 0 to 10,	IC138029, IC138033, IC138054, IC138065, IC138066, IC138072

NBDSN and EBDSN Screening Against CCN

A total 227 entries of NBDSN and 12 entries of EBDSN were screened against the Cereal Cyst Nematode (CCN) at three locations *viz.*, Hisar, Durgapura and Udaipur. In both NBDSN and EBDSN, all of the entries fall in the category of susceptible or highly susceptible having >9.1 cysts plant^{-1}.

Experiments on Leaf Blight Disease and CCN

Out of eight different cultivars *viz.,* Jyoti, RD 2508, Bilara-2, RD 2552, Raj Kiran, DWRB 137, DWRB 219, DWRB 223 tested for the susceptibility against leaf blight, RD 2508 was found most susceptible with maximum mean disease severity (78) and with the lowest average yield (27.74 q/ha).

Field evaluations at Hisar, Durgapura, and Udaipur showed that *Purpureocillium lilacinum* @ 2.5 kg/ha mixed with 100 kg FYM was the most effective eco-friendly treatment, consistently reducing nematode populations and improving grain yield. Fluensulfone 2% GR @ 20 kg/ha remained the most effective chemical treatment, while Neem cake, Mustard cake, and Jeevamrit provided moderate to good nematode suppression and yield benefits. Overall, *P. lilacinum* mixed with FYM emerged as the best sustainable option for managing cereal cyst nematode in barley.

Entomology

A total of 227 barley entries were screened under the National Barley Disease Screening Nursery (NBDSN) for resistance to foliar aphids, revealing no highly resistant genotype and indicating limited genetic variability for aphid resistance. Field evaluation of new-generation insecticides demonstrated significant suppression of aphid populations and enhanced grain yield over the untreated control. Dinotefuran 20 SG @ 80 g ha^{-1} (Ludhiana) and Pymetrozine 50% WG @ 240 g ha^{-1} (Vijapur) emerged as the most effective treatments. The study validated the efficacy of timely application of newer insecticidal molecules for effective aphid management and improved barley productivity.

Barley Quality Evaluation

During 2025-26, a total of 1004 barley samples including AVT and IVT entries of malt, hulless, feed, salinity/alkalinity, rain-fed and BQSN trials were analysed for different physical, chemical, malt and nutritional quality parameters.

Malt Barley Quality Evaluation

During 2025-26, a total 186 samples of AVT & IVT malt barley trials received from 6 locations of North Western Plain Zone were analyzed in the barley quality laboratory. The material having desirable traits has been presented in following table.

Promising entries for individual malting quality traits

Trait	Trial Name	Promising Entries
Hectoliter Weight (kg/hl) (>65)	AVT-MB-TS	RD 2849 (C), DWRUB 52 (C)
	IVT-MB-TS	BH 1080, RD 3149, RD 3151, RD 3150, RD 3152, DWRB 219 (C), RD 2849 (C)
Bold Grains (%) (>90)	AVT-MB-TS	DWRB 2312*, DWRB 238 (C)
	IVT-MB-TS	BH 1078, BH 1079, BH 1080, BH 1081, DWRB 2511, RD 3153, PL 989, PL 996, DWRB 238 (C)
Husk Content (%) (<11)	AVT-MB-TS	DWRB 2312*, DWRB 238 (C), RD 2849 (C), DWRUB 52 (C), DWRB 219 (C)
	IVT-MB-TS	All entries except DWRB 2507, DWRB 2509
Grain Beta Glucan (%) (<4)	AVT-MB-TS	NIL
	IVT-MB-TS	NIL
Malt Friability (%) (>70)	AVT-MB-TS	NIL
	IVT-MB-TS	BH 1078, BH 1079, DWRB 2507, DWRB 2508, DWRB 2509, DWRB2510, DWRB 2511, DWRB 2512, DWRB 2513, DWRB 2514, RD 3149, RD 3151, PL 990, DWRB 238 (C)
Hot Water Extract (% fgdb) (>80)	AVT-MB-TS	NIL
	IVT-MB-TS	NIL
Filtration Rate (ml/hr) (>250)	AVT-MB-TS	DWRB 2312*, DWRB 182 (C), DWRB 219 (C)
	IVT-MB-TS	BH 1078, BH 1080, DWRB 2508, DWRB 2509, DWRB 2510, DWRB2511, DWRB 2512, DWRB 2513, DWRB 2514, DWRB 2515, RD 3149, RD 3151, RD 3150, RD 3152, PL 989, PL 990, DWRB 219 (C), RD 2849 (C)
Diastatic Power (0L) (>90)	AVT-MB-TS	All entries have >90 0L
	IVT-MB-TS	All entries have >90 0L except RD 3152, DWRB 219 ©
FAN Content (ppm) (>150)	AVT-MB-TS	All entries have FAN >150 ppm
	IVT-MB-TS	All entries have FAN >150 ppm
**Over all Malt Quality (weighted performance compared to best check)	AVT-MB-TS	DWRB 2312* (21), DWRB 238 (C) (20), RD 2849 (C) (20)
	IVT-MB-TS	DWRB 238 (C) (24), BH 1078 (25), BH 1079 (24), DWRB 2510 (25), DWRB 2511 (25), DWRB 2512 (24), DWRB 2514 (24), RD 3149 (25), RD 3151 (25), PL 989 (24)

***AVT Final Year Entry; **Compared to best check**

Weighted malt quality score AVT entries for malting quality

S.N.	Code	Genotype	HW	Bold	Husk	Pro	BG	Fria	HWE	FR	DP	FAN	Total (30)
1	AVT-MB-NWPZ-4	DWRB 2312*	2	3	2	3	0	1	1	3	3	3	21
2	AVT-MB-NWPZ-1	DWRB 182 (C)	1	0	2	3	2	2	0	3	3	3	19
3	AVT-MB-NWPZ-2	DWRB 238 (C)	2	3	2	3	0	1	1	2	3	3	20
4	AVT-MB-NWPZ-3	RD 2849 (C)	3	0	2	3	1	2	1	2	3	3	20
5	AVT-MB-NWPZ-5	DWRUB 52 (C)	3	0	2	3	1	1	1	2	3	3	19
6	AVT-MB-NWPZ-6	DWRB 219 (C)	2	2	2	3	1	0	0	3	3	3	19

***AVT Final Year; All data from six locations**

Barley Quality Screening Nursery

Two nurseries namely high alpha amylase (BQSN 1) and hulless (BQSN 2) for superior nutritional traits were constituted and evaluated at 6 locations (Karnal, Hisar, Ludhiana, Pant Nagar, Durgapura and Kanpur). The promising genotypes identified are listed in the following table

Promising sources for nutritional quality parameters*

Traits	Promising Entries
TGW (g)	KNB-20-11, LKGSM-2503
Hectoliter Weight (kg/hl)	INBON-HI-(2016)-72, BCU8028, LKGSM-2504
Bold Grain (%)	AM-17 (2018-19)-51, INBON-HI-(2016)-72,
Protein Content (%)	DWRNB21, INBON-HI-(2016)-72, BCU8028,
Beta-glucan (%)	NIL
Phenol Score	AM-17 (2018-19)-51,
TPC (mg GAE/g; dwb)	INBYT-HI-(2017)-6 (B), AM17-(2018-19)-315 (A)
Antioxidant (% discoloration)	AM-17 (2018-19)-71, KNB-2025-1
Fe (ppm)	BCU8028, DWRNB 20,
Zn (ppm)	NIL

***At par or better than best check**

Food, Feed and Dual Purpose Barley

A total of 684 food, feed and dual purpose grain samples from various trials grown at different locations were received and analyzed. The promising entries identified are given below:

Promising entries for individual malting quality traits

Trait	Trial Name	Promising Entries
Thousand Grain Weight (g) (≥40)	AVT-NWPZ	PL891 (C)
	AVT-NEPZ	RD3121
	AVT-CZ	NIL
	IVT-NWPZ	DWRB2532, DWRB2533, DWRB2534, DWRB2535, DWRB2536, DWRB2537, DWRB2538, DWRB2540, RD3158, RD3164
	IVT-NEPZ	DWRB2506, DWRB2523, DWRB2532, DWRB2533, DWRB2534, DWRB2535, DWRB2536, DWRB2538, DWRB2540, PL1000,

Trait	Trial Name	Promising Entries
		RD3158, RD3163, RD3164,
	IVT-CZ	DWRB2533, DWRB2534, DWRB2535, DWRB2536, RD3158, RD3164,
	AVT/IVT-NHZ	UPB1134*, UPB1138, UPB1149, UPB1151,
Hectoliter Weight (kg/hl) (≥70)	AVT-NWPZ	RD3090*, DWRB244 (C), DWRB223 (C), Karan16 (C), PL891 (C)
	AVT-NEPZ	NIL
	AVT-CZ	DWRB2425, RD3088*, RD3120, K1149 (C)
	IVT:-NWPZ	DWRB2505, DWRB2522, DWRB2524, DWRB2525, DWRB2526, DWRB2532, DWRB2533, DWRB2534, DWRB2535, DWRB2537, DWRB2538, RD3162, RD3163, DWRB244 (C), K1149 (C), NDB943 (C)
	IVT-NEPZ	DWRB2537, RD3163, K1149 (C)
	IVT-CZ	DWRB2505, DWRB2522, DWRB2523, DWRB2524, DWRB2526, DWRB2530, DWRB2531, DWRB2532, DWRB2533, DWRB2534, DWRB2535, DWRB2537, DWRB2538, DWRB2539, DWRB2540, PL1000, RD3157, RD3162, RD3163, RD3164, DWRB223 (C), DWRB244 (C), K1149 (C), NDB943 (C)
	AVT/IVT-NHZ	All entries have ≥70 except UPB1134*, UPB1149, UPB1150,
Plump Grain Percentage (>2.5 mm) (≥70)	AVT-NWPZ	NIL
	AVT-NEPZ	DWRB2410,
	AVT-CZ	NIL
	IVT:-NWPZ	DWRB2534, DWRB2535, RD3158, RD3164,
	IVT-NEPZ	DWRB2506, DWRB2523, DWRB2528, DWRB2530, DWRB2531, DWRB2535, DWRB2539, PL999, PL1000, RD3157, RD3158, RD3159, RD3160, RD3161, RD3163, RD3164, UPB1138,
	IVT-CZ	DWRB2535, RD3158,
	AVT/IVT-NHZ	UPB1134*, UPB1149,
Protein Content (%) (≥13)	AVT-NWPZ	NIL
	AVT-NEPZ	DWRB2408, UPB1129, K1149 (C), NDB943 (C)
	AVT-CZ	DWRB2407, DWRB2410, DWRB2425, DWRB2442, RD3088*, RD3089*, RD3119, RD3120, PL891 (C), Karan16 (C), K1149 (C)
	IVT:-NWPZ	DWRB2506, DWRB2522, DWRB2526, DWRB2527, DWRB2528, DWRB2531, DWRB2532, DWRB2533, DWRB2534, DWRB2535, DWRB2536, DWRB2537, DWRB2538, DWRB2540, RD3157, RD3159, RD3161, RD3162, RD3163, RD3164, UPB1138, DWRB223 (C), DWRB244 (C), K1149 (C), NDB943 (C)
	IVT-NEPZ	DWRB2505, DWRB2506, DWRB2522, DWRB2524, DWRB2526, DWRB2528, DWRB2529, DWRB2531, DWRB2533, DWRB2534, DWRB2535, DWRB2536, DWRB2538, DWRB2539, RD3157, RD3159, RD3160, RD3161, RD3162, RD3163, RD3164, UPB1138, DWRB223 (C), DWRB244 (C), NDB943 (C)
	IVT-CZ	All entries have ≥13 % protein except DWRB2523, DWRB2525, PL1000
	AVT/IVT-NHZ	NIL
Grain Beta Glucan (%) (≥6.5)	AVT-NWPZ	DWRB2436, DWRB2442, DWRB244 (C)
	AVT-NEPZ	DWRB2436, DWRB2442
	AVT-CZ	DWRB2442,
	AVT/IVT-NHZ**	UPB1134*, UPB1150,
Fe Content (ppm) (≥42)	AVT-NWPZ	PL891 (C)
	AVT-NEPZ	PL976, UPB1121*, UPB1129, NDB943 (C)
	AVT-CZ	PL891 (C)
	AVT/IVT-NHZ**	NIL
Zn Content (ppm) (≥42)	AVT-NWPZ	NIL
	AVT-NEPZ	NIL
	AVT-CZ	K1149 (C)
	AVT/IVT-NHZ**	NIL
Predicted Glycemic Index	AVT-NWPZ	NIL
	AVT-NEPZ	UPB1121*

Trait	Trial Name	Promising entries
(pGI)$#	AVT-CZ AVT/IVT-NHZ	RD3088* NIL

****Fe and Zn estimated for AVT second year entries only; *AVT Final Year Entry; $Predicted Glycemic index (pGI) was estimated for AVT 2nd year entries only; #superior than best check.**

List of promising hulless barley entries with superior nutritional traits prescribed for biofortification as per criteria of proceeding of AICRPW&B worker's meet of 2024-25 (traits ≥13% protein, >6.5% beta glucan and >42 ppm Fe & Zn)

Sr. No.	Parameters	Promising Entries
AVT-NWPZ	Protein (≥13%)	NIL
	Beta glucan (≥6.5%)	DWRB244 (C) (7.5%), DWRB2442 (6.8%) (AVT-I), DWRB2436 (6.6%) (AVT-I)
	Fe (≥42 PPM)	PL891 (C) (42.6ppm)
	Zn (≥42 PPM)	NIL
AVT-NEPZ	Protein (≥13%)	DWRB2408 (13.2%) (AVT-I), UPB1129 (13.3%) (AVT-I), K1149 (C) (13.2%), NDB943 (C) (13.1%)
	Beta glucan (≥6.5%)	DWRB2436 (6.8%) (AVT-I), DWRB2442 (6.7%) (AVT-I),
	Fe (≥42 PPM)	PL976 (42.4 ppm) (AVT-I), UPB1121* (47.1 ppm) (AVT-II), UPB1129 (47.2 ppm) (AVT-I), NDB943 (C) (48 ppm)
	Zn (≥42 PPM)	NIL
AVT-CZ	Protein (≥13%)	DWRB2407 (13.2%) (AVT-I), DWRB2410 (14.1%)(AVT-I), DWRB2425 (14.9%)(AVT-I), DWRB2442 (13.3%)(AVT-I), RD3088* (13.4) (AVT-II), RD3089*(13.5%)(AVT-II), RD3119 (13.3%), RD3120(15%), PL891 (C) (14%), Karan16 (C) (13.8%), K1149 (C) (13.5%)
	Beta glucan (≥6.5%)	DWRB2442 (7%) (AVT-I),
	Fe (≥42 PPM)	PL891 (C) (45.9 ppm)
	Zn (≥42 PPM)	K1149 (C) (42.5 ppm)
AVT-NH	Protein (≥13%)	NIL
	Beta glucan (≥6.5%)	UPB1134*(6.5%) (AVT-II), UPB1150 (7.6%) (AVT-I)
	Fe (≥42 PPM)	NIL
	Zn (≥42 PPM)	NIL

Promising entries of AVT and IVT for individual grain quality trait# in dual purpose barley trials

Trait	Trial Name	Promising Entries
Thousand Grain Weight (g)	AVT-NWPZ AVT/IVT-NHZ	DWRB 2318*, PL 982 VLB196, UPB1146
Hectoliter Weight (kg/hl)	AVT-NWPZ AVT/IVT-NHZ	DWRB 2318*, PL 982 UPB1146
Plump Grain Percentage (>2.5 mm)	AVT-NWPZ AVT/IVT-NHZ	DWRB 2318*, PL 982 BHS498*, UPB1146, UPB1147, VLB195, VLB196,
Protein Content (%)	AVT-NWPZ AVT/IVT-NHZ	DWRB 2318* BHS498*, BHS502*, BHS518, UPB1146, VLB196

#At par or better than best check; *AVT Final Year Entry

Promising entries of AVT trials for individual grain quality trait# in feed barley trials

Trait	Trial Name	Promising Entries
Thousand Grain Weight (g)	AVT-NWPZ AVT-NEPZ AVT-CZ	NIL NIL RD 3126, RD 3128, RD 3129
Hectoliter Weight (kg/hl)	AVT-NWPZ AVT-NEPZ AVT-CZ	NIL NIL PL 977, RD 3126, RD 3129

Trait	Trial Name	Promising Entries
Plump Grain Percentage (>2.5 mm)	AVT-NWPZ	RD3128
	AVT-NEPZ	NIL
	AVT-CZ	BH 1065, RD 3126, RD 3128, RD 3129
Protein Content (%)	AVT-NWPZ	PL965, PL968, PL978,
	AVT-NEPZ	NIL
	AVT-CZ	PL 977, RD 3128, RD 3129,

#At par or better than best check; *AVT Final Year Entry

Salinity/Alkalinity Trials &Rainfed Trials Quality Evaluation

The Salinity/Alkalinity Trials & Rainfed grain samples from various trials grown at different locations were analysed for various physical and nutritional parameters. A total of 98 samples were received encompassing different trials grown in different zones and promising entries identified.

Promising entries for individual malting quality traits

Trait	Trial Name	Promising Entries
Thousand Grain Weight (g)	Sal/Alk-AVT/ IVT-NWPZ	DWRB2516, HUB309, RD3137*
	Sal/Alk-AVT/ IVT-NEPZ	DWRB2516, KB2410
	Rainfed-AVT/ IVT-NEPZ	DWRB2520, DWRB2521, HUB304, KB2421, KB2422, NDB1843, NDB1841* UPB1143, RD3131*, RD3186, RD3187, UPB1127*
Hectoliter Weight (kg/hl)	Sal/Alk-AVT/ IVT-NWPZ	BH1071*, DWRB2516, HUB309, KB2410, NDB1845, NDB1847*, RD3102**, RD3137*, RD3140*, RD3179, RD3180
	Sal/Alk-AVT/ IVT-NEPZ	DWRB2516, HUB309, HUB310, KB2410, KB2411, NDB1847*, RD3102**, RD3109**, RD3137*, RD3139*, RD3140*, RD3179, RD3180
	AVT/IVT- AVTIVT-NEPZ	DWRB2519, DWRB2518, NDB1841*, RD3131*, RD3187
Plump Grain Percentage (>2.5 mm)	Sal/Alk-AVT/ IVT-NWPZ	DWRB2516, RD3180
	Sal/Alk-AVT/ IVT-NEPZ	DWRB2516, RD3179
	Rainfed-AVT/ IVT-NEPZ	DWRB2520, NDB1843, NDB1841*, UPB1143, RD3131*, RD3186, RD3187, UPB1127*,
Protein Content (%)	Sal/Alk-AVT/ IVT-NWPZ RD3180,	BH1083, DWRB2517, HUB309, KB2411, NDB1845, NDB1847*, RD3109**, RD3137*, RD3138*, RD3139*, RD3140*, RD3179,
	Sal/Alk-AVT/ IVT-NEPZ	BH1071*, BH1082, BH1083, DWRB2516, HUB309, NDB1845, NDB1847*, RD3137*, RD3138*, RD3139*, RD3140*, RD3179,
	Rainfed-AVT/ IVT-NEPZ	HUB304, KB2422, NDB1843, NDB1846, RD3187

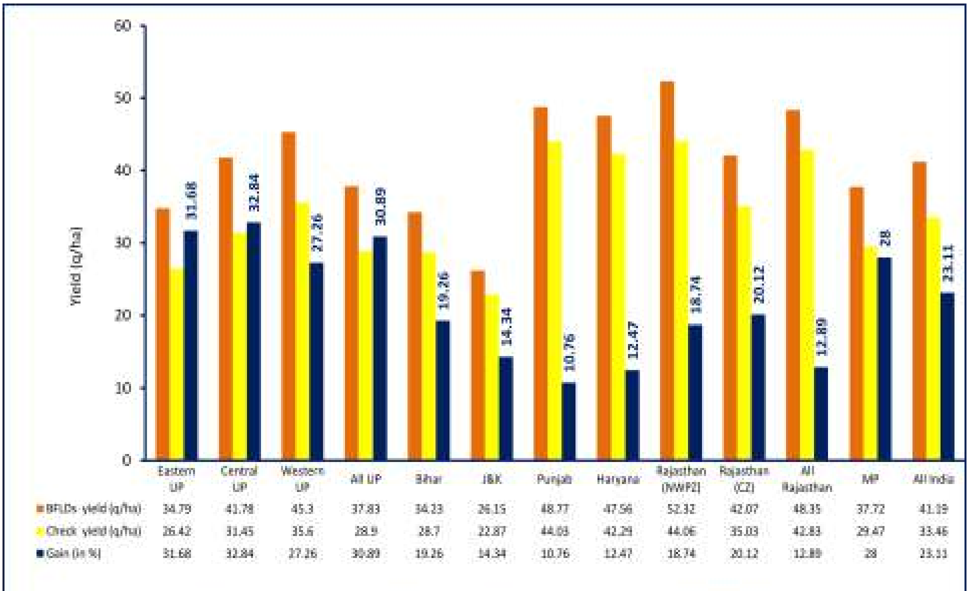
#At par or better than best check; *AVT first year entry;AVT final year entry**

Barley Frontline Demonstrations (2025–26)

During the *Rabi* 2025–26 season, 350 acres of Barley Frontline Demonstrations (BFLDs) were allocated to 38 cooperating centres across eight states/UTs, namely Himachal Pradesh, Uttar Pradesh, Bihar, Jammu & Kashmir, Punjab, Haryana, Rajasthan and Madhya Pradesh. A total of 350 demonstrations were conducted over 333 acres, benefiting 356 farmers through the evaluation of improved barley varieties along with the recommended package of production practices, including seed treatment, balanced nutrient management, irrigation scheduling and integrated weed management.

The demonstrations consistently outperformed farmers' practices across all locations. The highest yield advantage over the corresponding check was recorded in Central Uttar Pradesh (32.84%), followed by Eastern Uttar Pradesh (31.68%), Uttar Pradesh (overall) (30.89%), Madhya Pradesh (28.00%), Western Uttar Pradesh (27.26%), Rajasthan (CZ) (20.12%), Bihar (19.26%), Rajasthan (NWPZ) (18.74%), Jammu & Kashmir (14.34%), Rajasthan (overall) (12.89%), Haryana (12.47%) and Punjab (10.76%). Among the participating states, the highest demonstration productivity was recorded in Rajasthan (NWPZ) (52.32 q ha^{-1}), followed by Punjab (48.77 q ha^{-1}) and Rajasthan (overall) (48.35 q ha^{-1}). At the national level, the demonstrations recorded a mean productivity of 41.19 q ha^{-1}, compared with 33.46 q ha^{-1} under farmers' practice, resulting in an absolute yield advantage of 7.73 q ha^{-1} and an overall productivity gain of 23.11% over the check.

The results validate the effectiveness of the recommended barley production technologies under farmers' field conditions and demonstrate their potential to enhance productivity across diverse barley-growing environments.



State wise performance of the improved barley varieties during rabi 2025-26

State wise productivity under barley FLDs over check during *rabi* 2025-26

State	BFLDs Mean Yield (q/ha)	Check Mean Yield (q/ha)	Gain (%)
Eastern UP	34.79	26.42	31.68***
Central UP	41.78	31.45	32.84***
Western UP	45.30	35.60	27.26***
All UP	37.83	28.90	30.89***
Bihar	34.23	28.70	19.26**
J&K	26.15	22.87	14.34***
Punjab	48.77	44.03	10.76***
Haryana	47.56	42.29	12.47***
Rajasthan (NWPZ)	52.32	44.06	18.74***
Rajasthan (CZ)	42.07	35.03	20.12***
All Rajasthan	48.35	42.83	12.89***
MP	37.72	29.47	28.00***
All India	**41.19**	**33.46**	**23.11*** **

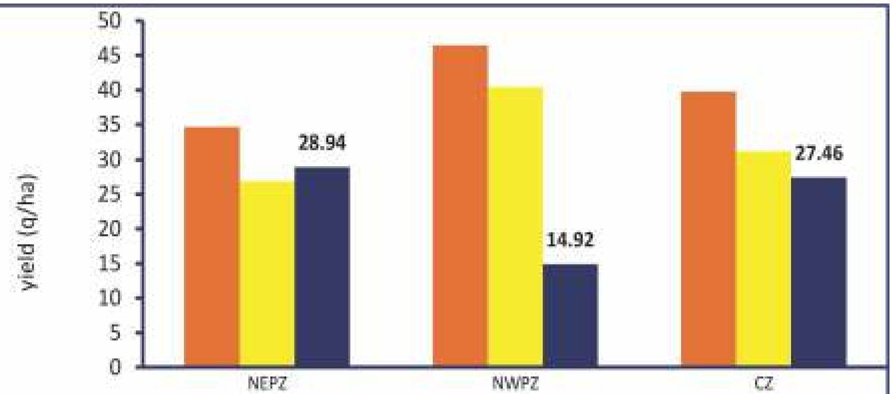
****** Significant at 1 per cent level*

Zone-wise Performance and Production Constraints in Barley

Across the barley-growing zones, Frontline Demonstrations (FLDs) consistently outperformed farmers' practices. Mean productivity under FLDs was 34.67, 39.76 and 46.44 q ha^{-1} in the North Eastern Plains Zone (NEPZ), Central Zone (CZ) and North Western Plains Zone (NWPZ), respectively, compared with 26.89, 31.19 and 40.41 q ha^{-1} under farmers' practice. The corresponding yield advantages were 7.78 q ha^{-1} (28.94%) in NEPZ, 8.57 q ha^{-1}

(27.46%) in CZ and 6.03 q ha^{-1} (14.92%) in NWPZ. The higher relative gains observed in NEPZ and CZ indicate greater scope for enhancing barley productivity through wider adoption of improved varieties and recommended crop management practices, whereas the higher absolute productivity in NWPZ reflects the favourable production environment and efficient crop management prevailing in the region.

Constraint analysis across the major barley-growing zones identified high cost of inputs as the most critical production constraint (cumulative score: 317), followed by declining groundwater table (283), small landholdings (282) and temperature fluctuations during crop growth (278). Other important constraints included damage by nilgai (257), low soil organic matter (240), limited availability of seed of newly released varieties (205) and labour scarcity (193), while high temperature at maturity and low market price of grain (168 each) also constrained barley production. These findings indicate that barley productivity is influenced by a combination of economic, climatic, natural resource and technological factors. Enhancing the timely availability of quality seed, promoting climate-resilient cultivars, improving soil and water resource management, strengthening extension support and facilitating access to affordable production inputs and efficient market linkages would contribute to improving productivity, profitability and adoption of improved barley production technologies across diverse production environments.



	NEPZ	NWPZ	CZ
BFLDs yield (q/ha)	34.67	46.44	39.76
Check yield (q/ha)	26.89	40.41	31.19
Gain (%)	28.94	14.92	27.46

Zone wise productivity over check during rabi 2025-26

Zone wise productivity under barley FLDs over regional during *rabi* 2025-26

Zone	BFLDs Mean Yield (q/ha)	Regional Mean Yield (q/ha)	Yield Gain (q/ha)	Yield Gain (%)
NEPZ	34.67	31.71	2.96	9.34***
NWPZ	46.44	41.21	5.23	12.69***
CZ	39.75	32.41	7.34	22.63***

****** Significant at 1 per cent level***

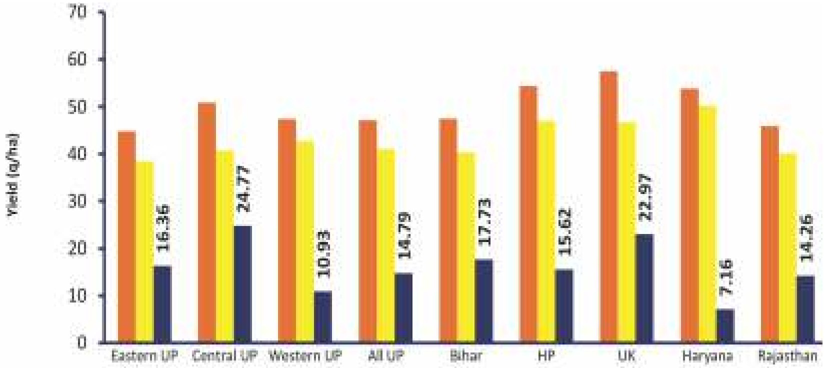
Biofortified Wheat Frontline Demonstrations (2025–26)

Biofortified Wheat Frontline Demonstrations (FLDs) conducted during the *Rabi* 2025–26 season demonstrated the superiority of improved biofortified wheat varieties and recommended crop production practices over farmers' practices across all participating states. The highest yield advantage was recorded in Central Uttar Pradesh (24.77%), followed by Uttarakhand (22.97%), Bihar (17.73%), Eastern Uttar Pradesh (16.36%), Himachal Pradesh (15.62%), Uttar Pradesh (overall) (14.79%), Rajasthan (14.26%), Western Uttar Pradesh (10.93%) and Haryana (7.16%).

Among the participating states, the highest demonstration productivity was recorded in Uttarakhand (57.43 q ha^{-1}), followed by Himachal Pradesh (54.40 q ha^{-1}), Haryana (53.88 q ha^{-1}) and Central Uttar Pradesh (50.88 q ha^{-1}). The observed yield advantages across diverse agro-climatic regions validate the effectiveness of improved biofortified wheat varieties integrated with recommended crop management practices under farmers' field conditions. The relatively higher yield gains in Central Uttar Pradesh and Uttarakhand indicate considerable scope for narrowing existing yield gaps through wider adoption of the demonstrated technologies, while the consistently higher productivity achieved across the participating states underscores their production potential under location-specific management practices.

Production Constraints in Biofortified Wheat

The constraint analysis across the major wheat-growing zones identified *Phalaris minor* (little seed canary grass) as the most critical constraint limiting biofortified wheat production, with the highest cumulative score (409), followed closely by high temperature at crop maturity (408), damage by nilgai (374) and low soil organic matter (359). Other important constraints included high cost of production inputs (345), labour scarcity (338), imbalanced fertilizer use (282), temperature fluctuations during crop growth (217), *Chenopodium album* (Bathua) infestation (202) and limited availability of seed of newly released varieties (197). The findings indicate that weed infestation, climatic stresses, soil fertility constraints, rising input costs and inadequate availability of quality seed remain the major factors limiting the productivity and large-scale adoption of biofortified wheat technologies. Targeted interventions focusing on timely availability of quality seed of improved biofortified varieties, integrated weed management, climate-resilient crop production practices, balanced nutrient management, and strengthened extension support would facilitate wider adoption of biofortified wheat and enhance productivity, profitability and resilience across diverse agro-ecological regions.



	Eastern UP	Central UP	Western UP	All UP	Bihar	HP	UK	Haryana	Rajasthan
Wheat demonstrations yield (q/ha)	44.8	50.88	47.45	47.15	47.48	54.4	57.43	53.88	45.88
Check yield (q/ha)	38.5	40.78	42.78	41.08	40.33	47.05	46.7	50.28	40.15
Gain (%)	16.36	24.77	10.93	14.79	17.73	15.62	22.97	7.16	14.26

State wise productivity under Wheat FLDs over Check during *rabi* 2025-26

Cluster Demonstrations of Climate-Resilient and Biofortified Wheat Varieties (2025–26)

Under the National Food Security Mission (NFSM), 1,100 cluster demonstrations of climate-resilient and biofortified wheat varieties were conducted through 11 Krishi Vigyan Kendras in 11 aspirational districts of Rajasthan, Uttar Pradesh, Madhya Pradesh and Bihar, covering 440 ha and benefiting 1,141 farmers. The demonstrations facilitated the dissemination of improved varieties and recommended crop production practices under farmers' field conditions.

Costs and Returns for Biofortified Wheat Frontline Demonstrations (2025–26)

The economic evaluation of biofortified wheat Frontline Demonstrations (FLDs) demonstrated a consistent economic advantage of the recommended production technologies over farmers' practices across all participating states and production zones. Demonstrations recorded higher gross and net returns, greater returns per rupee invested, and lower cost of production, reflecting improved resource-use efficiency and profitability.

Among the participating states, the highest gross return under demonstrations was recorded in Uttarakhand (₹75,216 acre^{-1}), followed by Bihar (₹74,699 acre^{-1}), whereas the highest net return was realized in Bihar (₹51,240 acre^{-1}), followed by Himachal Pradesh (₹49,922 acre^{-1}) and Uttarakhand (₹46,156 acre^{-1}). The highest return per rupee invested was observed in Himachal Pradesh (3.86), followed by Bihar (3.40) and Uttar Pradesh (3.28). The lowest cost of production under demonstrations was recorded in Himachal Pradesh (₹805 q^{-1}), indicating superior production efficiency.

At the zonal level, the Central Zone (CZ) recorded the highest return per rupee invested (3.30), followed by NEPZ (3.28) and NWPZ (3.14), while NEPZ registered the highest gross return (₹65,927 acre^{-1}) and net return (₹44,669 acre^{-1}). At the national level, demonstrations incurred an average operational cost of ₹21,392 acre^{-1} and generated a gross return of ₹65,096 acre^{-1} and a net return of ₹43,704 acre^{-1}, compared with ₹21,008 acre^{-1}, ₹57,292 acre^{-1} and ₹36,284 acre^{-1}, respectively, under farmers' practice. The benefit-cost efficiency improved from 2.86 under farmers' practice to 3.21 under demonstrations, while the cost of production declined from ₹1,248 q^{-1} to ₹1,116 q^{-1}.

The economic analysis confirms that the adoption of improved biofortified wheat varieties together with the recommended package of crop management practices enhances farm profitability through higher productivity, improved input-use efficiency and reduced unit cost of production, thereby supporting the wider dissemination of biofortified wheat technologies under diverse production environments.

Costs and Returns for Barley Frontline Demonstrations (2025–26)

The economic evaluation of Barley Frontline Demonstrations (FLDs) demonstrated the economic superiority of the recommended production technologies over farmers' practices across all participating states and production zones. Demonstrations consistently recorded higher gross and net returns, greater returns per rupee invested and lower cost of production, reflecting enhanced productivity, improved resource-use efficiency and higher farm profitability.

Among the participating states, the highest gross return under demonstrations was recorded in Rajasthan (₹54,978 acre^{-1}), followed by Punjab (₹51,414 acre^{-1}), while the highest net return was realized in Punjab (₹40,331 acre^{-1}), followed by Rajasthan (₹35,934 acre^{-1}) and Haryana (₹30,751 acre^{-1}). The highest return per rupee invested was recorded in Punjab (4.81), followed by Haryana (3.70) and Madhya Pradesh (3.07). The lowest cost of production under demonstrations was observed in Punjab (₹579 q^{-1}), indicating superior production efficiency under the demonstrated technologies.

At the zonal level, the North Western Plains Zone (NWPZ) recorded the highest gross return (₹50,360 $acre^{-1}$), net return (₹35,705 $acre^{-1}$) and return per rupee invested (3.73), followed by the Central Zone (CZ) and North Eastern Plains Zone (NEPZ). At the national level, demonstrations generated an average gross return of ₹45,230 $acre^{-1}$ and a net return of ₹29,573 $acre^{-1}$, compared with ₹37,076 $acre^{-1}$ and ₹21,883 $acre^{-1}$, respectively, under farmers' practice. Similarly, the return per rupee invested increased from 2.66 under farmers' practice to 3.14 under demonstrations, while the cost of production declined from ₹1,214 q^{-1} to ₹993 q^{-1}.

The economic analysis demonstrates that adoption of improved barley varieties in conjunction with the recommended package of crop management practices substantially enhances farm profitability through increased productivity, improved input-use efficiency and reduced unit cost of production. These findings further reinforce the economic viability and scalability of the demonstrated barley production technologies across diverse production environments.

Technology Outreach

Balanced Nutrient Management under the Mera Gaon Mera Gaurav (MGMG) Scheme**:** During 2025–26, ICAR-Indian Institute of Wheat and Barley Research (ICAR-IIWBR), Karnal strengthened its technology outreach activities under the Mera Gaon Mera Gaurav (MGMG) programme through multidisciplinary farmer-scientist interactions, village visits, field demonstrations and location-specific advisory services in wheat- and barley-based production systems. The programme emphasized the promotion of balanced nutrient management and sustainable crop production through dissemination of scientific recommendations on soil test-based fertilizer application, integrated nutrient management, balanced use of macro-, secondary and micronutrients, crop residue incorporation, organic manures and biofertilizers for improving soil health and nutrient-use efficiency.

In addition, farmers were sensitized to the adoption of improved wheat and barley varieties, timely sowing, integrated pest and disease management, efficient water management and climate-resilient production technologies.

The programme facilitated the transfer of location-specific technologies through continuous field engagement and digital extension, thereby strengthening the adoption of improved production practices and promoting sustainable intensification of wheat and barley production systems.

Khet Bachao Abhiyaan (2025–26): ICAR-Indian Institute of Wheat and Barley Research (ICAR-IIWBR), Karnal actively participated in the nationwide Khet Bachao Abhiyaan launched during June 2026 to promote soil health conservation and sustainable crop production. Through village-level awareness campaigns, farmer-scientist interactions, field demonstrations and extension activities in villages of Karnal district, the Institute disseminated scientific recommendations on soil test-based nutrient management, balanced fertilizer application, integrated nutrient management, green manuring, biofertilizers, crop residue management and judicious use of agro-inputs for improving soil health and resource-use efficiency.

The campaign also promoted the adoption of climate-resilient crop management practices aimed at enhancing soil fertility, sustaining productivity and improving the resilience of wheat- and barley-based production systems. By integrating field-level extension with digital outreach, the programme facilitated wider dissemination of soil health management technologies and reinforced the Institute's commitment to sustainable agricultural intensification and natural resource conservation.

ICAR-IIWBR Regional Station Dalang Maidan, Lahaul & Spiti (HP)

The ICAR-IIWBR Regional Station, located at Dalang Maidan (32°30′ N latitude and 76°59′ E longitude) in the Lahaul Valley of Himachal Pradesh, lies at an altitude of 3,045 m (9,990 ft) above mean sea level. The station serves as a summer nursery facility for wheat and barley crops.

Field view of ICAR-IIWBR, Regional Station and material sown at the station

Generation Advancement of Wheat and Barley

During the summer season of 2026, more than 48,000 wheat breeding lines and approximately 5,000 barley breeding lines were planted for generation advancement at the ICAR-IIWBR Regional Station, Dalang Maidan. These breeding materials were contributed by 50 breeders and researchers representing various ICAR institutes and State Agricultural Universities (SAUs). The facility was utilized by breeders and plant pathologists from all five wheat-growing zones of the country. The highest number of breeding lines was received from the North Western Plains Zone (NWPZ), followed by the Northern Hills Zone (NHZ), Central Zone (CZ), North Eastern Plains Zone (NEPZ), and Peninsular Zone (PZ).

Major contributors included ICAR–IIWBR, Karnal; ICAR-IARI, New Delhi; CCS Haryana Agricultural University, Hisar; National Agri-Food Biotechnology Institute (NABI), Mohali; ICAR-VPKAS, Almora; Borlaug Institute for South Asia (BISA), Ludhiana; and CSK Himachal Pradesh Krishi Vishwavidyalaya (CSKHPKV), Palampur. Sowing of all breeding materials was completed between 23 to 25 May 2026. The crop has now reached the early dough stage, and upon harvesting, the seed material will be processed and dispatched to the respective breeders and researchers in a timely manner for further advancement.

Corrective Hybridization

The Summer Nursery 2026 was also utilized for undertaking corrective crosses, backcrosses, and three-way crosses aimed at gene introgression, trait mapping for genetic studies, and the advancement of various wheat and barley breeding programmes. During mid-July 2026, more than 1,400 corrective crosses, backcrosses, and three-way crosses were attempted by breeders and researchers from different collaborating institutes.

Disease Screening and Monitoring

The Wheat Disease Monitoring Nursery (WDMN), supplied by the ICAR-IIWBR, Regional Station, Shimla, was planted at the experimental farm for disease surveillance. Yellow rust incidence was observed in the wheat and barley breeding material and also in the WDMN entries, as the prevailing environmental conditions during the season were conducive to rust development. However, minor infestations of insect pests, primarily stem borers and aphids, were observed during July and were effectively controlled through timely application of recommended insecticides.

Natural Repository of Wheat and Barley Germplasm

The off-season nursery facility also serves as a natural repository for the conservation and maintenance of wheat and barley germplasm. At present, approximately 12,000 wheat accessions and 8,000 barley accessions are being conserved under the naturally cool environmental conditions prevailing at the station, ensuring their safe maintenance and long-term preservation.

Training Programme

An awareness-cum-training programme on agriculture was organized for tribal farmers at the ICAR-IIWBR Regional Station, Dalang Maidan (Himachal Pradesh), under the Tribal Sub-Plan (TSP). The programme was chaired by Ratan Tiwari, Director, ICAR-IIWBR, Karnal. More than 350 tribal farmers participated in the programme and were sensitized to the significance of the Regional Station as an off-season nursery facility and the latest production and breeding technologies in wheat and barley. In addition, expert lectures were delivered on improved package of practices for vegetable and horticultural crops, as well as on animal and human health. Quality seed of selected vegetable crops was also distributed to the participating farmers to promote improved agricultural practices.

Future directions

Deciphering the Structural and Molecular Basis of Lodging Resistance in Hexaploid Wheat: Lodging remains a major constraint to wheat productivity, leading to substantial yield losses and deterioration in grain quality under adverse environmental conditions. The key structural, biochemical, and molecular determinants governing lodging resistance in wheat were identified. Increased plant height and longer basal internodes were the primary factors associated with lodging susceptibility, whereas greater mechanical tissue thickness along with higher cellulose and silica accumulation contributed significantly to stem strength and lodging tolerance. At the molecular level, enhanced expression of the lignin biosynthetic genes *CAD2, CCR2, COMT2*, and *F5H2* was strongly associated with increased lignin deposition and improved stem rigidity in lodging-resistant genotypes. These findings provide valuable insights into the mechanisms underlying lodging resistance and identify promising structural and molecular targets for developing high-yielding, lodging-resistant wheat cultivars through precision breeding.

BNI-Enabled Wheat: A Transformative Advancement in Nitrogen Use Efficiency: ICAR-IIWBR has made significant progress in developing BNI-enabled wheat by introgressing the trait into elite Indian wheat cultivars adapted to diverse production environments. Multi-omics investigations identified key microbial, transcriptomic, and metabolic signatures associated with BNI activity, providing novel insights into the biological mechanisms regulating nitrogen-use efficiency. These findings have generated valuable molecular resources and candidate biomarkers to accelerate the development of BNI-enabled wheat through precision breeding.

The adoption of BNI-enabled wheat has the potential to substantially reduce nitrogen fertilizer requirements while maintaining productivity, thereby lowering production costs, minimizing nitrogen losses, and mitigating greenhouse gas emissions. Ex-ante assessments indicate that adoption on 25% of India's wheat-growing area, coupled with a 30% reduction in nitrogen fertilizer use, could generate annual economic savings of approximately ₹2,000 crore and reduce nitrogen fertilizer consumption by nearly 3.69 lakh tonnes, demonstrating its immense potential for climate-resilient and resource-efficient wheat production.

Biotechnology Research: Developing climate-resilient, nutritionally superior, and resource-efficient wheat varieties is essential to address the growing challenges of climate change, resource constraints, and food and nutritional security. ICAR-IIWBR made significant advances by integrating genome editing, molecular breeding, functional genomics, and beneficial microbiome research to accelerate precision wheat improvement. Genome-editing efforts established a strong foundation for developing transgene-free wheat with enhanced nitrogen use efficiency, improved grain nutritional quality (iron and zinc bioavailability), superior grain quality, and greater heat tolerance. Trait-specific molecular markers enabled the identification of superior donor genotypes and favourable alleles governing productivity, adaptation, grain quality, and stress resilience, thereby strengthening marker-assisted breeding programmes. In parallel, beneficial endophytic microorganisms were identified as promising biological resources for enhancing drought tolerance through modulation of stress-responsive pathways, providing environmentally sustainable approaches to improve wheat resilience under water-limited conditions. These advances have generated valuable genomic resources, molecular tools, and biological interventions that will accelerate the development of next-generation climate-smart wheat cultivars through precision breeding and sustainable biotechnology.

Pre-breeding Research: The narrow genetic base of cultivated wheat limits the development of varieties resilient to emerging climatic challenges, diseases, and nutritional demands. To address this, ICAR-IIWBR strengthened wheat pre-breeding efforts by harnessing novel genetic variation from landraces, wild relatives, and synthetic wheat germplasm to broaden the breeding pool. Significant progress was achieved in developing diverse introgression lines carrying valuable genes for resistance to rust diseases, tolerance to heat and drought stress, and enhanced grain quality. Wild relatives, including *Thinopyrum bessarabicum* and several *Aegilops* species, served as important sources of genes for improved micronutrient density (iron and zinc), grain protein content, abiotic stress tolerance, and disease resistance, while indigenous landraces and *Triticum sphaerococcum* contributed desirable agronomic traits such as bold grains and improved spike architecture. These pre-breeding resources constitute a valuable reservoir of novel alleles for developing next-generation climate-resilient, nutritionally enriched, and high-yielding wheat cultivars.

Micro-test for Sedimentation Volume: A rapid micro-test requiring only 1 g of wholemeal flour was validated for estimation of SDS-lactic acid sedimentation volume using 82 wheat samples. Sedimentation volume determined by the micro-test exhibited a strong agreement with the standard AACC 6 g method across a range of 27–77 mL, with a coefficient of determination (R^2) of 0.84 and a correlation coefficient (r) of 0.92. The validated protocol substantially reduces sample requirement while providing reliable estimates of gluten strength, making it highly suitable for early-generation screening in wheat breeding programmes.

Glycemic Index Profiling of *Triticum dicoccum*: The glycemic index (GI) of 25 recombinant inbred lines (RILs) of *Triticum dicoccum* was determined using a standardized *in vitro* digestion protocol. The RILs exhibited substantial variation in glycemic index, ranging from 38.3 to 64.3, with a mean value of 50.8. The observed variability provides valuable opportunities for identifying low-glycemic wheat genotypes suitable for developing healthier wheat-based food products and breeding cultivars with improved nutritional quality.

***In silico* Characterization of the Wheat Phytase Gene (*TaPAPhy_a2*):** Phytate is a major anti-nutritional factor in wheat that limits the bioavailability of essential minerals such as iron and zinc, necessitating the development of wheat varieties with improved phytase activity. ICAR-IIWBR generated comprehensive structural and functional insights into the wheat phytase gene (*TaPAPhy_a2*), elucidating its conserved domains, protein architecture, and catalytic features. A reliable three-dimensional structural model of the phytase protein was developed, providing a valuable genomic resource for functional validation and molecular improvement of phytase activity. These findings will facilitate the development of nutritionally enhanced wheat cultivars with improved mineral bioavailability and greater health benefits for consumers.

Climate Effects on Malting Quality and Identification of Superior Donors: Contrasting growing environments markedly influenced barley malting quality. Favourable grain-filling conditions enhanced grain plumpness, malt extract and enzymatic activities, whereas terminal heat stress increased grain protein and reduced malting performance. Indigenous cultivars exhibited superior grain physical traits, while exotic cultivars possessed higher enzymatic potential and lower β-glucan content. Genotypes DWRB 91, DWRB 160, Traveller and Andreia emerged as valuable donor parents for developing climate-resilient, high-quality malting barley adapted to subtropical environments.

Novel Genetic Resources for Climate Resilience and Nutritional Quality: Extensive evaluation of indigenous landraces, wild barley and exotic germplasm identified valuable genetic resources for resistance to corn leaf aphid, yellow rust and powdery mildew. Several landraces combined high β-glucan, protein, starch, zinc (up to 39.5 ppm), iron (up to 42.2 ppm) and antioxidant activity (up to 53.5%), while multiple accessions exhibited salinity tolerance. These genetic resources provide important donors for breeding nutritionally enriched and climate-resilient barley cultivars.

Marker-assisted Enhancement of Malting Quality and Aphid Resistance: Marker-assisted breeding led to the development of improved genetic stocks combining superior malting quality with corn leaf aphid resistance. Genetic stock RMB 2301 (DWRBG 30) exhibited high diastatic power, elevated free amino nitrogen and superior malt yield. Advanced backcross derivatives carrying aphid resistance displayed stable field resistance, with EB 921-93, BCU 390-198, EB 921-33, EB 921-102 and BCU 390-200 identified as promising candidates for multilocation evaluation.

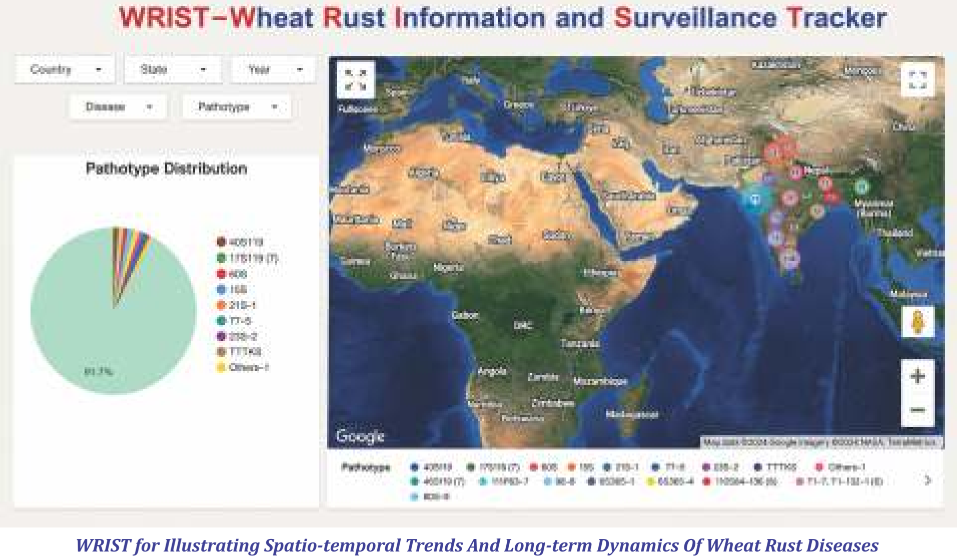
Spot Blotch Resistance: Distinct genetic and pathogenic diversity was observed among *Bipolaris sorokiniana* populations, indicating the dynamic nature of the spot blotch pathogen. Disease severity showed a very strong negative association with thousand-grain weight ($r = -0.95$ to -0.98), underscoring the substantial impact of spot blotch on grain productivity and reinforcing the need for durable resistance breeding.

Morpho-cultural, Morphological and Molecular Variability of *Bipolaris sorokiniana*: Comprehensive characterization of *Bipolaris sorokiniana* isolates collected from major wheat-growing regions of India revealed substantial morpho-cultural and genetic diversity, with isolates grouped into five distinct clusters. Population genetic analyses indicated that the majority of genetic variation exists within populations, highlighting the dynamic nature of the pathogen. These findings provide a scientific basis for pathogen surveillance, identification of emerging variants, and the development of effective resistance breeding and disease management strategies for spot blotch.

Pathogenic Variability among *Bipolaris sorokiniana* Isolates: Significant variability in virulence was established among *Bipolaris sorokiniana* isolates infecting wheat, with isolate *Bs-3* identified as the most aggressive. The classification of isolates into five distinct pathogenicity groups provides a robust framework for screening wheat germplasm, identifying durable sources of resistance, and accelerating the development of spot blotch-resistant cultivars.

Effector-based Assay for Pre-symptomatic Detection of Stripe Rust of Wheat: A highly sensitive and specific effector gene-based molecular diagnostic assay targeting the *Puccinia striiformis* f. sp. *tritici* PNPi gene was developed for rapid pre-symptomatic detection of stripe rust in wheat. The assay accurately detected all tested Indian stripe rust pathotypes without cross-reactivity and enabled pathogen detection before symptom development. Quantitative PCR further facilitated precise estimation of pathogen load, making the assay a valuable tool for early disease surveillance, epidemiological studies, and timely disease management.

Development of WRIST (Wheat Rust Information and Surveillance Tracker): An interactive Wheat Rust Information and Surveillance Tracker (WRIST) was developed by integrating more than 15 years of geo-referenced surveillance and molecular characterization data on stripe, leaf, and stem rusts. The platform enables visualization of spatial and temporal dynamics of wheat rust pathotypes, identification of disease hotspots, and analysis of long-term epidemiological trends. As a decision-support tool, WRIST strengthens early warning systems, facilitates precision disease management, and supports evidence-based policy decisions for sustainable wheat rust surveillance and management.



WRIST for Illustrating Spatio-temporal Trends And Long-term Dynamics Of Wheat Rust Diseases

Future Research Directions: Future research should integrate AI-assisted genomic prediction, pangenome-informed breeding, speed breeding, genome editing, high-throughput phenotyping, microbiome engineering, and multi-omics approaches to accelerate the development of climate-resilient, nutrient-dense, nitrogen-efficient wheat and barley cultivars. Greater emphasis should also be placed on predictive breeding, digital agriculture, circular bioeconomy, carbon-smart production systems, and translational research linking gene discovery with cultivar deployment.

Action taken report on the major recommendations of the 64th All India Wheat & Barley Research Workers' meet held at RVSKVV, Gwalior, Madhya Pradesh, August 25 – 27, 2025

S No.	Recommendation	Action taken
Crop Improvement		
1.	To streamline data reporting, it was suggested that, 10 years' data, of centres where trials were rejected, should be analysed. It the issues persists on long term basis; the centre may be dropped.	Data on trial rejection during the last 10 years was compiled and it was observed that a total of 873 trials were rejected across 164 centres. The highest number of rejected trials was recorded at Akola (37), followed by Shillongani (24), Gwalior (23), Gaja (20), Niphad (20), Varanasi (18), Ayodhya (17), Allahabad (16), Cooch Behar (16), Dharwad (16), Jabalpur (16) and Kalyani (15). The appropriate action in this regard, will be taken up during work plan finalizing meeting of 65th AGM being held at RARI Durgapura during 18-19 August, 2026.
2.	The promotion of entries in all the trials of crop improvement would be done based on comparison with the best consistent best check included from NIVT or AVT-I (in case of EDVs) itself. No comparison should be made with the check(s) has/have been added at later stages of testing. Accordingly, identified variety if any will be included as check in the NIVTs/IVTs.	The promotion of entries is done based on comparison with the best check of the trial. For EDVs it is done in comparison with the parental check. As per the recommendation, the entries identified for release were included as checks in the NIVT/IVTs, during 2025-26 crop season.
3.	Reasons for rejection of trials by monitoring teams should be specified and presented in the review. Trials not conducted and reported should also be presented along with the reasons for not reporting	Details of the trials rejected by the Monitoring Team have been documented in the Monitoring Report, together with the specific reasons for their rejection. The complete Monitoring Report has been appended in the Crop Improvement Progress Report for reference. Any observations or issues arising from the report may be discussed in detail during the review meeting.
4.	Test entries from CIMMYT/ICARDA trials/ nurseries should be nominated along with their trial name and entry number, in addition to parentage	Nominations received from cooperating centres for the crop season 2026–27, have been included after receiving the information as per the suggestion.
5.	Indents for CIMMYT/ICARDA trials/ nurseries and data reporting on the same, should be routed through ICAR-IIWBR, Karnal.	All indents for CIMMYT/ICARDA wheat trials and nurseries, along with the corresponding data reporting, were routed through ICAR-IIWBR, Karnal, in accordance with the prescribed procedure. A total of 168 sets of trials from CIMMYT and 8 sets of trials from ICARDA were obtained and evaluated through ICAR-IIWBR.
6.	For efficient utilization of resources, breeding hubs should be identified which can share the breeding material with small/satellite centres. A good sharing program of segregating material F3 onwards should be formulated and shuttle breeding should be encouraged	Segregating generations targeted for different production environments are being shared by ICAR-IIWBR through the Segregating Stock Nursery (SSN). During the crop season, 210 segregating populations contributed by mega centres namely VPKAS, Almora; PAU, Ludhiana; SDAU, Vijapur; GBPUA&T, Pantnagar; UAS Dharwad; and ICAR-IIWBR, Karnal were distributed to 23 small/satellite wheat breeding centres across the five wheat-growing zones.
7.	The coding of all the trials of crop improvement will be monitored by the Council.	The coding of trials during 2025-26 crop season was carried out in accordance with the guidelines issued by the Council.

S No.	Recommendation	Action taken
8.	In case of promotion of entries, rust ACI scores from artificial screening should be given preference over the natural scores	The recommendation has been incorporated in the constitution and promotion criteria of coordinated trials for the crop season 2025–26.
9.	Testing of MABB entries should follow the guidelines as recommended by the Council. A committee will be constituted for further streamlining the same.	MABB entries are being evaluated and promoted strictly in accordance with the guidelines approved by the Council.
10.	SPL-HYPT will be renamed as AVT-ES-HF-TAS in respective zones (NWPZ & CZ)	The recommendation has been implemented in the trial nomenclature.
11.	Scientists from cooperating centres should actively participate in the zonal monitoring of coordinated trials	A total of 32 scientists from different cooperating centres participated in the zonal monitoring of coordinated trials during the crop season 2025–26.
12.	All the varieties released from CVRC should be mandatorily registered with PPVFRA	The developers have been advised to ensure mandatory registration of all CVRC-released varieties with the PPV&FRA.
13.	Centres should register the promising entries/germplasm with NBPGR	Cooperating centres have been advised to register promising breeding lines and germplasm with NBPGR to facilitate their conservation and protection.
14.	Varietal proposal for VIC should be in the prescribed format. These should be screened at the head quarter before submitting to the committee for identification	The prescribed format was circulated to all developers, and all proposals were screened at ICAR-IIWBR headquarters before submission to the Varietal Identification Committee (VIC).
15.	Starting a new trial for rainfed conditions in PZ and the proposal will be moved from Zonal coordinator (PZ) to have a final call from the Council.	All final year entries under the Restricted Irrigated production condition are currently being evaluated under rainfed conditions in the coordinated agronomy trials. The initiation of a new trial for rainfed ecology in Peninsular Zone will be discussed with the trial conducting centres of the zone, during 65th AGM being held at RARI Durgapura during 18-20 August, 2026.
Resource Management and Social Sciences		
1.	On the basis of multi-locational two years study (2023-24 and 2024-25) in NWPZ, it is concluded that foliar spray of either tri-iodo benzoic acid @100 ppm at tillering or 6-benzyl amino purine @100 ppm at tillering or two foliar sprays of Chlormequat chloride @0.2% + tebuconazole @0.1% at first node and flag leaf stages provided wheat yield gain of 4.2-4.8 q/ha (7.8-9.0%) over control (no chemical spray) due to improvement in earhead density.	The recommendation has been forwarded to the concerned department for evaluation and inclusion in the region-specific agronomic recommendations and extension programmes aimed at promoting diversified and resource-efficient cropping systems.
2.	Based on two years study at five locations in NEPZ, it is recommended that intercropping of wheat + toria (8:2), wheat + linseed (4:2) and wheat + lentil (4:2) should be adopted for higher wheat equivalent yield (13.6 16.5%) over sole wheat.	The recommendation has been communicated to the concerned authority for consideration in the formulation of location-specific agronomic recommendations and technology dissemination initiatives for barley-based intercropping systems.
3.	The findings of two years study at five locations in NEPZ, it is recommended that intercropping of barley + linseed (4:2), barley + toria (8:2) and barley + lentil (4:2) should be adopted for higher barley equivalent yield (17.2-24.8%) over sole barley.	The recommendation has been submitted to the concerned department for consideration and appropriate action towards its inclusion in the recommended production technologies following the prescribed approval process.

S No.	Recommendation	Action taken
4.	On the basis of multi-locational two years study (2023-24 and 2024-25) in NWPZ, it is concluded that foliar spray of either tri-iodo benzoic acid @100 ppm at tillering or two foliar sprays of chlormequat chloride @0.2% + tebuconazole @0.1% at first node and flag leaf stages or 6-benzyl amino purine @100 ppm at tillering provided barley yield gain of 5.01-5.65 q/ha (11.5-13.0%) over control (no chemical spray) due to improvement in earhead density.	The recommendation has been submitted to the concerned department for consideration and appropriate action towards its inclusion in the recommended production technologies following the prescribed approval process.
Crop Protection		
1.	Continuation of collaborative wheat blast screening efforts in Bangladesh and Bolivia in partnership and reinitiation of screening of stem rust lines for Ug99 in Kenya.	Collaborative activities with international partners (CIMMYT) are being pursued through the concerned coordinating agencies. Preparatory steps have also been initiated for the reintroduction of selected stem rust resistance lines for Ug99 screening in Kenya, subject to quarantine and international shipment approvals.
2.	Conduct training programmes for proper documentation of AICRP trials, including creation of epiphytotics to enhance technical capacity and data quality.	A three-day Hands-on Training Programme on "Guidelines for Uniform Data Recording and Reporting in Crop Protection Trials under AICRP on Wheat and Barley" was organized at ICAR-IIWBR, Karnal from 28–30 January 2026. The programme was attended by 15 participants representing AICRP centres from across the country. The training focused on standardized trial documentation, disease scoring, data recording and reporting protocols, and the creation of artificial epiphytotics for obtaining uniform disease expression, thereby enhancing technical capacity and ensuring high-quality, uniform data generation.
3.	Monitor wheat blast in NEPZ, particularly in areas bordering Bangladesh. Promote adoption of blast-resistant varieties along with preventive measures in disease-prone regions.	Regular surveillance for wheat blast was undertaken in the North Eastern Plain Zone (NEPZ), with special emphasis on districts bordering Bangladesh. In February 2026, a team of scientists from ICAR-IIWBR, Karnal, and Bidhan Chandra Krishi Viswavidyalaya (BCKV), West Bengal, visited the Nadia and Murshidabad districts (bordering Bangladesh) to monitor the occurrence of wheat blast. No incidence of wheat blast was observed during the survey. Farmers and local officials were advised for continuous surveillance, cultivation of blast-resistant varieties, and adoption of recommended preventive phytosanitary and crop management practices.
4.	Calculate the coefficient of infection for Karnal bunt using post-harvest survey data from at least three separate lots.	Post-harvest survey data were compiled from representative grain lots collected from different locations. The coefficient of infection for Karnal bunt will be estimated using standard procedures based on observations.
Wheat Quality		
1.	Nutritional profile of region-specific wheat produces such as wheat from Bhalia, Sehore, Indore etc. should be analysed for quality parameters.	Quality profile of region-specific wheat varieties received from Madhya Pradesh has been done.

S No.	Recommendation	Action taken
2.	For iron and zinc estimation, only hand-threshed samples should be sent separately for AVT, HYPT, QCWBN, Dicoccum, AST and NIVT trials to ICAR-IIWBR, Karnal.	Cooperating centres have supplied hand threshed samples for estimation of Fe and Zn as recommended.
3.	Soil Fe, Zn, and nitrogen (total as well as available) data to be provided to ICAR-IIWBR by all centres conducting trials for quality analysis after taking due care of soil sample collection and analysis.	Soil data have been received from some centres. Efforts are being made to obtain the requisite soil Fe, Zn, and nitrogen (total as well as available) data from all participating centres to facilitate comprehensive quality analysis.
Barley Improvement		
1.	Estimation of the Glycemic Index (G.I) of hulless barley must be prioritized to establish and highlight its superior nutritional value.	The analysis of the Glycemic Index (GI) of hulless barley test entries in the final year of evaluation, along with check varieties from representative locations, was initiated from 2025–26 AICRP trials.
2.	The Hon'ble Agriculture Minister stressed that barley possesses both nutritional and medicinal properties; hence, its R&D must be vigorously strengthened to deliver advanced technologies to farmers.	Under AICRP on Barley, greater emphasis has been placed on developing nutritionally superior and climate-resilient barley varieties with enhanced quality traits. Research on nutritional and functional attributes, including grain quality parameters, has been strengthened, and promising technologies are being evaluated through multi-location testing for wider dissemination to farmers.
3.	Genotypic data of barley germplasm from ICARDA must be acquired at the earliest to accelerate and strengthen the breeding programme.	The genotypic data of ICARDA barley germplasm have been acquired and the barley biotechnologists are working on it to strengthen parental selection, genetic diversity analysis, and marker-assisted breeding for accelerating barley improvement.
4.	Field demonstrations of hulless barley on farmers' fields should be given high priority to showcase its potential and drive adoption.	Due to non-availability of sufficient quantity of seeds of hulless barley it was not included in FLD programme. This year it will be demonstrated under FLD.
5.	The ceiling of low site mean in NWPZ trials should be revised upward from 30 qtls/ha to 35 qtls/ha, setting a realistic and progressive benchmark for varietal evaluation.	The minimum low site mean criterion for hulled barley under irrigated timely sown conditions in the NWPZ has been enhanced from 30 q/ha to 35 q/ha (excluding rainfed and salinity/alkalinity situations) and has been incorporated into the AICRP barley varietal evaluation criteria.
6.	Until resistant genes for leaf blight are successfully incorporated, strict adoption of integrated plant protection measures must be enforced to safeguard crop performance and ensure yield stability.	The protection measures for control of leaf blight are suggested during the crop seasons through various modes including crop health advisories.

Financial Highlights for the Year 2025-26

A. Budget Utilization

(₹ in Lakhs)

Name of Scheme	Total BE 2025-26	Total RE 2025-26	Total Remittance Received 2025-26	TOTAL EXP.	% of EXP. Against RE
IIWBR, KARNAL	4080.50	4076.90	4076.90	4076.82	100 %
AICRP on Wheat & Barley	1773.60	2326.30	2326.30	2326.30	100 %

Expenditure Statement for the Year 2025-26 in respect of ICAR-IIWBR, Karnal

(₹ in Lakhs)

Name of Scheme	HEAD	BE 2025-26	RE 2025-26	EXPENDITURE					
				Other than EH, TSP & SCSP	TSP	NEH	SCSP	TOTAL EXP.	% of EXP. Against RE
IIWBR, KARNAL	Grants in Aid - Capital	266.00	147.00	130.98	0.00	15.99	0.00	146.97	99.98 %
	Grants in Aid - Salaries	2510.00	2530.00	2530.00	0.00	0.00	0.00	2530.00	100 %
	Grants in Aid - General :								
	(1) Pension	368.00	463.40	463.40	0.00	0.00	0.00	463.40	100 %
	(2) Others	936.50	936.50	755.00	119.99	11.49	49.97	936.45	99.99 %
	TOTAL	**4080.50**	**4076.90**	**3879.38**	**119.99**	**27.48**	**49.97**	**4076.82**	**100 %**

(₹ in Lakhs)

Name of Scheme	HEAD	BE 2025-26	RE 2025-26	EXPENDITURE					
				Other than EH, TSP & SCSP	TSP	NEH	SCSP	TOTAL EXP.	% of EXP. Against RE
AICRP (Wheat & Barley)	Grants in Aid - Capital	4.00	4.00	4.00	0.0	0.0	0.0	4.00	100 %
	Grants in Aid - Salaries	1440.00	1992.70	1992.70	0.0	0.0	0.0	1992.70	100 %
	Grants in Aid - General :								
	(1) Pension	0	0	0	0	0	0	0	0 %
	(2) Others	329.60	329.60	204.60	50.00	25.00	50.00	329.60	100 %
	TOTAL	**1773.60**	**2326.30**	**2201.30**	**50.00**	**25.00**	**50.00**	**2326.30**	**100 %**

B. Revenue Generation for the Year 2025-26

(₹ in Lakhs)

S. N.	Year	Target	Revenue Generated as per Schedule No. 8, 10 & 12 of Balance Sheet 2025-26	Total Revenue Receipts during 2025-26
1	2025-26	199.00	53.93	342.38

C. Status of Audit Paras (Office of Principal Director of Audit (Central), Chandigarh)

S. N.	Year	Number of outstanding Paras	Remarks
1	2017-20	4	Yes, Reply Submitted
2	2020-24	6	Yes, Reply Submitted

D. Status of ICAR Inspection Report as on 14.07.2026

S. N.	Year	Number of outstanding Paras	Remarks
1	Upto 2019-23	3	Yes, Reply Submitted

Status of AUC/UC in R/O Centres Under Aicrp Wheat and Barley

S. N.	Name of Center	Name of University	Position of AUC/UC
1	BAJAURA	HPKVV PALAMPUR	UC Received
2	BILASPUR	IGKVV RAIPUR	AUC Received
3	COOCH BEHAR	UBKV COOCH BEHAR	UC Received
4	DHARWAD	UAS DHARWAD	UC Received
5	DURGAPURA	RAU BIKANER	UC Received
6	AYODHA	NDUA&T FAIZABAD	UC Received
7	GWALIOR	RVSKVV GWALIOR	UC Received
8	HISAR	HAU HISAR	UC Received
9	JABALPUR	JNKVV JABALPUR	UC Received
10	JAMMU	SKUAS & T JAMMU	UC Received
11	JUNAGADH	JAU JUNAGADH	AUC Received
12	KALYANI	BCKVV NADIA	UC Received
13	KANPUR	CSAUA&T KANPUR	UC Received
14	LUDHIANA	PAU LUDHIANA	UC Received
15	MAHABALESWAR	MPKVV RAHURI.	AUC Received
16	NIPHAD	MPKVV RAHURI	UC Received
17	PALAMPUR	HPKVV PALAMPUR	UC Received
18	PANTNAGAR	GBPUA & T PANTNAGAR	AUC Received
19	POWARKHEDA	JNKVV, JABALPUR	AUC Received
20	RANCHI	BAU RANCHI	UC Received
21	SABOUR	RAU SAMASTIPUR	UC Received
22	SAGAR	JNKVV JABALPUR	UC Received
23	SRINAGAR	SKUAS & T SRINAGAR	AUC Received
24	UDAIPUR	MPUAT, UDAIPUR	UC Received
25	VIJAPUR	SDAU, SARDAR KRUSHI NAGAR	UC Received
26	PUNE	ARI PUNE	AUC Received
27	VARANASI	BHU VARANASI	UC Received
28	SHILLONGANI	AAU JORHAT	UC Received
29	IMPHAL NEH	CAU, IMPHAL	UC Received

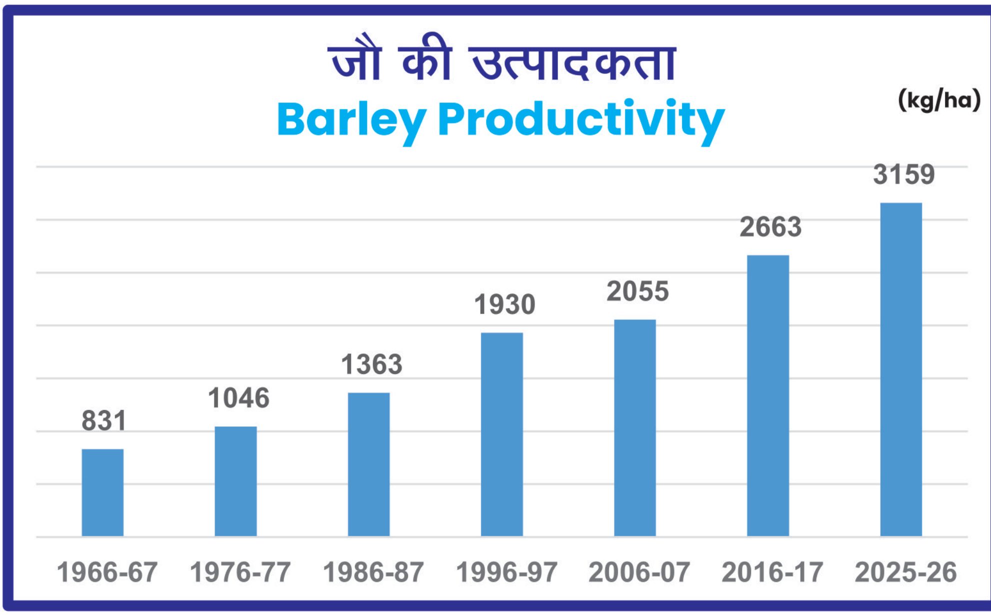
Head-wise Expenditure 2025-26 of AICRP Wheat and Barley

Centre	PAY	General	TSP	SCSP	NRC	NEH	Grand Total
Bajaura	5418000	575000					5993000
Bilaspur	6360000	400000	350000				7110000
Coochbehar	3876000	450000	500000	350000			5176000
Dharwad	10346000	1000000		750000			12096000
Durgapura	10150000	1111000					11261000
Ayodhya	4400000	1050000		300000	200000		5950000
Gwalior	2100000	375000	300000				2775000
Hisar	13600000	1000000		500000			15100000
Jabalpur	4050000	625000		527000			5202000
Jammu	8451000	455000		500000			9406000
Junagadh	3900000	450000					4350000
Kalyani	2417000	350000	300000	500000			3567000
Kanpur	5250000	600000					5850000
Ludhiana	23621266	1450000			200000		25271266
Mahableswar	2150000	200000					2350000
Niphad	6200000	900000		400000			7500000
Palampur	12550248	600000					13150248
Pantnagar	20302286	800000		800000			21902286
Powarkhera	6850000	690000		373000			7913000
Ranchi	3600000	450000					4050000
Sabour	5500000	350000					5850000
Sagar	3100000	300000					3400000
Srinagar	1950000	200000	362500				2512500
Udaipur	5800000	594250	687500				7081750
Vijapur	3947000	550000					4497000
Pune (100%)	10750200	1000000					11750200
Varanasi (100%)	1350000	699750					2049750
CAU, Imphal (100%)	1932000	300000				3362000	2232000
Shillongani	9349000	275000				1638000	9624000
VC General	0	2435000					2435000
ZC	0	225000					225000
Total	199270000	20460000	2500000	5000000	400000	5000000	232630000

Staff Strength Under AICRP on Wheat and Barley During 2025-26

SN	Name of Centre	Name of SAU / Institute	Scientific			Technical		
			Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant
1	Bajaura	CSKHPKVV, Palampur (HP)	2	2	0	2	2	0
2	Bilaspur	IGKVV, Raipur (Chhattisgarh)	2	2	0	2	2	0
3	Coochbehar	UBKVV, Coochbehar (WB)	2	1	1	2	1	1
4	Dharwad	UAS Dharwad (Karnataka)	4	4	0	3	3	0
5	Durgapura	SKNAU, Jobner (Rajasthan)	6	6	0	5	3	2
6	Ayodhya	NDUA&T, Ayodhya (UP)	4	1	3	4	1	3
7	Gwalior	RVSKVV, Gwalior (MP)	2	2	0	2	1	1
8	Hisar	CCSHAU, Hisar (Haryana)	6	4	2	5	4	1
9	Jabalpur	JNKVV, Jabalpur (MP)	2	2	0	2	0	2
10	Jammu	SKUAS&T, Jammu (J&K)	2	2	0	2	2	0
11	Junagadh	JAU, Junagadh (Gujarat)	2	2	0	2	1	1
12	Kalyani	BCKVV, Nadia (WB)	3	1	2	2	1	1
13	Kanpur	CSAUAS&T, Kanpur	5	3	2	4	4	0
14	Khudwani	SKUAS&T-K, Srinagar (J&K)	1	1	0	1	1	0
15	Ludhiana	PAU, Ludhiana (Punjab)	6	6	0	5	5	0
16	Mahableshwar	MPKVV, Rahuri (Maharashtra)	2	2	0	2	1	1
17	Malan	CSKHPKVV, Palampur (HP)	3	3	0	2	1	1
18	Niphad	MPKVV, Rahuri (Maharashtra)	4	4	0	4	2	2
19	Pantnagar	GBPUA&T, Pantnagar (Uttarakhand)	4	4	0	4	0	4
20	Powarkheda	JNKVV, Jabalpur (MP)	3	2	1	3	2	1
21	Ranchi	BAU, Ranchi (Jharkhand)	2	1	1	2	1	1
22	Sabour	BAU, Bhagalpur (Bihar)	3	3	0	3	2	1
23	Sagar	JNKVV, Jabalpur (MP)	1	1	0	1	1	0
24	Shillongani	AAU, Jorhat (Assam)	2	2	0	2	2	0
25	Udaipur	MPUA&T, Udaipur (Rajasthan)	2	2	0	2	2	0

SN	Name of Centre	Name of SAU / Institute	Scientific			Technical		
			Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant
26	Vijapur	SDAU, Dantiwada (Gujarat)	4	2	2	4	3	1
27	Imphal (100% funded)	CAU, Imphal (Manipur)	1	1	0	1	0	1
28	Pune (100% funded)	ARI, Pune (Maharashtra)	3	3	0	3	3	0
29	Varanasi (100% funded)	BHU, Varanasi (UP)	3	0	3	3	1	2
Total			**86**	**69**	**17**	**79**	**52**	**27**



65वीं अखिल भारतीय गेहूँ एवं जौ अनुसंधान कार्यकर्ता संगोष्ठी–2026
राजस्थान कृषि अनुसंधान संस्थान, दुर्गापुरा, जयपुर
श्री कर्ण नरेन्द्र कृषि विश्वविद्यालय, जोबनेर, राजस्थान

65th All India Wheat and Barley Research Workers Meet - 2026
Rajasthan Agricultural Research Institute, Durgapura, Jaipur
Shri Karan Narendra Agriculture University, Jobner, Rajasthan

अगस्त 18–20, 2026 | August 18-20, 2026