प्रगति प्रतिवेदन
PROGRESS REPORT
2023-24

जौ सुधार
BARLEY IMPROVEMENT

अखिल भारतीय समन्वित गेहूँ एवं जौ अनुसंधान परियोजना

AICRP on Wheat and Barley

भा.कृ.अनु.प.–भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल (हरियाणा)

ICAR-Indian Institute of Wheat & Barley Research, Karnal (Haryana)

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All India Coordinated Research Project on Wheat and Barley

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BARLEY IMPROVEMENT

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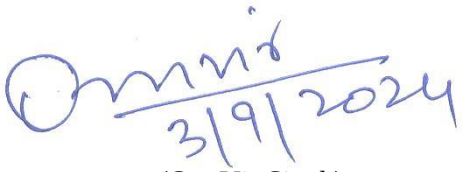

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RESEARCH HIGHLIGHTS OF BARLEY IMPROVEMENT

Barley, a vital cereal crop, has garnered increased attention due to its significant health-promoting properties, which are linked to the functional components within its grain. As a staple food, barley offers a sustainable solution to combating various chronic diseases and holds substantial commercial value, particularly in the malting industry. The area under barley cultivation and its production experienced growth during the 2022-23 season compared to 2021-22; however, this upward trend reversed again in 2023-24. Despite favorable agronomic conditions throughout the Rabi season of 2023-24, and experimental data showing promising crop development, the third advance estimate for barley production in 2023-24 projected a total yield of 1,653.22 thousand tonnes only. These projections indicated that barley was cultivated over 531.37 thousand hectares, with an average productivity of 29.99 quintals per hectare. Rajasthan remained the dominant producer, accounting for over 51.70% of the total cultivated area and contributing more than 62.13% to national production, followed by Uttar Pradesh, Haryana, Madhya Pradesh, and Himachal Pradesh. Notably, barley productivity increased from 2,733 kg per hectare in 2022-23 to 2,899 kg per hectare in 2023-24, with significant gains recorded in both Rajasthan and Punjab during this period (Table 1.1).

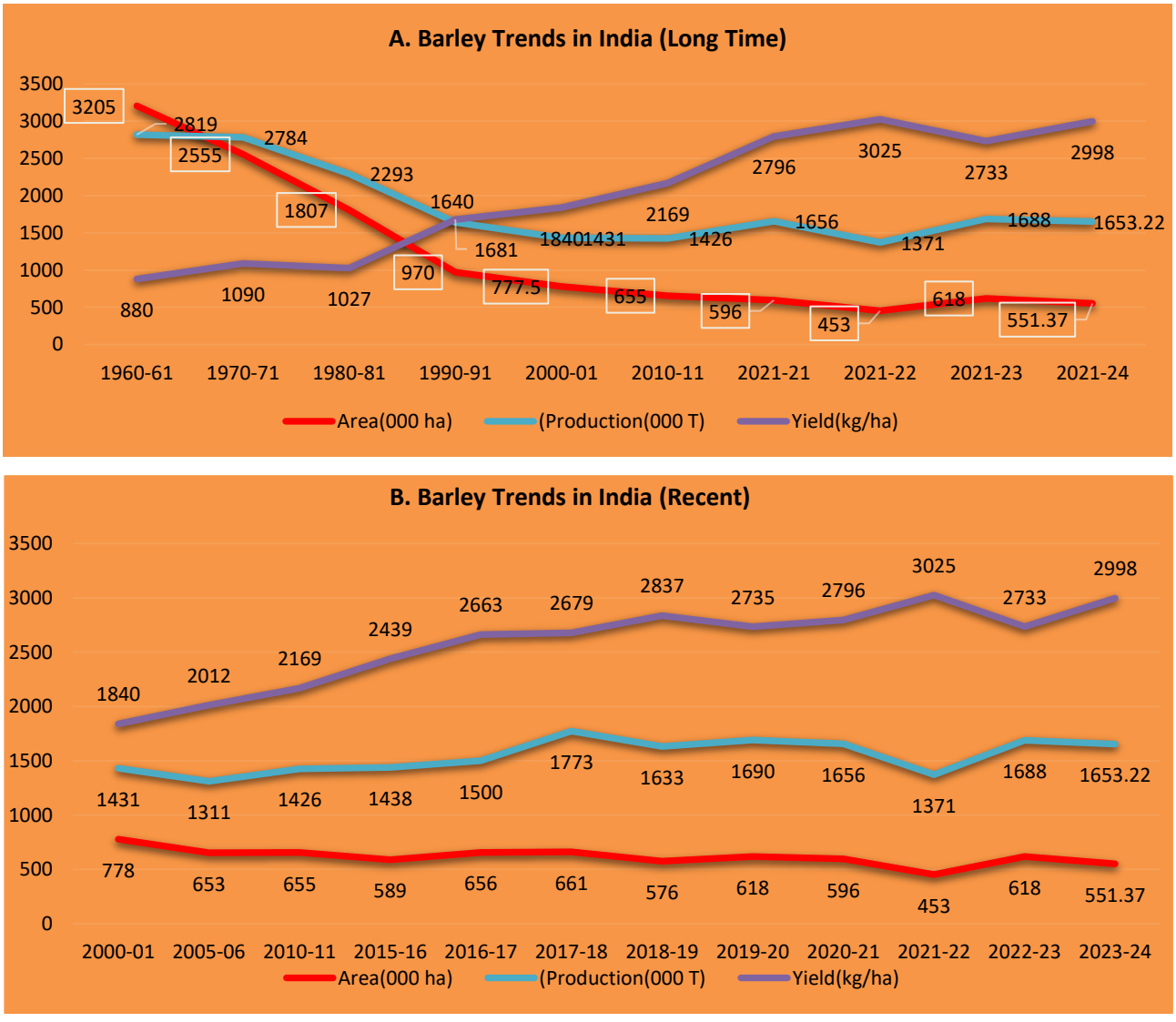

Fig.1.1. Graphical representation of barley area, production and productivity in long and recent times in India.

Table 1.1. Estimates of barley area, production and productivity in major barley growing states.

State/ Country	2021-22			2022-23 (Final Estimates)			2023-24 (3rd Estimates)		
	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	6.95	12.37	1779	7.32	12.33	1684	7.24	11.76	1624
Chhattisgarh	1.17	0.96	818	0.86	0.63	728	0.86	0.63	727
Haryana	3.29	10.65	3237	15.3	53.34	3486	11.42	38.66	3385
HP	18.11	31.39	1733	18.15	31.49	1735	17.19	29.34	1707
J&K	7.14	4.67	654	-	-	-	--	--	-
MP	16.00	32.48	2030	24.00	48.84	2035	19.00	32.97	1735
Punjab	5.00	15.48	3096	5.7	20.83	3655	5.20	20.19	3883
Rajasthan	200.47	711.05	3547	336.68	947.75	2815	285.06	1027.08	3603
UP	165.00	500.61	3034	166	510.12	3073	171.00	445.26	2604
Uttarakhand	20.00	29.28	1464	20	29.22	1461	18.46	26.24	1421
WB	0.17	0.29	1659	0.2	0.34	1700	0.10	0.19	1850
UT of Ladakh	9.97	21.94	2200	-	-	-	-	-	--
NCT Delhi	0.05	0.20	4000	-	-	-	-	-	--
Others	-	-	-	-	-	-	15.83	20.91	1321
All India	**453.32**	**1371.36**	**3025**	**617.59**	**1687.88**	**2733**	**551.37**	**1653.22**	**2998**

Source: DES, MoA & FW, India.

Development of New Barley Variety

DWRB219, derived from a cross of BETZS/DWRB88 a two-row hulled and malt barley variety developed by ICAR-Indian Institute of Wheat & Barley Research, Karnal, has been identified by VIC in 62nd Wheat and Barley Workshop and dedicated to the nation for commercial cultivation by the farmers for timely sown and irrigated conditions of North West Plain Zones of India. This is a high yielding (Ave. yield 54.49 qtls/ha), variety having yield potential upto 93 qtls/ha.

Fig. 1.2. DWRB 219, a two rowed, malt barley variety identified in 62nd Wheat & Barley Workshop for cultivation in NWPZ.

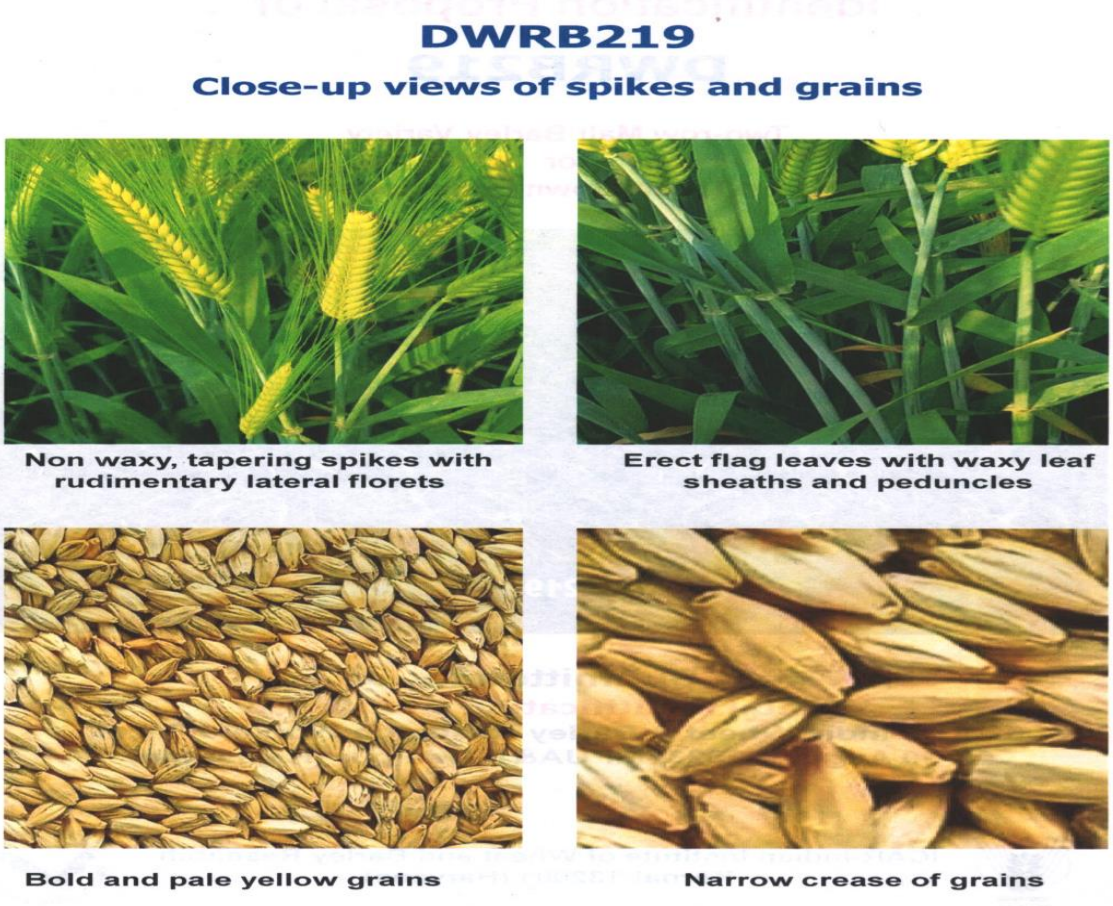

Table 1.2. Barley variety identified by VIC for its release during 2023-24.

SN	Variety	Parentage	Zone	Av. yield(q/ha)	Pot. Yield (q/ha)	Developed at	Production condition
1.	DWRB219 (For malting purpose	BETZS/ DWRB88	North West Plain Zone of India (Punjab, Haryana, Western UP & Rajasthan)	54.94	93.0	ICAR-Indian Institute of Wheat and Barley Research	Timely sown and Irrigated conditions. Resistant to rust and moderately tolerance to lodging.

Salient features of DWRB219

- DWRB219 is an exceptionally high-yielding two-row malt barley, with an average grain yield of 54.49 q/ha.
- It outperformed standard two-row malt barley checks: DWRUB52 by 13.87%, DWRB160 by 12.14%, DWRB 182 by 16.13%, and RD2849 by 12.18%.
- DWRB219 also surpassed six-row feed barley checks BH946 by 18.25% and DWRB137 by 4.74% in three years of trials.
- Consistently ranked in the highest performance group (20 out of 30 instances) in yield stability.
- In agronomic trials, DWRB219 showed superior grain yield, grains per ear, and 1000-grain weight at varying nitrogen dosages.
- Exhibited low yield reduction (-7.20%) at lower nitrogen (N60) and highest yield gain (+6.80%) at higher nitrogen (N120) compared to checks.
- Moderate lodging tolerance, crucial for maximizing yield potential.
- Demonstrated robust resistance to yellow rust and moderate resistance to leaf rust in NBDSN.
- Resistant to 6S0 yellow rust, and 40A and 122 black rust pathotypes in Seedling Resistance Tests.
- Showed superior resistance to leaf blights over three years in NBDSN.
- Achieved a competitive malting quality score of 17/36, with significant yield advantage over both current and long-term checks.
- Superior performance in hectolitre weight, grain size distribution, husk content, and 1000-grain weight compared to DWRB182.

Registration of Novel Barley Genetic Stocks

During the 2023-24 period, eight distinct barley genetic stocks—namely, DWRBG15, DWRBG16, DWRBG19, IC0138110-Sel, IC113045-Sel, DWRBG25 (tested as INBON-HI-(2016)-73), EC0578359-SEL, and EC0299361-SEL—have been successfully registered with ICAR-NBPGR. These genetic stocks are recognized for their unique and valuable traits, contributing significantly to the advancement of barley genetic resources.

Table 1.3. Genetic stocks registered with ICAR-NBPGR New Delhi during 2023-24.

SN	Name	INGRN	Trait (s)	Institute
1	DWRBG15	(INGR23084)	High protein (14.6%) and β glucan contents in grains (6.0%) in six row hulless barley	ICAR-IIWBR Karnal
2	DWRBG16	(INGR23085)	high β-glucan (6.1%) in six row hulless barley	ICAR-IIWBR Karnal
3	DWRBG19	INGR23086)	Low beta glucan (3.7%) in two-row malt barley	ICAR-IIWBR Karnal
4.	IC0138110-Sel	INGR23087	Early heading, Early maturity	ICAR-NBPGR New Delhi
5.	IC113045-Sel	INGR23088	Drought tolerance at seedling and adult pant stage	ICAR-NBPGR New Delhi
6.	DWRBG25(Tested as INBON-HI-(2016)-73)	INGR24019	Highter grain beta glucan content (8.0%dwb) Bold grain percentage (90.7%) High Protein content(16.1%dwb)	ICAR- IIWBR, Karnal
7.	EC0578359-SEL	INGR24020	Salinity tolerance (at 200 mM NaCI)	ICAR-NBPGR New Delhi
8.	EC0299361-SEL	INGR24021	Salinity tolerance (at 200 mM NaCI)	ICAR-NBPGR New Delhi

Trials for Crop Enhancements

Coordinated Yield Evaluation Trials

- A total of 117 test entries, contributed by 12 centers, were evaluated against 23 checks in coordinated yield trials conducted under various conditions, including rainfed (plains and hills), irrigated (plains), and saline soils. The new barley entries encompassed malt, feed, dual-purpose, and hulless types, though the majority were hulled, with a few hulless entries observed in the northern hills and plains.
- The trials were conducted at 10 primary centers and 31 additional testing sites, including ICAR, and SAUs, during the Rabi season of 2023-24.
- Of the 123 proposed yield evaluation trials, 122 were conducted against 34 check, as the IVT salinity and alkalinity tolerance trial at the Bhilwara center was not executed. At Hisar, two salinity and alkalinity trials were rejected due to poor crop stand at the Seed Farm, as determined by the monitoring team. Data were received on time for 120 trials. Upon analysis, only 90 trials (73.17% of those proposed and 75.0% of those received) were deemed suitable for reporting.

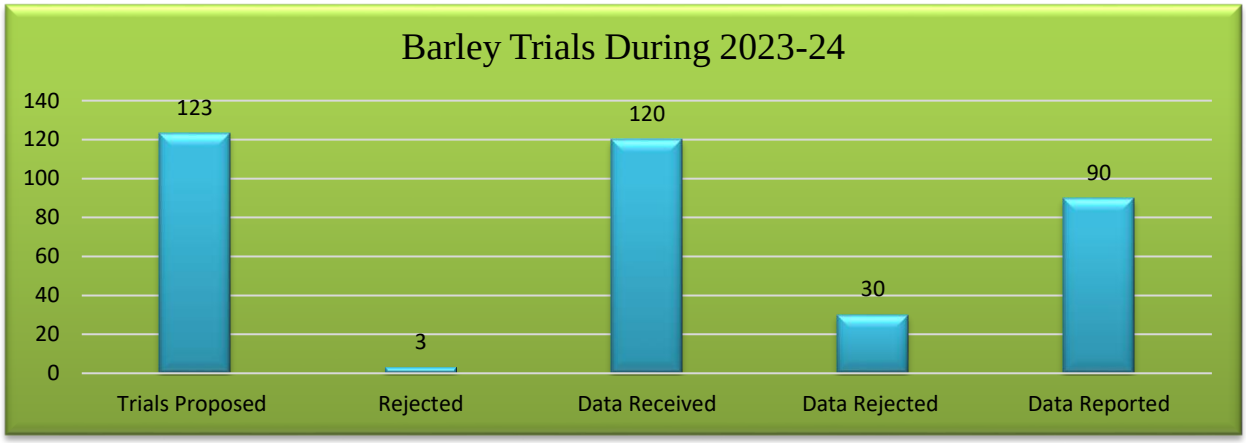

Fig 1.3. Barley trials proposed, rejected, data received data, data rejected and data reported.

Promising entries in AVT/IVTs during 2023-24

Following a comprehensive multilocation evaluation across various trial series, 51 entries demonstrated significant yield superiority over the best check (Table). Additionally, 15 entries exhibited numerical superiority across different trials/zones; however, they were statistically at par with the best check based on CD values. Notably, seven entries, while also statistically at par within CD limits, possess additional desirable traits. The decision regarding their promotion or retention in the AICRP trials for the subsequent year will hinge on strict promotion criteria, including significant superiority over the check or the presence of additional trait(s), as well as monitoring reports for purity, disease/pest resistance, and relevant quality traits.

Table 1.5. Leading Entries in Various Trials for 2023-24.

SN	Trial name	Zone	Significantly superior in grain yield over check	Numerically superior in grain yield over check + desirable Trait(s)	AT par with check in grain yield but having traits of quality or economic importance
Malt Barley Trials (Plains)					
1.					
	AVT-I-MB	NWPZ	DWRB235, DWRB238, RD3064	***	***
2.	IVT-IR-MB	NWPZ	DWRB2307, DWRB2309, DWRB2311, DWRB2312, RD3084, RD3086, RD3105, PL958, PL959	RD3087	***
Rainfed Barley Trial (Plains)					
3.	AVT/IVT-Rainfed	NEPZ	None	HUB288, RD3098	***
Salinity/Alkalinity Barley tolerance Trials (Plains)					
4.	IV/AVT-Sal/Alk	Plains	RD 3102	RD 3109	KB2031, RD3080, HUB294
Hulless Barley Trials (Plains)					
5.	AVT-(I&II) -NB	NWPZ	DWRB223, DWRB 244	***	***
6.	AVT-(I&II) -NB	CZ	NONE	***	***
7.	IVT-NB	NWPZ	NONE	PL960, RD3091	RD3092,R D3089, RD3090
8.	IVT-NB	NEPZ	DWRB2304, DWRB2306, PL960, RD3088, RD3089, RD3091,RD3092, UPB1121	****	****
9.	IVT-NB	CZ	PL960, RD3088, RD3089, UPB1121	DWRB2304, DWRB2306	RD3092
Rainfed Trials (Hills)					
10.	IVT/AVT-FB	NHZ	HBL884,VLB187	BHS498, HBL886, VLB185	***
11.	IVT/AVT-DP	NHZ	BHS502, BHS498, HBL884, VLB184, UPB1118	***	***
	AVT-1-HB	NHZ	NONE	BHS497	****
12.	IVT-HB	NHZ	BHS499	BHS500	***
f..	**Feed Barley Trials (Plains)**				
13.	AVT-II-FB	NEPZ	UPB1106	***	***
14.	IVT-FB	NWPZ	RD3095,BH1059,PL955	***	BH1058, PL1054, UPB 1123
15.	IVT-FB	NEPZ	BH1059, HUB290, PL955	***	BH1058, UPB1122 DWRB2302, RD3095
16.	IVT-FB	CZ	*****	***	***
Dual Purpose Barley Trials (Plains)					
17.	IVT-DP	NWPZ	JHSBB19, JHSBB16, JHSBB22, JHSBB28, DWRB2318, DWRB2313	***	***
18.	IVT-DP	NEPZ	NONE	***	***
19.	IVT-DP	CZ	DWRB2316, DWRB2313, JHSF21	DWRB2314, JHSBD11	***

Malt Barley Trials

AVT-I-MB-NWPZ

- The Advanced Varietal Trial of Malt Barley (AVT-MB-NWPZ) was conducted at 11 locations in the North Western Plains Zone (NWPZ) during the 2023-24 season.
- The trial followed standard protocols and was successfully completed at all locations, with data included in the zonal mean analysis.
- Seven genotypes were evaluated: three test entries (DWRB235, DWRB238, RD3064) and four check varieties (DWRUB52, DWRB137, DWRB182, RD2849).
- DWRB235 and DWRB238 were contributed by ICAR-IIWBR, Karnal, while RD3064 was contributed by the Durgapura center.
- The trial was carefully monitored during the optimal growth stage, with no issues of genetic purity or discrepancies reported.
- Mild spot blotch disease was observed at Hisar, Ludhiana, and Pantnagar, but overall, the crop status was rated as very good across all sites.
- Grain yield ranged from 42.01 q/ha (Hisar) to 76.37 q/ha (Tabiji), with a zonal mean of 53.65 q/ha.
- The check variety DWRB137 yielded the highest at 59.74 q/ha but was excluded from malt genotype comparison due to being a feed barley variety.
- Among malt barley entries, RD3064 ranked first with 56.78 q/ha, followed by DWRB238 (55.59 q/ha) and DWRB235 (55.59 q/ha).
- All three test entries (RD3064, DWRB238, DWRB 235) showed significant superiority over the best check variety and are recommended for promotion to AVT II of malt barley.

IVT-MB-NWPZ

- The Initial Varietal Trial of Malt Barley was conducted across 12 locations in the North Western Plains Zone (NWPZ) during the 2023-24 season. All trials adhered to standard guidelines and were successfully executed, with data from all locations included in the zonal mean analysis. A total of 25 genotypes were evaluated, comprising 21 test entries and 4 check varieties (DWRUB52, DWRB137, DWRB182, RD 2849).
- The test entries were contributed by various centers: Durgapura center provided 7 entries (RD3084, RD3085, RD3086, RD3087, RD3105, RD3106, RD3107); ICAR-IIWBR, Karnal contributed 6 entries (DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312); CCSHAU, Hisar contributed 3 entries (BH1055, BH1056, BH1057); PAU, Ludhiana contributed 3 entries (PL957, PL958, PL959); and Pantnagar center contributed 2 entries (UPB1124, UPB1125).
- The trial was meticulously monitored with no issues related to genetic purity or discrepancies reported. Mild occurrences of spot blotch disease were observed at Hisar, Ludhiana, and Pantnagar, but overall, the crop status was very good across all locations. Grain yield ranged from 38.43 q/ha at Dholpur to 68.00 q/ha at Durgapura, with a zonal mean of 53.23 q/ha.
- The top-performing test genotypes were DWRB2312 (61.41 q/ha, 1st rank), DWRB2311 (58.30 q/ha), RD3105 (57.82 q/ha), PL958 (57.58 q/ha), PL959 (56.98 q/ha), DWRB2307 (56.39 q/ha), RD3086 (56.05 q/ha), DWRB2309 (55.91 q/ha), and RD3084 (55.80 q/ha). DWRB137, a feed barley variety, yielded 58.65 q/ha but was excluded from comparisons with malt barley entries. Among malt barley checks, RD2849 was the highest-yielding at 51.62 q/ha, ranking 15th overall.
- Based on their significant superiority over the best malt check, nine test entries—DWRB2312, DWRB2311, RD3105, PL958, PL959, DWRB2307, RD3086, DWRB2309, RD3084—are recommended for promotion to AVT I.

IVT/AVT-Rainfed-NEPZ

- The Initial Varietal Trial for Rainfed Barley in the North Eastern Plain Zone was conducted at eight locations.
- Data from Varanasi, Sabour, and Ranchi were excluded from zonal mean analysis due to low site means, leaving data from five locations for consideration.
- The trial evaluated 13 genotypes: 12 test entries and one check variety (K 603).
- The test entries were contributed by various centers: Durgapura (6), Varanasi (2), Kanpur (2), and Ayodhya (2).
- Grain yield ranged from 15.77 q/ha at Chiyanki to 41.28 q/ha at Kanpur, with a zonal mean of 27.01 q/ha.
- RD 3098 achieved the highest grain yield at 33.54 q/ha, followed by HUB 288 at 33.32 q/ha, and K 603 at 32.92 q/ha.
- HUB 288 and RD 3098 were numerically superior in yield compared to K 603 and demonstrated favorable resistance to rust and blight diseases. These entries may be considered for promotion to AVT- I.

AVT/IVT-SAL-ALK-Plain Zones

- The Advanced/Initial Varietal Trial for Salinity and Alkalinity Conditions was conducted in 2023-24 across seven locations in the North Western and North Eastern Plain Zones of India, with satisfactory results at all sites except Hisar-I and Hisar-II, and Bhilwara not completing the trial.
- The trial evaluated 18 genotypes, including 15 test entries from various centers and 3 check varieties (NDB1173, RD2794 and RD2907).
- The trial was closely monitored, with no issues related to genetic purity or discrepancies reported, but due to poor plant stand, the trials at Hisar-I and Hisar-II were rejected.
- Disease and pest incidence were minimal, with only mild spot blotch at Hisar-I, and overall crop status was satisfactory across locations.
- RD3102 achieved the highest grain yield (41.58 q/ha), significantly superior to the check, while RD3109 was numerically superior; RD3084 and HUB294 were on par with the check, showing strong rust resistance and good blight resistance, respectively, and KB2031 was on par with the check, demonstrating excellent rust resistance and moderate blight resistance.

AVT-(I&II)-NK-(NWPZ, NWPZ)

- The advanced varietal trial for naked barley was conducted across six locations in NWPZ and five locations in the Central Zone, following the specified technical program.
- Pantnagar was excluded from the NWPZ zonal pooled analysis due to its low site mean (LSM: 21.46 q/ha), with the remaining five locations included for zonal mean calculation.
- The trial featured two test entries and three check varieties: K1149 (Gitanjali), Karan16, and PL891, with monitoring teams visiting trials at Ludhiana, Hisar, Durgapura, Modipuram, and Pantnagar.
- In NWPZ, grain yield location means ranged from 26.03 q/ha at Hisar to 54.49 q/ha at Durgapura, with an overall zonal mean of 39.91 q/ha.
- The AVT-2nd year entry DWRB223 ranked first with a mean grain yield of 47.4 q/ha, significantly outperforming all checks; DWRB244 from AVT-1st year ranked second with 40.9 q/ha, showing significant superiority and strong rust resistance with 7.8% beta-glucan, 43.3 ppm iron, and 38.2 ppm zinc content.
- In the Central Zone, three locations (Gwalior, Vijapur, and Morena) were excluded from the zonal mean analysis, with grain yield means ranging from 30.32 q/ha to 38.10 q/ha; no genotypes were advanced in this zone.

IVT-NK-(NWPZ, NEPZ, CZ)

- The trial was conducted at 15 locations across India, covering NWPZ (6 locations), NEPZ (4 locations), and the Central Zone (5 locations).
  The Pantnagar location in NWPZ was excluded from the zonal mean analysis due to a low site mean

of 19.88 q/ha.

- In NEPZ, Varanasi (11.53 q/ha) and Ranchi (19.18 q/ha) were excluded from the zonal pooled analysis due to low site mean grain yields.
- In the Central Zone, Morena (due to delayed sowing) and Vijapur due to low site mean (16.29 q/ha) were not included in the zonal pooled analysis.
- The trial included 10 test entries and 3 check varieties: K1149, Karan16, and PL891.
- Monitoring teams visited trial sites in NWPZ (Hisar, Ludhiana, Durgapura, Modipuram, and Pantnagar).
- Monitoring teams also visited NEPZ locations (Kanpur, Ayodhya, and Varanasi).
- In the Central Zone, monitoring teams visited Morena, Gwalior, Tikamgarh, Udaipur, and Vijapur.
- The trials were observed to be in good condition across all visited locations.
- In NWPZ, grain yield location means ranged from 26.20 q/ha (Hisar) to 54.17 q/ha (Durgapura).
- The overall zonal mean in NWPZ was 36.55 q/ha.
- Test entries PL960 (43.10 q/ha) and RD3091 (41.85 q/ha) ranked first and second in NWPZ.
- Check variety PL891 ranked third in NWPZ with a mean grain yield of 41.41 q/ha.
- In NEPZ, location means for grain yield ranged from 25.08 q/ha (Ayodhya) to 35.84 q/ha (Kanpur), with a zonal mean of 30.46 q/ha.
- In the Central Zone, test entries RD3088, PL960, RD3089, and UPB1121 all showed significantly superior grain yields compared to the check varieties, with location means ranging from 38.46 q/ha (Gwalior) to 57.63 q/ha (Tikamgarh).

AVT/IVT-RAINFED (NHZ)

- The advanced varietal trial (Rainfed) for the North Hills Zone was revised based on annual workshop decisions, combining normal and dual-purpose barley evaluation into a single trial.
- The trial included four replications: R1 and R3 focused on grain yield, while R2 and R4 assessed both grain yield and green fodder potential, with forage cutting scheduled 70 days post-sowing.
- Conducted at 8 locations across Uttarakhand, Himachal Pradesh, and Jammu and Kashmir, the trial featured 24 genotypes, including 19 test entries and 5 check varieties.
- Zonal monitoring at Almora, Gaja, Majhera, Bajaura, Malan, and Shimla confirmed no genetic purity issues, with excellent trial performance at monitored sites.
- Data from six locations were included in the zonal pooled analysis, excluding Gaja due to forage cutting in all replications and Majhera and Almora due to low site means.
- In the normal trial, grain yield location means varied from 14.4 q/ha at Malan to 47.3 q/ha at Wadura, with a zonal mean of 27.6 q/ha.
- The entry HBL884 ranked first with a mean grain yield of 32.7 q/ha, followed by VLB187 in second place with 32.4 q/ha, both in the first non-significant group.
- VLB187 showed significant superiority over the best check, HBL113, which had a mean grain yield of 30.5 q/ha.
- Among hulless barley entries, BHS499 ranked 19th with a mean grain yield of 25.2 q/ha, comparable to the hulless check variety BHS352 (23.6 q/ha).
- Entries BHS497 and BHS500, ranked 20th and 21st respectively, with mean grain yields of 24.4 q/ha and 24.3 q/ha, both showing numerical superiority over the hulless check BHS352.
- The dual-purpose trial was conducted at eight locations in the Northern Hills Zone, but Gaja was excluded from statistical analysis due to cutting in all four replications.
- Data from Almora and Majhera were also excluded from the zonal mean analysis, leaving five locations for zonal pooled analysis of grain yield after regeneration in the cut treatment.
- Grain yield location means ranged from 16.5 q/ha at Khudwani to 25.8 q/ha at Shimla, with an overall zonal mean of 22.2 q/ha.
- HBL884 ranked first among the test entries with a mean grain yield of 28.3 q/ha, leading the first non-significant group.

- Entries BHS498 (25.7 q/ha), UPB1118 (24.8 q/ha), BHS502 (24.4 q/ha), and VLB185 (24.3 q/ha) ranked 3rd to 6th, all significantly outperforming the dual-purpose check variety BHS380 (22.5 q/ha).
- In the IVT-RF-NHZ trial, forage cutting was conducted 70 days after sowing, with data from Almora, Majhera, and Gaja excluded from zonal mean analysis due to low site means.
- Green fodder yield location means ranged from 20.2 q/ha at Bajaura to 58.3 q/ha at Khudwani, resulting in an overall zonal mean of 31.7 q/ha.
- Test entry VLB185 ranked second with a mean fodder yield of 35.2 q/ha in the first non-significant group, while the dual-purpose check variety BHS380 ranked tenth with 32.9 q/ha.
- A joint ranking was developed to assess overall dual-purpose performance, considering both grain and fodder yields.
- VLB185 showed superior performance with a grain yield of 24.3 q/ha and a fodder yield of 35.2 q/ha, outperforming the dual-purpose check BHS380, which had a grain yield of 22.5 q/ha and a fodder yield of 32.9 q/ha.

AVT-FB-NEPZ

- The Advanced Varietal Trial II for irrigated, timely sown feed barley was conducted at six NEPZ locations: Kanpur, Kumarganj, Pusa, Samastipur, Varanasi, and Sabour.
- Data was collected from all locations, but only results from Kanpur, Kumarganj, Pusa, and Samastipur were included in the zonal pooled analysis, excluding Varanasi and Sabour due to low site means.
- The trial tested one entry, UPB1106, against four check varieties: BH946, DWRB137, HUB113, and BH393.
- Grain yield ranged from 31.8 q/ha at RPCAU, Pusa, to 49.1 q/ha at Kanpur, with an overall zonal mean of 37.2 q/ha.
- UPB1106 ranked highest with 39.9 q/ha, closely followed by BH946 at 38.9 q/ha, and showed significant superiority over the best-performing zonal check, HUB113.

IVT-FB-(NWPZ, NEPZ, CZ)

- The trial was conducted at 21 locations across the NWPZ (8 locations), NEPZ (7 locations), and the Central Zone (6 locations), with successful data collection from each site.
- The trial included 19 test entries and four zonal checks: DWRB137 (NWPZ, NEPZ, CZ), BH946 (NWPZ), RD2899 (CZ), and HUB113 (NEPZ). One test entry from the Hisar center was excluded due to complete seed damage by insects.

- To meet the Lattice Square Design requirements, RD2907 and DWRB64 were added as filler entries, bringing the total number of entries to 25.
- The zonal pooled analysis in the NWPZ included results from all eight locations, with grain yields ranging from 34.7 q/ha at Hisar to an exceptionally high 76.9 q/ha at Durgapura, resulting in a zonal mean of 48.9 q/ha.
- Among the NWPZ checks, DWRB137 was the top performer, yielding 53.2 q/ha and ranking fifth overall.
- The test entries RD3095 (57.6 q/ha), BH1059 (55.9 q/ha), and PL955 (55.9 q/ha) ranked first, second, and third, respectively, and each significantly outperformed the best check in the zone.
- In the NEPZ, data from Varanasi (26.1 q/ha) and Sabour (12.1 q/ha) were excluded from the zonal pooled analysis due to low site means, with the analysis conducted using data from the remaining five locations.
- Grain yields in the region ranged from 32.4 q/ha at BISA, Samastipur to 48.7 q/ha at Kanpur, resulting in an overall zonal mean of 36.9 q/ha. DWRB137 was identified as the best check variety, yielding 42.5 q/ha and ranking seventh overall.

- The top three test entries—BH1059 (46.4 q/ha), HUB290 (46.3 q/ha), and PL955 (45.8 q/ha)—ranked first, second, and third, respectively, all significantly outperforming the best zonal check variety.
- In the Central Zone, data from Morena and Vijapur were excluded from the zonal pooled analysis due to late sowing at Morena and a low site mean of 24.8 q/ha at Vijapur, with the analysis based on data from the remaining four locations.
- Grain yields ranged from 31.1 q/ha at Gwalior to 66.0 q/ha at Tikamgarh, resulting in an overall zonal mean of 50.4 q/ha. The zonal check variety RD2899 ranked first with a yield of 58.3 q/ha.
- Following RD2899, the top-performing entries were DWRB2302 (58.2 q/ha), RD3096 (56.4 q/ha), PL954 (55.9 q/ha), PL955 (55.6 q/ha), and BH1059 (55.4 q/ha); however, none of the test entries showed significant superiority over the best check variety in this zone.
- A monitoring team found all barley trials at Dholpur (NWPZ) and Morena, Gwalior, Tikamgarh, and Banda (Central Zone) to be rust-free, but observed leaf blight in entries GB1 (56) and RD3096 (35) during the IVT-IRTS-FB trial at Gwalior, Tikamgarh, and Banda centers.

IVT-DP- (NWPZ, NEPZ and CZ)

- The trial was conducted at 16 locations across the NWPZ, NEPZ, and Central Zone, including sites like Hisar, Karnal, Ludhiana, and Kanpur.
- Data were successfully collected from all 16 locations.
- The trial tested 12 entries, such as DWRB2313 and JHSBD11, alongside two dual-purpose barley checks, RD2715 and RD2552.
- Data from all six NWPZ locations were received, but Pantnagar's data were excluded due to failure to cut all replications at 55 DAS, violating the technical program.
- Data from Ludhiana, Modipuram, and Dholpur were not included in the zonal pooled analysis because their green fodder yields were below 125 q/ha, despite grain yields exceeding 22 q/ha.
- The zonal pooled analysis included data from Hisar, Karnal, and Durgapura, where both grain yield and green fodder yield from the first cut at 55 DAS were considered; Hisar was included despite slightly lower fodder yield.
- Grain yields varied from 28.2 q/ha at Hisar to 47.5 q/ha at Durgapura, and green fodder yields ranged from 123.7 q/ha at Hisar to 203.2 q/ha at Karnal.
- Six test entries showed significantly higher grain yields, but none surpassed the best check variety RD2715 in green fodder yield, which ranked first at 197.7 q/ha.
- The trial in the NEPZ was conducted at four locations, with data received from all sites, but Ranchi's data were excluded due to failure to cut all replications at 55 DAS, violating the technical program.
- Data from Varanasi and Kumarganj were also excluded; Varanasi was rejected due to low site means for both grain and green fodder yields, and Kumarganj due to a low green fodder yield.
- At the Kanpur location, the average grain yield across entries was 31.2 q/ha, while the green fodder yield was 125.7 q/ha.
- The test entry DWRB2318 achieved the highest grain yield at 39.1 q/ha, and the check variety RD2715 recorded the highest green fodder yield at 135.0 q/ha.
- With data available from only one location, no decisions could be made regarding the promotion of entries in the NEPZ.
- The trial in the Central Zone was conducted at five locations, with data received from all, but data from Morena and Vijapur were excluded due to failure to cut all replications at 55 DAS, violating the technical program.
- The Tikamgarh location was also excluded from the pooled analysis due to a low green fodder yield.
- The pooled analysis of the remaining locations showed that Gwalior had the highest site means for both grain yield (34.6 q/ha) and green fodder yield (283.0 q/ha).
- Zonal averages were 31.2 q/ha for grain yield and 247.4 q/ha for green fodder yield, with the test entry DWRB2316 ranking first in both categories, significantly outperforming the best check variety, RD2715.

❖ A monitoring team visited the trials at Morena, Gwalior, and Tikamgarh, confirming that all trials were conducted properly and were rust-free.

Molecular Profiling of Barley AVT 2023-24

Molecular profiles were generated to distinguish entries with their respective checks for barley AVT-MB-NWPZ and AVT-NB-NWPZ trials 2023-24. A set of 46 SSR/STS markers covering all the seven linkage groups of barley was screened with twelve genotypes including entries and checks. During UPGMA clustering of AVT-MB-NWPZ, three entries under evaluation were grouped in single cluster at similarity coefficient (Sm) value 0.77 and showed sufficient genetic variability at molecular level.

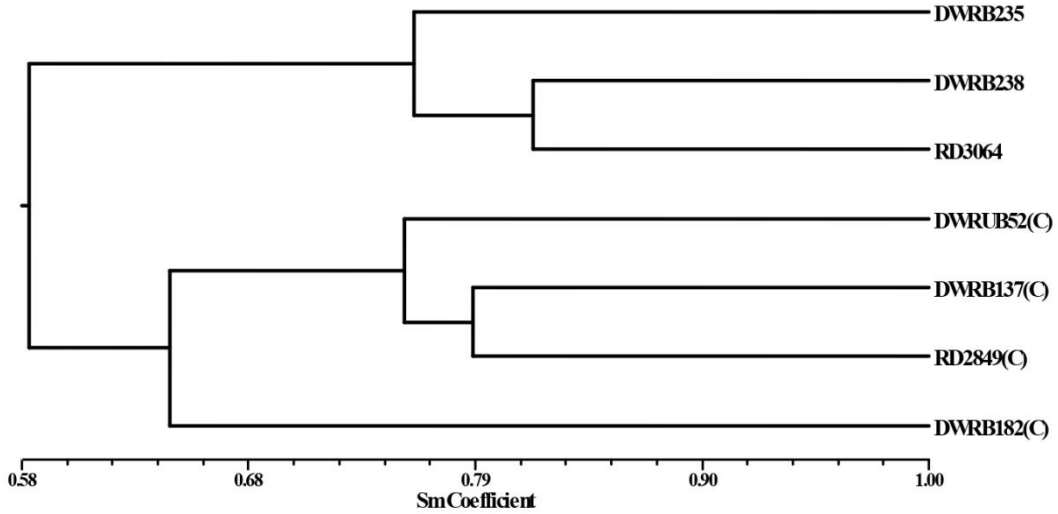

Fig. 1.4. Sm coefficient among AVT-MB-final year entries

UPGMA based clustering of AVT-MB-NWPZ 2023-24 entries and checks for genetic variability

Average polymorphic information content (PIC) of AVT entries and checks varied of this trial entries varied from 0.31 to 0.44 across seven linkage groups of barley and chromosome 6H was found most variable.

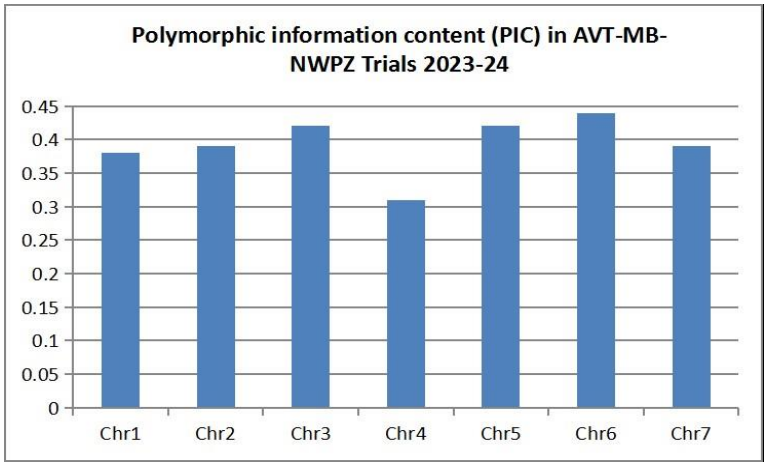

Fig. 1.5. Polymorphic information content (PIC) in AVT-MB-NWPZ Trials 2023-24

Likewise, for AVT-NB-NWPZ trial, five genotypes including one entry and four checks clustered within Sm range of 0.63 to 1.0.

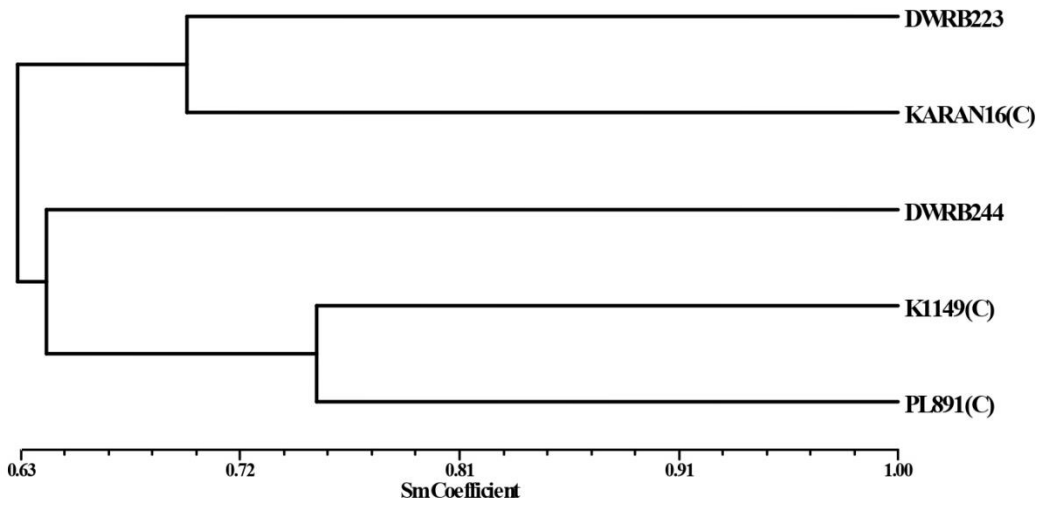

Fig. 1.6. Sm coefficient among AVT-NK-NWPZ final year entries

UPGMA based clustering of AVT-NB-NWPZ 2023-24 entries and checks for genetic variability

Average polymorphic information content (PIC) of AVT entries and checks varied of this trial entries varied from 0.23 to 0.46 across seven linkage groups of barley and chromosome 7H was found most variable.

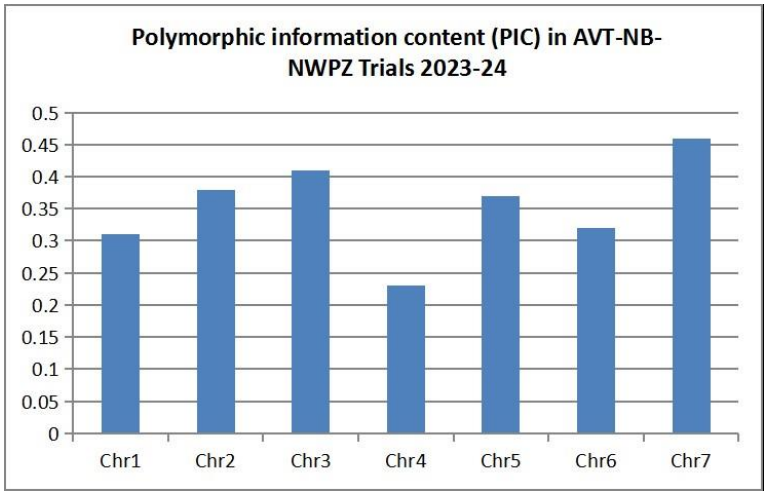

Fig. 1.7. Polymorphic information content (PIC) in AVT-NK-NWPZ Trials 2023-24

In both dendrograms, each entry is uniquely placed at separate node and is distinct from rest of entries and check lines, respectively. The eventual intend of this effort is to develop molecular markers based amplification profiles for varietal characterization and to assess the level of genetic diversity in Indian barley.

Breeder and Nucleus Seed Production of Barley during 2023-24

Breeder Seed Indent

A total of 571.55 quintals of breeder seed across 29 varieties was indented by the Seed Division, DA&FW, New Delhi, for production in 2023-24 and distribution in 2024-25. The breeder seed indent was requested by seven states—Rajasthan, Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Madhya Pradesh, and Uttarakhand—and five public sector agencies, including the National Seeds Corporation, IFFDC, NDDB, KVSS, and the National Seed Association of India (NSAI). Rajasthan placed the largest indent of 200 quintals (35%), followed by Uttar Pradesh with 100 quintals (17%), KVSSL with 12%, and National Fertilizer Limited. The top five indenting agencies accounted for nearly 85% of the total breeder seed indent for 2023-24.

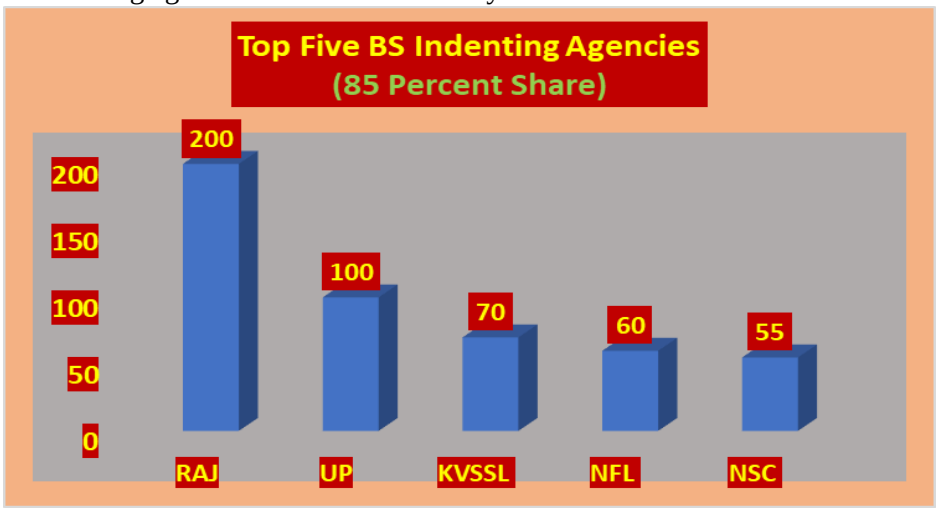

Fig 1.8. Percent share of different BS indenting agencies.

Breeder Seed Allocation and Production

A total of 554.35 quintals of breeder seed across 20 varieties was allocated to nine BSP centers across six states. The indent of 17.20 quintals of breeder seed for five varieties was not allocated in BSP-1 due to either a low indent (<2.0 quintals) or the varieties being over 10 years old. Among the 20 varieties, the highest breeder seed indent was received for DWRB 137 (129.55 quintals), followed by RD 2907 (68.50 quintals) and RD 2899 (60.0 quintals).

In the 2023-24 production cycle, a total of 787.50 quintals of breeder seed was produced, exceeding both the indent of 571.55 quintals and the allocation of 554.35 quintals, resulting in a surplus of 215.95 quintals against the allocation and 233.15 quintals against the indent. Among the nine breeder seed production centers, RARI, Durgapura reported the highest production at 405.80 quintals, followed by IIWBR, Karnal with 148.00 quintals, and CCSHAU, Hisar with 96.00 quintals. The top five indented varieties accounted for 61.28% of the total indent during 2023-24. Additionally, 19.04 quintals of nucleus seed for 24 varieties was produced against a 17.60 quintal allocation in BNS-1 2023-24.

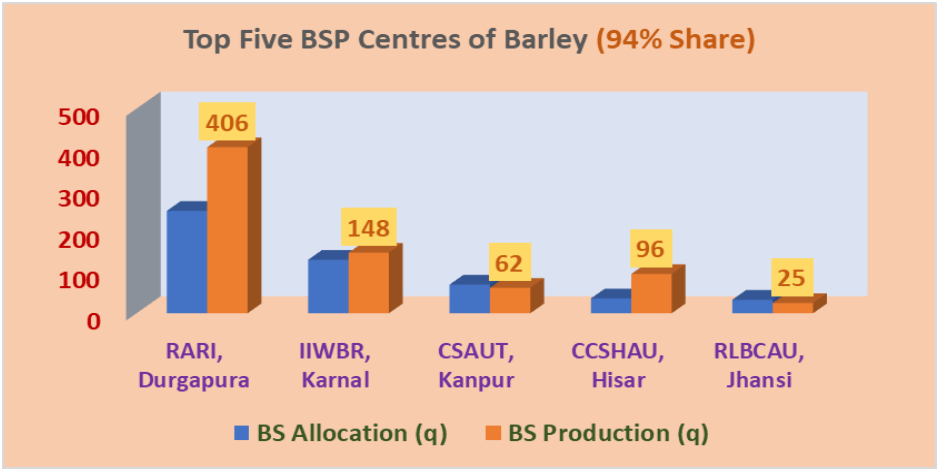

Fig. 1.9. Breeder and Nucleus Seed Allocation & Production.

Table 1.6. Breeder and Nucleus Seed Allocation & Production.

S.No.	BSP Centre	BS Allocation	BSP IV (Production)	Surplus /Deficit ±	NS Allocation	BNS IV (Production)	Surplus /Deficit±
1	RARI, Durgapura	250.25	405.80	155.55	7.00	3.60	-3.40
2	IIWBR, Karnal	130.75	148.00	17.25	4.00	7.50	3.50
3	CSAUT, Kanpur	70.00	62.20	-7.80	2.00	4.80	2.80
4	CCSHAU, Hisar	36.25	96.00	59.75	2.00	3.10	1.10
5	RLBCAU, Jhansi	33.00	25.00	-8.00	1.00	0.00	-1.00
6	PAU, Ludhiana	12.60	40.00	27.40	0.50	0.00	-0.50
7	HPKV, Palampur	10.50	7.00	-3.50	0.50	0.00	-0.50
8	IARI-RS, Karnal	10.00	2.50	-7.50	0.50	0.04	-0.47
9	VPKAS, Almora	1.00	1.00	0.00	0.10	0.00	-0.10
	Total	**554.35**	**787.50**	**233.15**	**17.60**	**19.04**	**1.44**

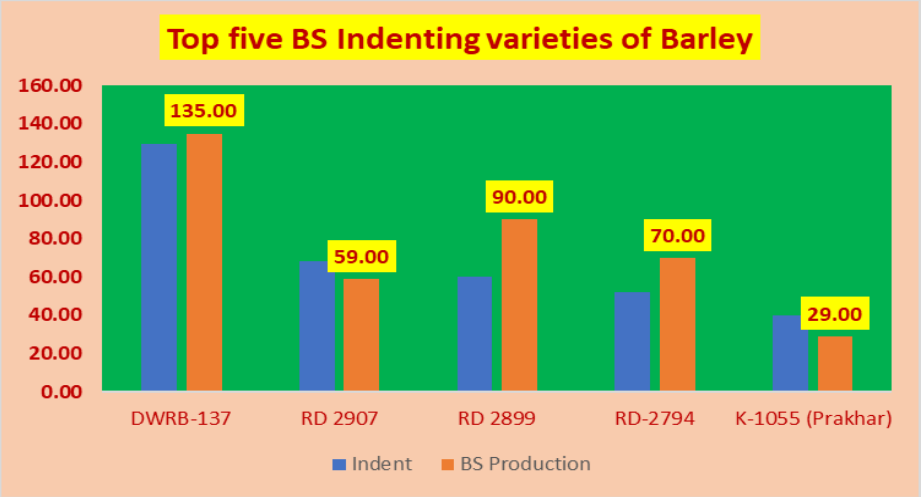

Fig. 1.10. Breeder seed top five Indented varieties of barley.

Barley Germplasm - *International trials and nurseries*

To enhance the availability of promising new genetic diversity within the national barley program, the All India Coordinated Wheat and Barley Improvement Program (AICWBIP) oversees the import and evaluation of international trials and nurseries. During the Rabi 2023-24 season, two international yield trials and one observation nursery, comprising a total of 195 genotypes for various production conditions, were received from ICARDA (Table 4). Each set of these nurseries and trials was evaluated at ICAR-IIWBR, Karnal, with additional sets distributed for evaluation at various locations according to specific regional requirements.

Furthermore, the Elite International Barley Germplasm Nursery (EIBGN), consisting of 24 entries, was provided to 12 locations as a set of 48 entries, which included six checks repeated four times at each location across NWPZ, NEPZ, and NHZ. Additionally, the National Barley Genetic Stock Nursery (NBGSN), featuring a set of 12 promising genetic stocks with valuable breeding traits from various cooperating centers, was distributed to 12 centers for further utilization in breeding programs.

Table. 1.7. International trials and nurseries evaluated during crop season 2023-24

SN.	Trials/Nurseries	Genotypes received	National Check	# Sets	Locations
1	2024 International Barley Yield Trial for Feed Forage and Malt in Favourable Environments (IBYT-FFM-24)	24	DWRB137	4	Durgapura, Hisar, Kanpur, Karnal
2	2024 International Barley Yield Trial for Arid and Semi-Arid regions (IBYT-ASA)	24	Lakhan	4	Pantnagar, Karnal Durgapura, Kanpur,
3	2024 International Barley Observation Nursery (IBON-24)	147 + 6 checks	DWRB137	5	Hisar, Kanpur, Karnal, Ludhiana, Durgapura,

Barley Germplasm Exchange, Conservation and rejuvenation

Germplasm Exchange: A total of 358 barley accessions were disseminated to various institutions nationwide, while 168 new barley germplasm accessions were incorporated into the collection.

Germplasm Conservation: The germplasm repository currently safeguards and manages 8,239 barley accessions within the Medium Term Storage Module at ICAR-IIWBR, Karnal, under precise conditions of 4°C and 30% relative humidity. Additionally, 56 barley accessions, including 45 wild accessions of *Hordeum spontaneum*, are preserved.

Database and Inventories: The barley database, encompassing 106 notified varieties, 67 genetic stocks, and the comprehensive germplasm inventory, undergoes regular updates to ensure accuracy and completeness.

DUS Project on Barley (Funded by PPV&FRA): This year, four candidate varieties—2880/3840, 2883/2394, 23BABC7301, and 23BARANA02—were cultivated for their first-year evaluation. Concurrently, the maintenance of barley reference collections, comprising 49 and 106 released varieties, was undertaken. The DUS data are being systematically compiled for submission to the PPV&FRA, New Delhi.

Characterization: A total of 25 barley genotypes, including 23 high-malting types and 2 hulless entries from the AVT final year, were thoroughly characterized according to 32 DUS (Distinctness, Uniformity, and Stability) traits, adhering to the established DUS guidelines.

Rejuvenation and Evaluation of Barley Germplasm Accessions: This year, 1,044 barley germplasm accessions were successfully rejuvenated, with comprehensive data collection focusing on several promising traits. The accessions demonstrating favorable characteristics are detailed as follows:

Table 1.8. Accessions that exhibited promising characteristics.

Trait	Criteria	Promising Accessions
Days to heading	<70 days	BCU 407, BCU 446, BCU 443, BCU 447, BCU 4865, BCU 411, BCU 485, BCU 594, BCU 457, BCU 591
Days to maturity	<120 days	BCU 449, BCU 4656, BCU 4865, BCU 5327, BCU 4827, BCU 4829, BCU 4830, BCU 4889, BCU 599, BCU 600, BCU 4826, BCU 4858, BCU 4883
Plant height	<80 cm	BCU 4956, BCU 411, BCU 4865, BCU 4907, BCU 594, BCU 633, BCU 420, BCU 370, BCU 616, BCU 558, BCU 924
Grain yield (g/plot)	High	BCU 4372 (1476 g), BCU 4364 (1404 g), BCU 4342 (1228 g), BCU 4259 (1136 g), BCU 4094 (1124 g), BCU 4282 (1120 g), BCU 4118 (1116 g)

Monitoring of Barley Yield Trials & Nurseries

Teams assigned to monitor Barley Yield Trials and Nurseries across the Central Zone, NWP, and NEP Zones conducted visits to various locations during the optimal crop stage. They recorded observations on varietal performance, trial conduct, disease and pest incidence, and the genetic purity of test entries (Table 5). Immediate decisions were made regarding the rejection of trials and the assessment of test entry purity. The proceedings from these team meetings have been circulated for necessary action by the concerned breeders and scientists, with copies appended to the report for record-keeping.

Table.1.9. Zonal monitoring visits of the barley teams

Zone	Date	Centres visited	Team Members
NEPZ Team I	Feb. 27-March 1, 2024	Sabour, Pusa, Samastipur	Drs. Lokendrra Kumar, Anil Khippal and S.S Vaish
NEPZ Team II	March 6-10, 2024	Kanpur, Dalipnagar, Kumarganj, Saini, & Varanasi	Drs. Om Vir Singh and Dr. Vijay Yadav
CZ	Feb. 13-16, 2024	Dholpur, Morena, Gwalior, Tikamgarh and Banda	Drs. Jogendra Singh, S.S. Rajput, P.S. Shekhawat and Sudhanshu Jain
NWPZ & CZ	March 4-8, 2024	Bawal, Navgaon, Durgapura, Tabiji, Udaipur, Vijapur	Drs. Lokendra Kumar, S.S> Punia, R.S. Beniwal
NWPZ	March 11-12, 2024	CCSHAU., Hisar, Bhatinda Ludhiana, IIWBR, Hisar	Drs. S.K Bishnoi, Jaspal Kaur, Bhagat Singh, Simarjit Kaur
NWPZ	March 15-16, 2024	Modipuram and Pantnagar	Drs. Lokendra Kumar and Jogendra Singh
NHZ	April 14-17, 2024	Malan, Bijaura and Shimla	Drs. Jogendra Singh, D.P. Walia and P.L. Kashyap
NHZ	April 15-17, 2024	Majhera, Almora and Gaja	Drs. Charan Singh, Pramod Prasad and Navin Chander Gahtyari

CROP PROTECTION (Plant Pathology)

Status of barley diseases and insect pests

To evaluate the health status of the barley crop, a comprehensive survey was conducted by scientists from the Rajasthan Agricultural Research Institute (RARI), Durgapura, on December 21, 2023, across farmers' fields in the Dausa district of Rajasthan. The results indicated that the barley crop was generally healthy. Prior to this, a team from Bihar Agricultural University (BAU), Sabour, conducted an extensive survey in Bhagalpur and its surrounding areas on December 16-17, 2023, observing a minor incidence of spot blotch in barley crops at several locations, including Barari, Jagdishpur, Nathnagar, Sabour, and Kahalgaon.

Another survey by the RARI team on January 18, 2024, in the Jaipur and Dausa districts revealed traces of leaf stripe, loose smut, covered smut, and bacterial streak in the barley crop at a few locations. Further, the Uttar Banga Krishi Viswavidyalaya (UBKV) team from Coochbehar conducted surveys on January 10-12, 2024, January 17, 2024, January 24, 2024, and January 26, 2024, in farmers' fields across several northern districts of West Bengal and adjacent areas, including Malda (Manikchak, Harishchandrapur-I, and Chanchal blocks), Dakshin Dinajpur (Raiganj and Balurghat areas), Uttar Dinajpur (Islampur sub-division), Darjeeling (Kharbari block), Kalimpong (RRS, Hill Zone), Jalpaiguri (Mohit Nagar and surrounding areas), and Coochbehar district (Dinhata, Tufanganj, Mathabhanga, and Pundibari blocks). The spot blotch incidence in barley crops was recorded as high as 56% at Pundibari, Coochbehar.

Additionally, a subsequent survey was conducted on February 15, 16, and 29, 2023, focusing on wheat fields in the Dakshin Dinajpur, Malda, Darjeeling, and Coochbehar districts by a UBKV team, where the spot blotch incidence in barley crops reached up to 89% in Pundibari, Coochbehar.

Status of Resistance in Breeding Lines and Advanced Entries:

Adult plant resistance (APR)

During the 2023-24 crop season, a total of 686 barley breeding lines were systematically screened across various nurseries—namely, the Initial Barley Disease Screening Nursery (IBDSN), National Barley Disease Screening Nursery (NBDSN), and Elite Barley Disease Screening Nursery (EBDSN)—for resistance against multiple diseases, aphid infestations, and Cereal Cyst Nematode (CCN) at different collaborating research centers. Specifically, 492 lines were evaluated under the IBDSN, 144 under the NBDSN, and 50 under the EBDSN (Fig. 1). The Seedling Resistance Test (SRT) for NBDSN and EBDSN entries was conducted at the Indian Institute of Wheat and Barley Research (IIWBR), Regional Station, Flowerdale, Shimla. In addition to disease resistance screening of barley germplasm, experiments were conducted at various locations to assess the efficacy of

different fungicides for the chemical control of foliar blight. Furthermore, NBDSN entries were also evaluated for resistance to aphid and CCN infestations.

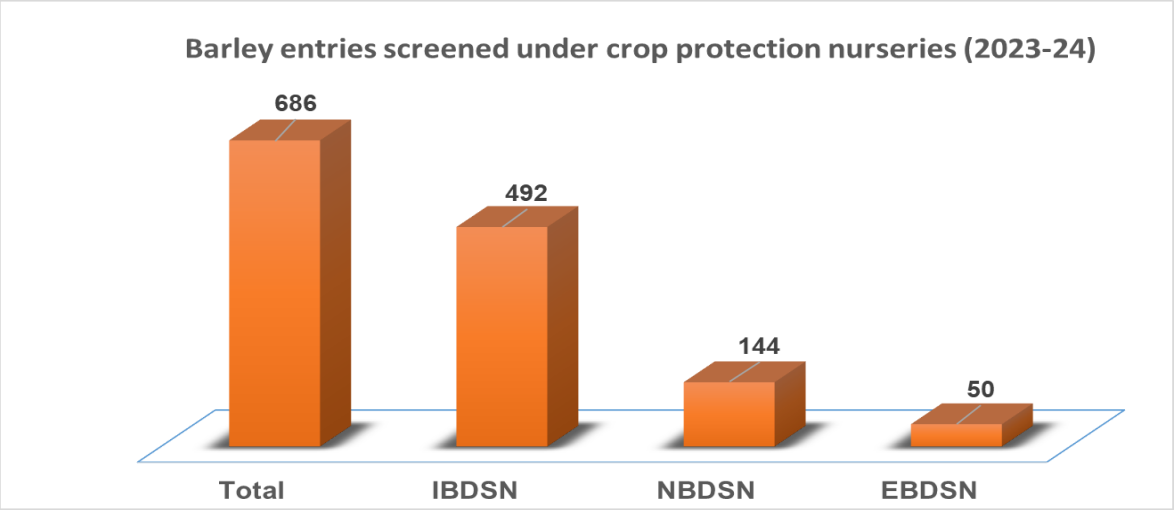

Fig.1.11. Barley entries screened under crop protection nurseries (2023-24).

Initial Barley Disease Screening Nursery (IBDSN) 2023-24

During the 2023-24 season, a total of 492 barley entries, contributed by 14 breeding centers, were systematically screened under the Initial Barley Disease Screening Nursery (IBDSN) for resistance against major diseases, specifically stripe rust and leaf blight, across various coordinating centers. The stripe rust screening was conducted at Bajaura, Ludhiana, Durgapura, Almora, Karnal, and Jammu, while leaf blight screening was performed at Ayodhya, Pantnagar, Kanpur, and Varanasi.

Of the 492 entries evaluated, 47 entries were completely free from yellow rust, showing an Average Coefficient of Infection (ACI) of 0, and 291 entries exhibited a resistant reaction, with an ACI of less than 10. In the leaf blight screening, 3 entries demonstrated resistance, with an average score (double-digit) of 00-13 and a Host Severity (HS) of ≤ 35, while 39 entries were found to be moderately resistant, with an average score (double-digit) of 14-35 and an HS of ≤ 57. The detailed results are presented in Table1.10.

Table 1.10. Resistant entries in IBDSN

Yellow rust, ACI = 0, Entries –47	BK2316, BK2329, BK2330, BK2334, BK2337, BK2353, BK2360, BK2362, BK2364, PKB2332, PKB2353, PKB2358, PKB2362, PKB2365, HB2315, HB2318, HB2319, HB2321, HB2322, VB 2301, BH23-01, BL2210, BL2316, BL2338, BL2361, BBM 972, BBM 976, BBM994, JAUB13, JAUB14, UPBM02, UPBM04, UPBM21, BD2021, BD2025, BD2033, BD2034, BD2036, BD2053, BD2056, BD2057, BD2061, BD2067, BD2068, BD2070, HUBL2307, and ICB-397
Yellow rust, ACI > 0 to 10, Entries – 291	BK2303, BK2305, BK2306, BK2307, BK2308, BK2309, BK2310, BK2311, BK2312, BK2313, BK2314, BK2315, BK2317, BK2319, BK2320, BK2321, BK2324, BK2325, BK2326, BK2327, BK2328, BK2331, BK2332, BK2333, BK2335, BK2336, BK2339, BK2341, BK2343, BK2345, BK2346, BK2347, BK2348, BK2349, BK2352, BK2354, BK2358, BK2359, BK2361, BK2363, BK2365, PKB2301, PKB2304, PKB2306, PKB2307, PKB2313, PKB2314, PKB2315, PKB2321, PKB2323, PKB2325, PKB2333, PKB2334, PKB2335, PKB2341, PKB2342, PKB2343, PKB2346, PKB2348, PKB2349, PKB2354, PKB2355, PKB2356, PKB2359, PKB2360, PKB2363, PKB2364, PKB2366, HB2301, HB2303, HB2304, HB2305, HB2306, HB2307, HB2308, HB2310, HB2311, HB2312, HB2313, HB2314, HB2316, HB2317, HB2320, JHSBB 14, JHSBC 36, JHSBK 40, NDB 1835, NDB 1836, NDB 1837, NDB 1840, NDB 1841, NDB 1842, NDB 1843, NDB 1844, NDB 1845, NDB 1846, NDB 1847, NDB 1850, NDB 1851, NDB 1852, VB 2302, VB 2303, VB 2304, VB 2306, VB 2307, VB 2308, VB 2309, VB 2310, VB 2311, VB 2313, VB 2314, VB 2319, VB 2322, VB 2323, VB 2324, VB 2325, VB 2330, BH23-03, BH23-04, BH23-05, BH23-06, BH23-08, BH23-09, BH23-11, BH23-12, BH23-13, BH23-14, BH23-15, BH23-16, BH23-19, BH23-20, BL2211, BL2216, BL2217, BL2219, BL2238, BL2242, BL2243, BL2244, BL2245, BL2247, BL2248, BL2250, BL2255, BL2260, BL2271, BL2289, BL2292, BL2293, BL2300, BL2302, BL2306, BL2307, BL2311, BL2317, BL2321, BL2322, BL2329, BL2332, BL2334, BL2336, BL2337, BL2340, BL2341, BL2342, BL2343, BL2344, BL2352, BL2353, BL2354, BL2355, BL2358, BL2359, BL2362, BL2363, BL2365, BL2368, BL2373, BL2374, BL2221, BBM

	963, BBM 964, BBM 965, BBM 967, BBM 968, BBM 969, BBM 970, BBM 971, BBM 973, BBM 974, BBM 975, BBM 977, BBM 978, BBM 979, BBM 981, BBM 982, BBM 984, BBM 985, BBM 986, BBM 988, BBM 989, BBM 991, BBM 992, BBM 993, BBM 995, BBM 996, BBM 997, BBM 998, JAUB11, JAUB12, JAUB15, JAUB16, JAUB18, UPBM01, UPBM03, UPBM05, UPBM06, UPBM07, UPBM08, UPBM14, UPBM15, UPBM16, UPBM18, UPBM19, UPBM22, UPBM23, UPBM24, UPBM25, UPBM26, UPBM27, UPBM28, BD2011, BD2012, BD2013, BD2014, BD2015, BD2016, BD2017, BD2018, BD2019, BD2020, BD2023, BD2024, BD2027, BD2028, BD2030, BD2031, BD2032, BD2042, BD2043, BD2044, BD2045, BD2046, BD2048, BD2049, BD2050, BD2051, BD2052, BD2054, BD2055, BD2058, BD2059, BD2060, BD2062, BD2063, BD2064, BD2065, BD2066, BD2069, HUBL2303, HUBL2305, HUBL2310, IBYT ASA 22, IBYT ASA 23, IBYT ASA 32, IBYT ASA 38, SELECTION-87, SELECTION-160, IBON-106, IBON-113, IBON-115, AL-109, AL-110, AL-213, AL-219, AL-220, ICB-19, ICB-132, ICB-139, ICB-289, and ICB-295
Leaf blight, Avg. 00-13 with HS ≤ 35, Entries – 3	PKB2325, PKB2332, and PKB2362
Leaf blight, Avg. 14-35 with HS ≤ 57, Entries –39	BK2325, PKB2329, PKB2335, PKB2345, PKB2347, PKB2348, PKB2353, PKB2356, PKB2359, PKB2361, PKB2363, PKB2365, HB2307, HB2311, VB 2303, VB 2304, VB 2313, VB 2316, VB 2320, VB 2322, VB 2323, VB 2325, VB 2327, VB 2330, BL2378, BBM 975, BBM 984, JAUB17, UPBM09, UPBM10, BD2038, BD2040, HUBL2304, IBYT ASA 32, IBON-105, IBON-113, IBON-115, ICB-290, and ICB-295

National Barley Disease Screening Nursery (NBDSN) 2023-24

During the 2023-24 season, entries in the National Barley Disease Screening Nursery (NBDSN) were rigorously evaluated for resistance to stripe rust, leaf rust, leaf blight, and Cereal Cyst Nematode (CCN) at various hotspot centers. The screening for stripe rust was conducted at Bajaura, Hisar, Ludhiana, Durgapura, Almora, Karnal, and Jammu, while leaf rust resistance was assessed at Ludhiana, Jammu, and Wellington. Leaf blight screening took place at Ayodhya, Pantnagar, Dharwad, Kanpur, Varanasi, Coochbehar, and Kalyani, with CCN screening performed at the Durgapura and Hisar centers.

Out of the 144 entries evaluated, 16 were found completely free from stripe rust, and 119 entries exhibited a resistant reaction, characterized by an Average Coefficient of Infection (ACI) of less than 10. Regarding leaf blight screening, 2 entries were found to be moderately resistant, with an average score (double-digit) of 14-35 and a Host Severity (HS) of ≤ 57. The detailed results are presented in table.

Table 1.11. Sources of resistance in NBDSN

Yellow rust, ACI = 0, Entries – 16	RD3093, UPB 1123, PL 955, DWRB137 ©, DWRB 2301, RD2899 ©, JHSBB19, DWRB2318, UPB-1120, UPB-1118, HBL-113©, DWRBU-52 ©, DWRB-238, DWRB-2309, RD-3110, and RD-2794 ©
Yellow rust, ACI > 0 to 10, Entries – 119	HUB 291, DWRB2303, RD2907 (Filler), PL 954, BH1059, BH1058, HUB 290, GB1, DWRB 2302, PL 956, DWRB2319, UPB 1122, RD3096, DWRUB64 (Filler), RD 3095, KB 2212, HUB113 ©, GB2, BH 946 ©, DWRB 2314, RD 2552 ©, JHSBE16, JHSBD22, DWRB2316, JHSBD11, RD 2715 ©, DWRB2317, DWRB 2313, JHSBF28, JHSBF21, DWRB 2315, UPB 1106, BH 946, HUB113, DWRB137, BH393 (Filler), VLB-188, BHS-499, VLB-184, BHS-501, HBL-886, BHS-400©, BHS-497, HBL-888, BHS-380©, UPB-1119, VLB-118©, BHS-352©, HBL-884, VLB-189, VLB-186, VLB-185, BHS-502, BHS-500, BHS-498, HBL-885, VLB-187, RD-3092, RD-3090, RD-3091, DWRB-2304, DWRB-2305, DWRB-2306, RD-3088, PL-891©, UPB-1121, RD-3089, DWRB-244, DWRB-223, DWRB-2849 ©, DWRB-182 ©, RD-3064 ©, DWRB-235, DWRB-137 ©, PL-959, RD-3105, RD-3087, DWRUB-52 ©, DWRB-2311, PL-957, RD-3085, DWRB-2308, BH-1056, BH-1057, BH-1055, DWRB-2310, RD-3106, DWRB-2312, RD-3107, PL-958, RD-2849 ©, RD-3084, RD-3086, DWRB-2307, UPB-1124, UPB-1125, RD-3100, RD-3099, RD-3094, RD-3108, KB-2231, KB-2201, RD-3097, HUB-287, NDB-1821, NDB-1173©, BH-1061, RD-2907©, RD-3103, RD-3109, NDB-1829, RD-3104, RD-3102, RD-3111, RD-3101, RD-3080, HUB-293, KB-2031, and BH-1062
Leaf blight, Avg. 14-35 with HS ≤ 57, Entries – 2	DWRB2316, and BHS-380©,

Elite Barley Disease Screening Nursery (EBDSN, 2023-24)

The Elite Barley Disease Screening Nursery (EBDSN) for the 2023-24 crop season was constituted with entries that had demonstrated resistance to various diseases in previous evaluations under the NBDSN and EBDSN programs. A total of 50 entries were screened for disease resistance in this nursery.

Screening for stripe rust was conducted at the Bajaura, Hisar, Ludhiana, Durgapura, Karnal, Almora, and Jammu centers. Leaf rust resistance was evaluated at Ludhiana, Jammu, and Wellington, while leaf blight screening was performed at Ayodhya, Pantnagar, Kanpur, and Varanasi. The detailed results are presented in Table.

Table1.12. Confirmed sources of resistance in EBDSN.

Yellow rust, ACI = 0, Entries – 12	HLR 115, HLR 137, HLR 271, DWRB127, DWRB137, DWRB143, DWRB206, BHS478, BHS479, KB2160, RD2907, and VLB183
Yellow rust, ACI > 0 to 10, Entries – 30	HLR 75, HLR 103, HLR 134, HLR 272, HLR 273, DWRB6, DWRB128, DWRB207, BHS474, BHS480, BHS481, BHS483, BHS485, BHS486, HVS-9, HVS-27, HVS-40, HVS-43, HVS-44, HVS-45, DWR47-IC443614, RD2794, RD3065, RD3077, RD3078, VLB175, DWRUB52, DWRB182, DWRB239, and DWRB240
Leaf blight, Avg. 14-35 with HS ≤ 57, Entries – 10	DWRB206, HVS-7, HVS-14, HVS-28, HVS-40, HVS-42, HVS-43, HVS-44, HVS-45, and DWRB190

Chemical control experiments on diseases and insect pests

- Among eight fungicidal treatments tested, two sprays of Tebuconazole 50% + Trifloxystrobin 25%, Propiconazole 13.9% + Difenoconazole 13.9%, and Propiconazole 25% were identified as the most effective in managing leaf blight in barley.
- An experiment to manage the cereal cyst nematode, *Heterodera avenae*, in barley was conducted under controlled conditions in a screen house, utilizing 15 cm earthen pots. The study investigated the efficacy of bio-agents, both alone and in combination with vermicompost. The treatment involving *Pseudomonas fluorescens* at 3.5 kg/ha combined with 500 kg of vermicompost per hectare resulted in the lowest cyst population (9 cysts/plant). All treatments enhanced barley growth parameters and reduced nematode populations, with the highest nematode count (49 cysts/plant) and the poorest plant growth observed in the untreated control.

Crop Protection (Entomology)

A comprehensive screening of 154 NBDSN (National Barley Development and Screening Network) entries was conducted across seven distinct agro-climatic locations, including Ludhiana, Karnal, Kanpur, Khudwani, and Durgapura, with the primary objective of identifying potential sources of aphid resistance. The majority of these entries exhibited varying degrees of aphid infestation, which were contingent upon the local incidence levels. Notably, the Khudwani and Durgapura locations recorded minimal aphid infestations.

The resistance levels of the entries were systematically categorized based on the average infestation scores obtained from three critical locations: Ludhiana, Kanpur, and Karnal. These categories ranged from susceptible (grade 4) and highly susceptible (grade 5) to moderately resistant (grade 3) and resistant (grade 2). Among the entries evaluated, 17 entries, including DWRB2303, RD3093, DWRB2319, DWRB2301, DWRUB64, HUB113, GB2, RD 2552, DWRB137, VLB-184, BHS-501, HBL-886, UPB-1120, VLB-187, RD-3090, DWRB-2306, and UPB-1125, demonstrated moderate resistance, categorized as grade 3.

Additionally, a field experiment aimed at the management of aphids through the foliar application of novel bio-chemical agents was implemented at three locations: Ludhiana, Kanpur, and Karnal. The

application of pymetrozine 50 WG at dosages of 100 g/ha and 120 g/ha was found to be highly effective in significantly reducing the aphid population in these regions.

A subsequent survey carried out during the 2023-24 crop season revealed that aphid infestation levels in barley crops remained consistently low to moderate across the Ludhiana, Kanpur, and Karnal locations. The incidence of termite damage within barley fields was also recorded as low to moderate. Furthermore, the presence of natural predators, such as coccinellid beetles, chrysoperla, and syrphid flies, was frequently observed, actively preying on barley aphids, thereby contributing to the biological control of these pests.

BARLEY QUALITY EVALUATION

This year, a total of 551 barley samples were analyzed across categories including malt, barley quality screening nurseries, and feed and food barley. A summary of the key findings is presented below:

MALT BARLEY TRIAL

Malt production is one of the primary industrial uses of barley, and achieving high-quality malt requires raw material with specific minimum quality traits. This year, a total of 192 samples of Advanced Varietal Trials (AVT) and Initial Varietal Trials (IVT) malt barley were collected from six locations within the North Western Plain Zone and analyzed in the quality laboratory of the Barley Improvement Programme. The materials exhibiting desirable traits for various quality parameters are detailed in the table. ***

Table 1.13. Promising entries for individual malting quality traits.

Trait	Promising entries
Hectoliter weight (>65 for two row; >62 for 6 row)	AVT: DWRB235, DWRB238, DWRUB52©, RD-2849©, DWRUB137© IVT: BH1057, DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312, PL957, PL958, PL959, RD3084, RD3086, RD3087, UPB1124, UPB1125, DWRB182©, RD2849©, DWRUB137©
Bold Grains (>90% for two row; >80% for 6 row)	AVT: DWRB235, DWRB238, DWRUB137© IVT: BH1055, BH1056, DWRB2307, DWRB2312, PL957, PL959, RD3084, RD3087, RD3105, RD3106, RD3107, UPB1124, DWRUB137©
**Husk Content (<11% for both types)	AVT: DWRUB52©, DWRUB137© IVT: DWRB2309, DWRB2310, PL959, RD3084, RD3107, UPB1124, DWRUB52©
**Grain Beta Glucan (<4% for both types)	AVT: NIL IVT: RD3084, RD3105
Malt Friability (>70% for two row; >65% for 6 row)	AVT: NIL IVT: RD3105
Hot water extract (>80% for both types)	AVT: NIL IVT: NIL
Filtration Rate (>250 min. for both types)	AVT: DWRUB137©, DWRB182© IVT: NIL
Diastatic Power (>90 ^{0}L for both types)	AVT: DWRB235, DWRB238, RD-3064, DWRUB52©, DWRUB137©, DWRB182©, RD-2849© IVT: BH1055, BH1056, BH1057, DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312, , PL957, PL958, PL959, RD3084, RD3085, RD3086, RD3087, RD3105, RD3106, RD3107, UPB1124, UPB1125, DWRUB52©, DWRUB137©, DWRB182©, RD-2849©
FAN Content (>150 ppm for both types)	AVT: DWRB235, DWRB238, RD-3064, DWRUB52©, DWRUB137©, DWRB182©, RD-2849© IVT: BH1055, BH1056, BH1057, DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312, , PL957, PL958, PL959, RD3085, RD3086, RD3087, RD3105, RD3106, UPB1124, UPB1125, DWRUB52©, DWRUB137©, RD-2849©
Wort β- glucan (<300 ppm for both types)	AVT: NIL IVT: RD3105
**Over all Malt Quality (weighted performance compared to best check)	AVT: DWRB238

**Six row; ** Compared to the best check*

BARLEY QUALITY SCREENING NURSERY

This year, three specialized nurseries were established, focusing on distinct quality traits: BQSN1 (high alpha-amylase genotypes), BQSN2 (antioxidant, iron, and zinc content), and BQSN3 (low beta-glucan and high protein content). These nurseries were cultivated across six locations: Karnal, Hisar, Ludhiana,

Pantnagar, Durgapura, and Kanpur. A total of 324 samples were analyzed, with the most promising genotypes presented in the following two tables.

BQSN 1: (High Alpha Amylase Genotypes)

Table 1.14. Promising sources for different traits*

Traits	Promising entries
High Alpha amylase activity	BCU5955, BCU5958, BCU5958, BCU5960, BCU5961, BK316, BK323,
Bold Grain Percentage	BK 303, BK 306, BK311, BK 312, BK315
Protein	BCU5954, BCU5955, BCU5958, BCU5960, BK303, BK315

**At par or better than best check*

BQSN 2: Antioxidant, Fe and Zn (Hulless/Naked Genotypes)

Table 1.15. Promising sources for different traits*

Traits	Promising entries
High Antioxidant	DWRB-189 ©
High Fe	DWRB-189 ©
High Zn	IC532985, IC0438103, IC0532979, EC0578267, HLR-322, HLR-196, HLR-136, HLR-64, HLR-34 HLR-24

**At par or better than best check*

BQSN 3: Low Beta-Glucan and High Protein

Table 1.16. Promising sources for different traits*

Traits	Promising entries
High Protein	RMB2307
Low Beta-glucan	DWRB182 ©

**At par or better than best check*

Feed and Food Barley

Feed and food grain samples from various trials conducted across different locations were analyzed for their physical parameters and protein content. A total of 35 samples, representing diverse trials from various zones, were evaluated, and promising entries were identified.

Table 1.17. Entries having highest thousand grain weight, protein content, hectoliter weight, grain beta-glucan content, Fe and Zn in respective trials

Trial	Zone	TGW(g)	PC (%)	HW (kg/hl)	G-BG (%)*	Fe (ppm)	Zn (ppm)
Food/Hulless Barley							
AVT-IR-TS	NWPZ/CZ	DWRB 244, DWRB 223	DWRB 244, DWRB223	DWRB 223, DWRB 244	DWRB 244	K1149©	DWRB223

**G-BG: Grain Beta Glucan at two locations only*

Resources Management

The All India Coordinated Research Project (AICRP) on Barley conducted during the 2023-24 season provided crucial insights into barley's performance across various agro-climatic zones of India. This study focused on evaluating different barley genotypes, optimizing nitrogen application under saline conditions, and assessing the efficacy of herbicides for weed control. The findings from this research are significant for improving barley productivity and ensuring sustainable agricultural practices under diverse environmental challenges.

The study extensively examined the performance of the hulless barley genotype DWRB 223 compared to established varieties like PL 891, Karan 16, and NDB 943 across the North Western Plain Zone (NWPZ) and Central Zone (CZ). The trials were designed to reflect the common sowing practices of the regions, with sowing times split between timely (November 6-15) and late (December 1-10) periods. The results demonstrated a notable decline in yield when sowing was delayed, with average yields falling from 46.78 q/ha under normal conditions to 29.12 q/ha under late conditions—a decrease of 37.7%. This decline was primarily due to reductions in key yield components such as earhead density, grain count per earhead, and thousand-grain weight. Among the tested genotypes, Karan 16 consistently exhibited superior performance, with an average yield of 43.64 q/ha, significantly outperforming both DWRB 223 and the other check

varieties. Karan 16 also showed the highest earhead density and grain count, reinforcing its potential as a robust genotype for different sowing times and environmental conditions. In contrast, PL 891 excelled in producing larger grains, as indicated by its highest thousand-grain weight, making it a promising variety for regions prioritizing grain size.

Similarly, in the Central Zone, the genotype trials conducted at Gwalior and Udaipur (with the Vijapur trial excluded due to inconsistencies) reinforced the dominance of Karan 16. This variety achieved an average yield of 33.50 q/ha, significantly higher than that of DWRB 223 and other checks. The yield reduction due to delayed sowing was less severe in this zone, with only an 8.8% decline from 32.48 q/ha to 29.61 q/ha, further highlighting Karan 16's adaptability. In addition, Karan 16 recorded the highest earhead density and produced robust grains, confirming its suitability for diverse climatic conditions within the Central Zone. These findings underscore the value of Karan 16 as a reliable and high-performing barley variety across different environmental settings.

In exploring the response of barley to varying nitrogen levels under salinity stress, the study evaluated the genotype KB 2031 alongside three check varieties—RD 2794, RD 2907, and NDB 1173—across the North Western and North Eastern Plain Zones. The trials involved nitrogen applications at 60, 75, and 90 kg/ha. The results indicated a clear positive correlation between nitrogen levels and yield, with the highest yields recorded at 90 kg N/ha. For instance, in the North Western Plain Zone, yields increased from 36.19 q/ha at 60 kg N/ha to 42.48 q/ha at 90 kg N/ha, primarily due to increased earhead density. Among the genotypes, NDB 1173 consistently produced the highest yields across all nitrogen levels, with an average yield of 39.82 q/ha. However, KB 2031 stood out for its grain quality, producing the largest grains with a thousand-grain weight of 47.49 g, demonstrating its potential in areas where grain size is a critical factor. In the North Eastern Plain Zone, similar trends were observed, with KB 2031 emerging as the top yielder, recording a significant 10.37% yield increase from 60 kg N/ha to 90 kg N/ha. These findings highlight the importance of optimizing nitrogen fertilization, particularly in saline conditions, to enhance barley productivity and grain quality.

The study also focused on feed barley, evaluating the performance of UPB 1106 against three checks—HUB 113, BH 946, and DWRB 137—under timely and late sowing conditions in the North Eastern Plain Zone. The trials revealed a significant yield decline with delayed sowing, with an average reduction of 14.84%. Despite this, HUB 113 consistently outperformed the other varieties, achieving an average yield of 35.06 q/ha, which was significantly higher than that of BH 946 and comparable to UPB 1106 and DWRB 137. HUB 113 also recorded the highest number of effective tillers and grains per earhead, indicating its strong adaptability and performance under varying sowing conditions. Moreover, UPB 1106 produced the largest grains, with a thousand-grain weight of 41.55 g, underscoring its potential for regions where grain weight is a priority. These findings suggest that HUB 113 and UPB 1106 are strong candidates for feed barley production, particularly in areas where sowing dates are subject to variability.

The efficacy of herbicides in controlling broad-leaved weeds in barley was another critical aspect of the study. Given the challenges posed by weed infestations in barley fields, the research evaluated various herbicide treatments across different zones. The trials consistently showed that weed-free conditions led to the highest grain yields. For example, in the North Western Plain Zone, the highest yield of 54.33 q/ha was recorded under weed-free conditions. Among the herbicides tested, a combination of metsulfuron methyl with a surfactant and the ready mixture of halauxifen-methyl with fluroxypyr at 200.6 g/ha were particularly effective, with yields approaching those under weed-free conditions. These treatments also resulted in the lowest weed counts and dry weights, significantly reducing weed pressure compared to untreated plots. In the North Eastern Plain Zone, similar results were obtained, with metsulfuron plus carfentrazone plus a surfactant proving highly effective in reducing weed density and boosting yields. The results from these trials suggest that strategic herbicide applications can effectively manage weed populations in barley fields, reducing the need for labor-intensive manual weeding and supporting higher yields.

Barley Frontline Demonstrations (2023-24)

To effectively disseminate new agricultural technologies among farmers, it is essential to demonstrate these technologies directly in farmers' fields. During the 2023-24 rabi crop season, a total of 140 hectares were allocated for Barley Frontline Demonstrations (BFLDs) across 40 cooperating centers in eight states and union territories, including Himachal Pradesh, Uttar Pradesh, Bihar, Jammu & Kashmir, Punjab, Haryana, Rajasthan, and Madhya Pradesh. Of these, 135.2 BFLDs were successfully conducted by 39 centers,

covering an area of 138.4 hectares and involving 420 farmers. These demonstrations featured improved barley varieties along with a comprehensive package of agronomic practices, including seed treatment, irrigation management, nutrient management, and weed management.

The highest number of barley FLDs were conducted in Uttar Pradesh (40.4 hectares), followed by Madhya Pradesh (24.0 hectares), Rajasthan (22.8 hectares), Punjab (19.2 hectares), Haryana (14.8 hectares), Bihar (8.0 hectares), Himachal Pradesh (6.8 hectares), and Jammu & Kashmir (4.0 hectares). Regionally, the majority of FLDs were implemented in the North Western Plain Zone (57.2 hectares), followed by the Central Zone (43.2 hectares), the North Eastern Plain Zone (32.8 hectares), and the North Hill Zone (2.0 hectares).

The highest increase in barley yield was observed in the Union Territory of Jammu & Kashmir, with a gain of 57.57%, followed by Central Uttar Pradesh (42.52%), Eastern Uttar Pradesh (38.56%), the entire state of Uttar Pradesh (36.87%), Madhya Pradesh (35.23%), Himachal Pradesh (34.48%), and Rajasthan's Central Zone (25.65%). The lowest yield increase was reported in Haryana, with a gain of 8.53%.

Table 1.18. State wise performance of the improved barley varieties during *Rabi* 2023-24.

State	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (in %)
HP/UT	29.25	21.75	34.48**
Eastern UP	35.58	25.68	38.56***
Central UP	34.78	24.40	42.52***
Western UP	61.25	49.53	23.67***
Bihar	38.28	31.03	23.37***
All UP	37.78	27.60	36.87***
J&K	33.05	20.98	57.57***
Punjab	47.50	41.50	14.46***
Haryana	43.60	40.18	08.53*
Rajasthan (NWPZ)	57.90	51.78	11.83***
Rajasthan (CZ)	40.78	32.45	25.65***
All Rajasthan	51.38	44.43	15.64***
MP	40.40	29.88	35.23***
All India	42.05	33.83	24.32***

**** Significant at 1 per cent level, ** Significant at 5 per cent level*

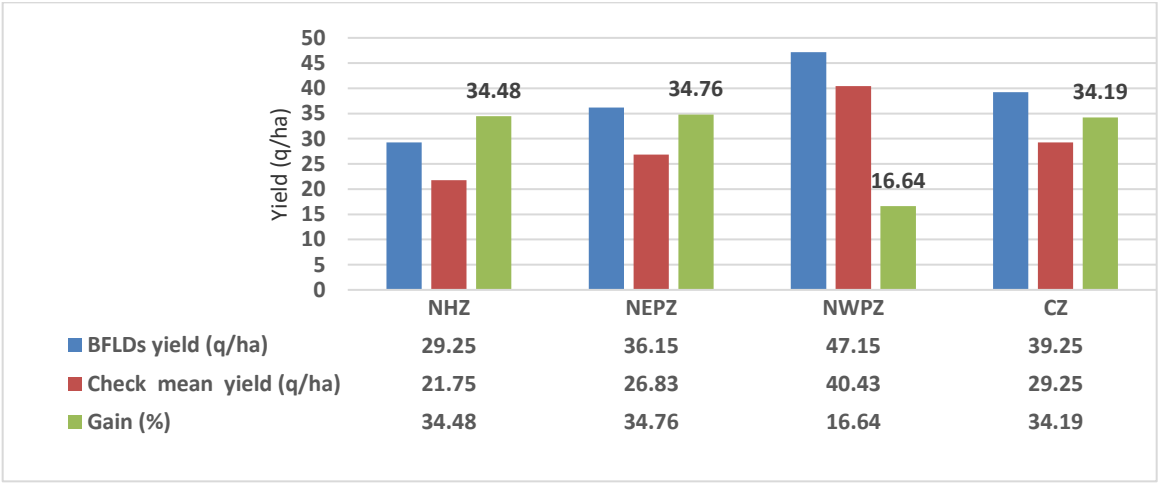

Fig. 1.12. Zonewise productivity over check during rabi 2023-24

Center-wise Yield Gain Under Barley Frontline Demonstrations (FLD)

The analysis of barley Frontline Demonstrations (FLD) for the 2023-24 Rabi season reveals significant variations in yield gains across different centers. The highest yield gain was recorded at the Basti center (81.47%), followed by Kanpur (40.59%) in the North Eastern Plain Zone (NEPZ). In the Central Zone (CZ), Rewa achieved the highest gain (64.92%), followed by RLBCAU Jhansi (62.65%) and Lalitpur (45.55%). In

the North Hill Zone (NHZ), Shimla recorded a gain of 34.48%. Within the North Western Plain Zone (NWPZ), Kathua led with a yield increase of 57.57%, followed by Mansa at 34.53%. Conversely, the lowest yield gain was observed at Muktsar (4.58%) in the NWPZ.

Performance of Barley Varieties

The highest average yielding varieties at specific centers were as follows: BHS 400 at Shimla in NHZ (29.25 q/ha), RD 2907 at Gorakhpur in NEPZ (44.50 q/ha), RD 2907 at Durgapura Jaipur in NWPZ (70.40 q/ha), and DWRB 137 at Rajgarh in CZ (47.38 q/ha). These results clearly demonstrate that recent barley varieties have consistently outperformed older or check varieties across all locations. The yield gains attributable to varietal interventions ranged from 4.22% at Sri Muktsar Sahib center in Punjab to 91.33% at Basti center in Uttar Pradesh.

Notably, the varieties BHS 400 (33.75 q/ha), RD 2907 (46.25 q/ha), RD 2907 (70.85 q/ha), and DWRB 137 (49.40 q/ha) outperformed others at Shimla, Gorakhpur, Durgapura Jaipur, and Vidisha centers in the NHZ, NEPZ, NWPZ, and CZ, respectively.

Regional Yield Gains

The yield improvement due to the adoption of improved varieties was highest in the NEPZ (34.76%), followed by NHZ (34.48%), CZ (34.19%), and NWPZ (16.64%).

Analysis of Constraints in Barley Production

A comprehensive analysis of constraints affecting barley production across different growing zones highlights several critical challenges: declining water tables, high input costs, infestation by *Phalaris minor* (mandusi), small landholdings, labor shortages, low market prices for barley grains, limited participation in exposure visits organized by various departments, lack of access to canal irrigation, untimely rainfall, and poor-quality herbicides and pesticides.

Recommendations for Improvement

To address these challenges, it is essential to educate and upskill farmers on modern barley production technologies, including the complete package of practices and soil health management. The state departments of agriculture must take proactive measures to ensure the supply of quality seeds and inputs. Additionally, farmers need to be informed about the impact of climate change on barley cultivation and should adopt appropriate mitigation strategies. To secure better prices, farmers should focus on producing high-quality barley and consider registering on the e-NAM platform for selling their produce.

Monitoring and Evaluation

The ICAR-IIWBR team, along with experts from the Ministry of Agriculture & Farmers Welfare and representatives from the concerned centers, monitored the barley FLDs and SCSP wheat demonstrations at the Sangrur, Mansa, Bathinda, Muktsar, Kathua, Kapurthala, Ayodhya, Varanasi, and Mirzapur centers during the 2023-24 Rabi crop season.

Costs and Returns for Barley FLDs vis-à-vis Check Plots

The economic analysis of barley revealed that, on average, improved barley varieties demonstrated in farmers' fields under the FLD programme yielded a profit of approximately ₹67,404 per hectare. A significant difference in returns per rupee of investment was observed between the demonstration plots and the check plots across various states and zones. Himachal Pradesh recorded the highest returns per rupee of investment (₹6.58) from the demonstrations, followed by Punjab (₹4.25) and Rajasthan (₹3.13). The highest profit per hectare in FLDs was noted in Rajasthan (₹86,033), followed by Himachal Pradesh (₹75,174) and Punjab (₹74,516). The profit differential between FLD and check plots ranged from ₹28,634 in the Union Territory of Jammu & Kashmir to ₹5,724 in Haryana. Notably, operational costs were lower in FLDs than in check plots in the majority of barley-growing states, likely due to a reduction in input usage and other cultural practices as per the recommended guidelines. Returns per rupee of investment were highest in the North Hill Zone (NHZ) at ₹6.58, followed by the North Western Plain Zone (NWPZ) at ₹3.39 and the Central Zone (CZ) at ₹2.79. Cost of production estimates indicated that the cost incurred to produce a unit quantity of barley was lowest in Himachal Pradesh (₹476 per quintal), attributable to lower operational costs combined with relatively higher yield levels.

Crop Improvement

Barley Improvement Programme is decribed in detail in the following pages.

Table 2.1. BREAK UP OF BARLEY IMPROVEMENT YIELD TRIALS (*RABI* 2023-24).

Trial Name	No. of centers				
	Proposed	NC/TF/ NR	Data Recvd	Data Rejected	Data Reprtd
Malt Barley Trials (Plains)					
AVT-I-MB-NWPZ	11	-	11	-	11
IVT-MB-NWPZ	12	-	12	-	12
Rainfed Barley Trials (Plains)					
IVT-RF-NEPZ	8	-	8	-	8
Salinity/Alkalinity Barley Tolerance Trials (Plains)					
AVT/IVT-SST-NWP/NEPZ-CZ	7	3 (Bhilwara-NC, Hisar-I&II-Rej)	4	---	4
Hulless Barley Trials (Plains)					
AVT-(I&II)-NB-NWPZ	6	-	6	1 (Pantnagar-LSM)	5
AVT-(I&II)-NB-CZ	5	-	5	3 (morena-LS, Gwalior & Vijapur-LSM)	2
IVT-NB-NWPZ	6	-	6	1 (Pantnagar)	5
IVT-NB-NEPZ	4	-	4	2 (Varansi & Ranchi)-LSM	2
IVT-NB-CZ	5	-	5	2 (Morena-Late Sowing; Vijaypur-LSM)	3
Rainfed Barley Trials (Hills)					
IVT/AVT-NHZ (Feed & Food Barley	8	-	8	2 (Gaza-all 4 rep. cut; Majhera-LSM)	6
IVT/AVT-DP-NHZ	8	-	8	3 (Gaza, Majhera, Almora)-LSM	5
Feed Barley Trials (Plains)					
AVT-II-IR-FB-NEPZ	6	-	6	2 (Varansi & Sobour)	4
IVT-IR-FB-NWPZ	8	-	8	-	8
IVT-IR-FB-NEPZ	7	-	7	3 (Varansi, Sabour, Ranchi)-LSM	4
IVT-IR-FB- CZ	6	-	6	2 (Morena-Late Sowing,Vijaypur-LSM)	4
Dual Purpose Barley Trials (Plains)					
IVT-DP-NWPZ	7	-	7	4 (Pantnagar-not cut 4 replications, Ludhiana, Modipuram, Dholpur-LSM of Forage	3
IVT-DP-NEPZ	4	-	4	3(Ranchi- not cut,Varansi-LSM both grain & Forage, Kumarganj-LSM-Forage)	1
IVT-DP-CZ	5	-	5	2 (Morena-Late Sown; Tikamgarh LSM-Forage)	3
TOTAL	123	3	120	30	90
			97.56%	(P=73.17%) (R=75%)	75%

Data received percentage of proposed trials 97.56%; Data reported percentage of proposed trials 73.17%; Data reported percentage of received data 75%.

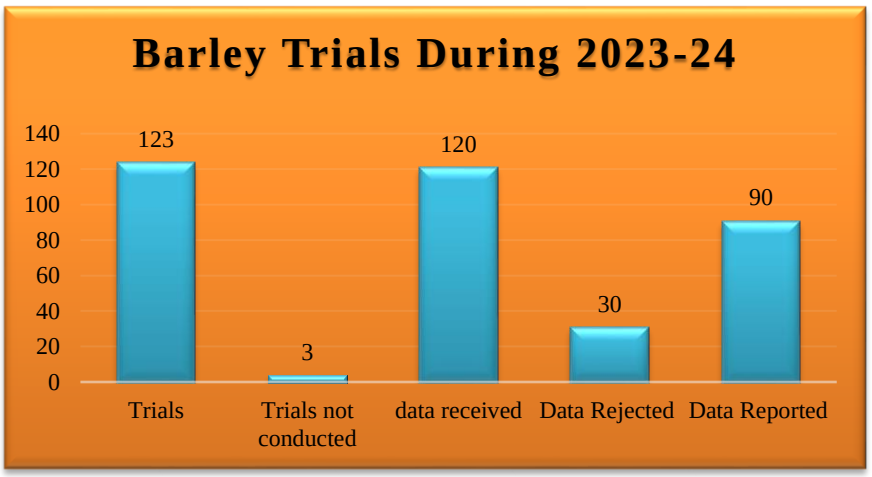

Fig 2.1. Barley trials proposed, rejected, data received data, data rejected and data reported.

Performance of test sites during *Rabi* 2023-24

A. MAIN CENTRES

No.	Centres	No. of Trials			Trials Rejected		
		Allotted	Name	Conducted	No.	Name	Reason
1.	Almora	2	AVT/IVT-RF-NHZ (Uncut); AVT/IVT-RF-NHZ (DP)	2	2	Cut & uncut	LSM
2.	Bajaura	2	AVT/IVT-RF-NHZ (Uncut); AVT/IVT-RF-NHZ (DP)	2	-	-	-
3.	Durgapura	6	AVT-MB, IVT-MB, AVT-NB, IVT-NB. IVT-FB,IVT-DP	6	-	-	-
4.	Kumarganj	6	II-FB, IVT-FB, IVT-RF, IVT-NB, AVT/IVT-SST, IVT-DP	6	1	IVT-DP	LSM
5	Hisar HAU	6	AVT-MB, IVT-MB, AVT-NB, IVT-NB. IVT-FB,IVT-DP	6	-	-	-
6.	Kanpur	5	AVT-II-FB, IVT-FB, IVT-RF, IVT-HB, IVT-DP	5	-	-	-
7.	Karnal	6	AVT-MB, IVT-MB, AVT-HB, IVT-HB. IVT-FB,IVT-DP	6	-	-	-
8.	Ludhiana	6	AVT-MB, IVT-MB, AVT-HB, IVT-HB. IVT-FB,IVT-DP	6	1	IVT-DP	LSM
9.	Shimla	2	AVT/IVT-RF-NHZ (Uncut); AVT/IVT-RF-NHZ (DP)	2	-	-	-
10	Varanasi	5	AVT-II-FB, IVT-FB, IVT-NB, IVT-RF, IVT-DP	5	4	NB,FB, FB,DP-	LSM
11	Pantnagar	6	AVT-MB, IVT-MB, AVT-NB, IVT-NB. IVT-FB,	6	3	NB,NB, DP	LSM

Table 2.2. No. of trials allocated, conducted and rejected at different main centres.

Contd……..

B. TESTING CENTRES /SAU / DEPTT. OF AGRIC.

No.	Centres	Trials Allotted	Conducted	Trials Rejected		
				No.	Trial Name	Reason
1	Bawal	2	2	-		-
2	Banda	1	1			
3	Bathinda	2	2	-		
5	Bhilwara	1	0	-	AVT/IVT-Saline/Alkaline	NC
6	Bisa-Samastipur	2	2			
7	Chiyanki	1	1	-		-
8	Dalipnagar	1	1	1		-
	Dholpur	3	3	1	IVT-DP	LSM
9	Fatehpur	1	1	1		-
10	Gwalior	4	4	1	AVT-NB	LSM
11	Gaza	2	2	2	AVT/IVT-RF-NHZ (Uncut); AVT/IVT-RF-NHZ (DP)	LSM
12	Hisar IIWBR	2	2	2	AVT/IVT-Saline/Alkaline	Poor crop stand
13	Karnal, CSSRI	1	1	-		-
14	Khudwani	2	2	-	-	-
15	Majhera	2	2	2	AVT/IVT-RF-NHZ (Uncut); AVT/IVT-RF-NHZ (DP)	LSM
16	Malan	2	2	-	-	-
17	Modipuram	6	6	1	IVT-DP	LSM
18	Morena	4	4	4	AVT-NB,IVT-NB, IVT-FB, IVT-DP	LATE SOWING
19	Navgaon	2	2			
20	Pusa, CAU	3	3			
21	Ranchi	4	4	3	IVT-DP, IVT-FB, IVT-NB	LSM
22	Sabour	3	3	2	IVT-FB, AVT-II-FB	LSM
23	Saini	1	1		-	-
24	Sriganganagar	2	2	-	-	-
25	Tabiji	3	3	-	-	-
26	Tikamgarh	4	4	1	IVT-DP	LSM
27	Udaipur	4	4			
28	Vijapur	4	4	3	AVT-NB, IVTNB, IVT-FB	LSM
29	Wadura	2	2	-	-	-

Table 2.3. No. of trials allocated, conducted and rejected at different testing centres.

LSM = Low site mean, NC= Not conducted

Trial wise locations during *Rabi* 2023-24

SN	Trial Name	Locations	Total
1	AVT-MB-NWPZ	Bawal, Hisar, Karnal, Ludhiana, Bathinda, Durgapura,Navgaon, Tabiji, Sriganganagar, Pantnagar, Modipuram	11
2	IVT-IR-MB-NWPZ	Bawal, Hisar, Karnal, Ludhiana, Bathinda, Durgapura,Navgaon, Tabiji, SG Nagar, Pantnagar, Modipuram, Dholpur	12
3	IVT-RF-NEPZ	Kanpur, Varanasi, Kumarganj, Saini, Pusa (CAU), Sabour, Ranchi, Chiyanki	8
4	AVT/IVT-SST-NWPZ/NEPZ	CSSRI-Karnal, IIWBR-Hisar-I, IIWBR-Hisar-II, Bhilwara, Fatehpur, Dalipnagar, Kumarganj,	7
5	AVT-NB-NWPZ	Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Modipuram	6
6	AVT-NB-CZ	Udaipur, Gwalior, Morena, Tikamgarh, Visapur	5
7	IVT-NB-NWPZ	Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Modipuram	6
8	IVT-NB-NEPZ	Kanpur, Kumarganj, Varansi, Ranchi	4
9	IVT-NB-CZ	Gwalior, Morena, Tikamgarh, Vijapur, Udaipur	5
10	AVT/IVT-RF-NHZ	Bajaura, Malan, Shimla, Almora, Gaza, Majhera, Khudwani, Wadura	8
11	AVT-II-FB-NEPZ	Kanpur, Kumarganj, Varansi, Pusa, Samastipur, Sabour	6
12	IVT-FB-NWPZ	Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Modipuram, Tabiji	7
13	IVT-FB-NEPZ	Kanpur, Kumarganj, Varansi, Pusa, Samastipur, Sabour, Ranchi	7
14	IVT-FB-CZ	Gwalior, Morena, Tikamgarh, Udaipur, Banda, Dholpur, Vijapur	7
15	IVT-DP-NWPZ	Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Modipuram	6
16	IVT-DP-NEPZ	Kanpur, Varansi, Kumarganj, Ranchi,	4
17	IVT-DP-CZ	Udaipur, Gwalior, Morena, Tikamgarh, Udaipur, Dholpur, Vijapur	7

Table 2.4. Trial wise names and No. of locations.

No. of entries contributed by different centres during *Rabi 2023-24*

No.	CONTRIBUTING CENTRE	SYMBOLS	Entries contributed
1.	ALMORA, V.P.K.A.S.	VLB	5
2.	BAJAURA, R.R.S. (CSKHPKV)	HBL	5
3.	DURGAPURA, R.A.R.I. (SKRAU)	RD	28
4.	HISAR, C.C.S.H.A.U.	BH	8
5.	IGFRI, Jhansi	JHSB	6
6,	KANPUR, C.S.A.U.&T.	KB	12
7.	KARNAL, ICAR-I.I.W.B.R.	DWRB	19
8.	LUDHIANA, P.A.U.	PL	7
9.	NDUAT., FAIZABAD	NDB	5
10.	PANTNAGAR, G.B.P.U.A.&T.	UPB	8
11.	SDAU. Vijapur	GB	2
12.	SHIMLA, RS, I.A.R.I.	BHS	5
13.	VARANASI, B. H. U.	HUB	7
	Total (Entries + Checks)		117+ 23

Table 2.5. No of entries contributed by different centres.

PARENTAGE OF BARLEY STRAINS UNDER COORDINATED EVALUATION DURING *RABI* 2023-24

SN	Entries	Parentage
ICAR-IARI, RS, Shimla		
1.	BHS 498	UPB1008/RD2751/HBL113
2.	BHS 499	HBL276/RD2715
3.	BHS 500	HBL276/RD2715
4.	BHS 501	BHS380/RD2715
5.	BHS 502	HBL704/RD2715
GBPUA&T, Pantnagar		
6.	UPB 1118	DWRUB52/RD2891/BCU73
7.	UPB 1119	UPB1054/VLB130
8.	UPB 1120	VLB130/UPB1001
9.	UPB 1121	EIBGN2020-21 PLOT NO. 46
10.	UPB 1122	RD2849/UPB1054
11.	UPB 1123	DWRUB101/RD2552/BH976
12.	UPB 1124	DWRUB136/BH976
13.	UPB 1125	EIBGN2021-22 PLOT NO.43
ICAR-VPKAS, Almora		
14.	VLB 185	Xena/DWR28
15.	VLB 186	P.STO/3/LBIRAN/UNA8 0//LIGNEE640/4/BLLU/5 /PETUNIA 1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BL LU/5/PETUNIA 1/7/SC 36219 L3
16.	VLB 187	P.STO/3/LBIRAN/UNA8 0//LIGNEE640/4/BLLU/5 /PETUNIA 1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BL LU/5/PETUNIA 1
17.	VLB 188	DWR28/RD2668
18.	VLB 189	Atahualpa/MADRE SELVA

CSKHPKV, RRS, Bajaura		
29.	HBL 884	Xena/3/LOGAN-BAR/MSEL//AZAF
20.	HBL 885	HBL276/Dyar Local
21.	HBL 886	LOGAN-BAR/MSEL//AZAF/6/MERIT,B/4/AZAF/3/ARUPO/K8755//MORA/5/MSEL
22.	HBL 887	DWR81/BH936
23.	HBL888	BHS 380/HBL821

BHU, Varanasi		
24.	HUB287	JYOTI X HUBL-09-17
25.	HUB288	MOROC - 9-75 X RD2552
26.	HUB290	JYOTI X HUB113
27.	HUB291	HUB113 X KARAN-280
28.	HUB292	K- 560 X HUB113
29.	HUB293	MN BRITELEGEACY/DONA JOSEFA
30.	HUB294	CHICM/AN57//ALBERT/3/ALGER/CERES362-1-1/4/ARTA/5/MUNDAH
CCSHAU, Hisar		
31.	BH 1055	UPB 1039/BH 992
32.	BH 1056	NDB 1580/DWRB 101
33.	BH 1057	RD 2909/BH 959
34.	BH 1058	RD 2891/BH 885
35.	BH 1059	DWRB 123/BH 885
36.	BH 1060	RD 2849/BH 959
37.	BH 1061	NDB 1602/BH 902
38.	BH 1062	RD 2849/BH 946
RARI, SKNAU, Durgapura		
39.	RD 3084	RD 2849 X DWRUB 64
40.	RD 3085	DWRB 91 X BH 902
41.	RD 3086	DWRUB 52 X BH 946
42.	RD 3087	DWRUB 64 X BH 946
43.	RD 3088	RD 2904 X NDB 943
44.	RD 3089	NDB 943 X BH 959
45.	RD 3090	HUB 243 X Karan 16
46.	RD 3091	RD 2668 x NDB 943
47.	RD 3092	RD 2035 x Karan 16
48.	RD 3093	HUB 113 x BH 959
49.	RD 3094	RD 2035 x DWRB 137
50.	RD 3095	HUB 113 x RD 2715
51.	RD 3096	NDB 1445 x RD 2794
52.	RD 3097	PL 751 x RD 2715
53.	RD 3098	NDB 1173 x RD 2794
54.	RD 3099	BH 946 x RD 2508
55.	RD 3100	PL 751 x RD 2035
56.	RD 3101	BH 959 x RD 2035
57.	RD 3102	BH 946 x RD 2035
58.	RD 3103	BH 959 x RD 2660
59.	RD 3104	RD 2794 x RD 2660
60.	RD 3105	RD 2849 x RD 2668

61.	RD 3106	RD 2668 X UPB 1008
62.	RD 3107	RD 2668 x DWR 137
63.	RD 3108	RD 2035 x RD 2715
64.	RD 3109	BH 946 x RD 2508
65.	RD 3110	BH 902 x RD 2794
66.	RD 3111	RD 2794 x RD 2624
NDUAT. Ayodhya		
67.	NDB 1821	CANELA//E.ACACIA/DEFRA/4/CLI18/E.QUEBRANCHO//E.QUEBRANCHO/ NCL95109/3/CANELA
68.	NDB 1823	MADRE_SELVA//ER//Apm
69.	NDB 1825	ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4PETUNIA 1/5PETUNIA1/CHINIA/ 3ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO/8/P.STO/3LBI RA N/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/6/M111/7/LEGACY/3/SVANHALS-BAR/MSEL//AZAF/GOB24DH
70	NDB 1829	QB813-2/5/Aths/Lignee686/4Rhn-03/3/Bc/Rhn//Ky63-1294/6/Hma-02//11012-/CM67/3/Alanda/5/Rhn-03//Ligee527/NK1272/4Lignee527//Chn-01/3/Alanda
71.	NDB 1833	Tamalpais/UC969/Madera-UC937
ICAR-IGFRI. Jhansi		
72.	JHSBD-11	JB-240/RD-2552
73.	JHSBE-16	JB-240/NDB-1545
74.	JHSBB-19	NDB-1545/JB-240
75.	JHSBF-21	JB-240/K-1185
76.	JHSBD-22	JB-240/RD-2552
77.	JHSBF-28	JB-240/K-1185
SDAU. Vijapur		
78.	GB 1	RD2835/BH922
79.	GB 2	IBYT-HI-10/BH922
PAU, Ludhiana		
80	PL 954	BH946 X DWRB137
81.	PL 955	BH946 X RD2552
82.	PL 956	PL426 X BH902
83.	PL 957	RD2917 X DWRB137
84.	PL 958	ATAHUALPA/PL807 //PL807
85.	PL959	ATAHUALPA/PL807 //PL807
86.	PL 960	PL807 X BHS352
CSAUA&T, Kanpur		
87.	**KB 2201**	VLB 118 / RD 2809
88.	**KB 2203**	K 1149 / KB 1318
89.	**KB 2215**	K 1149 / K 603
90.	**KB 2211**	AM 16-86 / HUB 113
91.	**KB 2212**	VLB 118 / RD 2809
92.	**KB 2216**	VLB 118 / RD 2809
93.	**KB 2231**	AM 16-86 / HUB 113
94.	**KB 2232**	EIBGN (20-21) E-03
95.	**KB 2234**	EIBGN (20-21) E-16
96.	**KB 2247**	RD 2866 / K 409
97.	**KB 2255**	3rd GSBSN-58 / IBON-MRA(11-12)-22
98.	**KB 2258**	2nd GSBSN (14-15)-77 / K 551
ICAR-IIWBR, Karnal		
99.	DWRB 2301	Carbo/Hamra/4/Rhn-08/3/DeirAlla106//DL71/Strain205/6/Rhn-03/Eldorado/5/ Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda

100.	DWRB 2302	Alanda/5/Aths/4/Pro/TolI//Cer*2/TolI/3/5106/6/Baca'S'/3/AC253//CI08887/CI05761/7/Alanda-01/3/Alanda//Lignee527/Arar
101.	DWRB 2303	DWR83/SMM83
102.	DWRB 2304	ZIGZIG/4TOCTE/HIGO/LINO/3/PETUNIA1
103.	DWRB 2305	NACKTA/HJAA33//FNC1
104.	DWRB 2306	KARAN16/BCU554
105.	DWRB 2307	DWRB101/DWRUB52
106.	DWRB 2308	DWRB101/IRINA
107.	DWRB 2309	DWRB101/BH976
108	DWRB 2310	DWRB101/DWRB123
109	DWRB 2311	DWRB101/DWRB123
110	DWRB 2312	DWRUB52/DWR81
111	DWRB 2313	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M111
112.	DWRB 2314	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY /7/DOÑA JOSEFA
113.	DWRB 2315	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY /7/BREA/DL70//3*CABUYA
114.	DWRB 2316	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA
115.	DWRB 2317	DWRB101/DWRB123
116.	DWRB 2318	RD103/RD2715
117.	DWRBG 2319	Manal/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
Checks (20)		
118.	BH946	BHMS22A/BH549//RD2552
119.	BHS352	HBL240/BHS504//VLB129
120.	BHS380	VOILET/MJA/7/ABN-B6/BA/GAL// FZA-B /5/DG/DC-B/ PT-BAR /3/RA-B/BA /3/4/TRYIGAL…
121.	BHS400	34th IBON-9009
122.	DWRUB52	DWR17/K551
123.	DWRB137	DWR28/DWRUB64
124.	DWRB182	DWRUB52/DWRB78
125.	HBL113	SELECTION FROM ZYPHYZE
126.	HUB113	KARAN280/C138
127.	K1149	K12/K572/10//EB410
128.	K603	K257/C138
129.	Karan16	AZAM (DWARF)1/EB7576
130.	KB1425	K508/NDB1295
131.	Lakhan	K12/IB226
132.	NDB 1173	BYTLRA3(94-95)
133.	PL891	IBON 343/12th HSBN-176
134.	RD2552	RD2035/DH470
135.	RD2715	RD387/BH602//RD2035
136.	RD2794	RD2035/RD2683
137.	RD2849	DWRUB52/PL705
138.	RD2899	RD2592/RD2035//RD2715
139.	RD2907	RD103/RD2518//RD2592
140.	VLB118	14th EMBSN-9313

Table 2.6. Parentage of entries evaluated in different IVT trials during 2023-24 .

ADVANCED VARIETAL TRIAL-I-MALT BARLEY-NWPZ (2023-24) (AVT-I-MB-NWPZ)

The Advanced Varietal Trial of Malt Barley was conducted across 11 locations in the North Western Plains Zone (NWPZ) of India during the 2023-24 season. The trial adhered to standard protocols and was successfully completed at all locations, with the data from each site being included in the zonal mean analysis. The trial's status was reported as excellent across all 11 centers.

A total of seven genotypes were evaluated, including three test entries and four check varieties (DWRUB52, DWRB137, DWRB182, and RD2849). Of the test entries, two (DWRB235 and DWRB238) were contributed by ICAR-IIWBR, Karnal, while the third (RD3064) was contributed by the Durgapura center. All three test entries were in their second year of the Advanced Varietal Trial (AVT I).

The trial was carefully monitored at each center during the optimal growth stage of the crop. No issues related to genetic purity or other discrepancies were reported from any location. In terms of disease and pest incidence, no significant problems were observed, except for a mild occurrence of spot blotch disease at the Hisar, Ludhiana, and Pantnagar centers. Overall, the crop status was rated as very good across all sites.

Regarding grain yield, the mean yield across locations ranged from 42.01 q/ha at Hisar to 76.37 q/ha at Tabiji, with a zonal mean yield of 53.65 q/ha. Among the seven genotypes, the check variety DWRB137 achieved the highest yield at 59.74 q/ha. However, as DWRB137 is a feed barley variety, it was excluded from the comparison of malt genotypes. Among the malt barley entries, the test entry RD3064 ranked first with a grain yield of 56.78 q/ha, followed by DWRB238 (55.59 q/ha), DWRB235 (55.59 q/ha), and the check variety DWRUB52 (50.39 q/ha).

Based on these results, all three test entries—RD3064, DWRB238, and DWRB235—demonstrated significant superiority over the best check variety and are recommended for promotion to AVT II of malt barley.

Table 2.7. Grain yield (q/ha) data of AVT-I-Malt Barley-NWPZ (2023-24).

Entry name	Entry code	Bawal			Hisar			Karnal			Bathinda			Ludhiana			Durgapura		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
DWRB-235	AVT-MB-TS-6	48.58	2	0	53.00	1	1	63.09	1	1	50.52	2	1	48.54	1	1	63.06	7	0
DWRB-238	AVT-MB-TS-5	46.33	3	0	44.78	3	0	59.13	2	0	44.15	4	0	42.50	5	0	67.04	3	0
RD-3064	AVT-MB-TS-4	42.63	6	0	42.45	4	0	51.40	4	0	45.63	3	1	38.75	7	0	78.10	2	1
DWRUB-52 ©	AVT-MB-TS-3	40.75	7	0	39.50	6	0	43.38	6	0	41.88	5	0	41.04	6	0	64.65	4	0
DWRB-182 ©	AVT-MB-TS-2	43.73	4	0	27.54	7	0	40.96	7	0	39.73	7	0	42.66	4	0	64.35	5	0
RD-2849 ©	AVT-MB-TS-1	43.02	5	0	41.51	5	0	44.10	5	0	40.85	6	0	44.79	2	1	63.71	6	0
DWRB-137 © *	AVT-MB-TS-7	55.67	1	1	45.30	2	0	56.29	3	0	50.71	1	1	42.71	3	0	78.91	1	1
	G.M.	45.82			42.01			51.19			44.78			43.00			68.55		
	S.E.(M)	1.22			1.50			0.84			2.63			1.66			2.05		
	C.D.	3.00			3.67			2.06			6.45			4.07			5.03		
	C.V.	5.34			7.12			3.28			11.74			7.71			5.98		
	DOS	16.11.23			10.11.23			15.11.23			15.11.23			05.11.24			06.11.24		

Entry name	**Entry code**	**Navgaon**			**Tabijji**			**SG Nagar**			**Modipuram**			**Pantnagar**			**Zonal**		
		Yield	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**
DWRB-235	AVT-MB-TS-6	57.35	3	1	76.25	4	0	43.71	7	0	57.13	2	1	50.28	4	0	**55.59***	**3**	**0**
DWRB-238	AVT-MB-TS-5	48.08	6	0	82.08	3	0	65.02	4	0	58.41	1	1	53.96	1	1	**55.59***	**4**	**0**
RD-3064	AVT-MB-TS-4	60.92	2	1	91.67	2	1	70.43	2	1	51.39	4	0	51.19	3	0	**56.78***	**2**	**0**
DWRUB-52 ©	AVT-MB-TS-3	52.55	4	0	55.92	7	0	74.41	1	1	57.08	3	1	43.10	7	0	**50.39**	**5**	**0**
DWRB-182 ©	AVT-MB-TS-2	47.72	7	0	60.33	6	0	56.75	5	0	51.32	5	0	48.85	5	0	**47.63**	**7**	**0**
RD-2849 ©	AVT-MB-TS-1	49.69	5	0	70.83	5	0	49.40	6	0	48.48	7	0	51.91	2	1	**49.84**	**6**	**0**
DWRB-137 © *	AVT-MB-TS-7	61.43	1	1	97.50	1	1	69.31	3	0	51.06	6	0	48.22	6	0	**59.74**	**1**	**1**
	G.M.	53.96			76.37			61.29			53.55			49.64			**53.65**		
	S.E.(M)	1.74			2.91			1.98			0.76			0.94			**0.54**		
	C.D.	4.28			7.14			4.85			1.86			2.32			**1.25**		
	C.V.	6.46			7.62			6.45			2.83			3.80					
	DOS	18.11.24			15.11.24			15.11.24			20.11.24			20.11.24					

Note: DWRB137, being a feed barley variety, was excluded from yield comparisons with the test entries.
*The entries RD3064, DWRB238, and DWRB235 have demonstrated significant superiority over the best check variety.

Table 2.8. Ancillary data of AVT-Malt Barley-NWPZ (2023-24).

Entry name	**Entry code**	**Agronomic traits**						**Grain traits**			**Diseases & Insects**	
		Days to heading	**Days to maturity**	**Plant height (cm)**	**No of tillers/m**	**Ear type**	**Spike length (cm)**	**Colour**	**H/Hl**	**TGW (g)**	**Spot Blotch**	**Aphid**
DWRB-235	AVT-MB-6	90 (81-99)	134 (122-146)	94 (85-98)	153 (139-182)	2R	8.0 (7.2-9.6)	LY	H	49.8 (44.4-54.8)	12 (0-34)	0
DWRB-238	AVT-MB-5	91 (86-95)	134 (121-145)	93 (82-103	160 (141-191)	2R	7.9 (7.1-9.8)	LY	H	51.5 (45.7-53.6)	23 (13-45)	0
RD-3064	AVT-MB-4	92 (82-97)	131 (121-147)	98 (85-108)	134 (114-158)	2R	8.9 (7.5-11.1)	LY	H	56.8 (49.6-62.8)	24 (13-35)	0
DWRUB-52 ©	AVT-MB-3	91 (80-98)	134 (120-149)	102 (89-115)	137 (121-168)	2R	8.5 (7.0-10.9)	LY	H	46.2 (45.2-53.2)	24 (13-45)	0
DWRB-182 ©	AVT-MB-2	89 (79-98)	135 (121-142)	91 (82-96)	163 (146-197)	2R	7.9 (6.9-9.2)	LY	H	43.8 (40.2-48.9)	23 (11-35)	0
RD-2849 ©	AVT-MB-1	91 (81-97)	135 (119-151)	98 (92-110)	134 (119-167)	2R	8.4 (7.3-10.0)	LY	H	49.7 (45.3-55.2)	23 (11-36)	0
DWRB-137 ©	AVT-MB-7	84 (79-96)	132 (122-143)	94 (82-104)	112 (94-128)	6R	7.9 (6.9-9.0)	LY	H	44.2 (40.2-48.3)	35 (25-46)	0

INITIAL VARIETAL TRIAL-MALT BARLEY-NWPZ (2023-24)
(IVT-MB-NWPZ)

The Initial Varietal Trial of Malt Barley was conducted across 12 locations in the North Western Plains Zone (NWPZ) during the 2023-24 season. Adhering to standard guidelines, the trial was successfully executed at all sites, with the status reported as good across all 12 centers. Consequently, data from all locations were included in the zonal mean analysis.

This trial evaluated 25 genotypes, comprising 21 test entries and four check varieties (DWRUB52, DWRB137, DWRB182, and RD2849). Among the test entries, seven (RD3084, RD3085, RD3086, RD3087, RD3105, RD3106, and RD3107) were contributed by the Durgapura center; six (DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, and DWRB2312) by ICAR-IIWBR, Karnal; three (BH1055, BH1056, BH1057) by CCSHAU, Hisar; three (PL957, PL958, PL959) by PAU, Ludhiana; and two (UPB1124, UPB1125) by the Pantnagar center.

The trial was meticulously monitored at the optimal growth stages across all centers. No issues related to genetic purity or other discrepancies were reported. Regarding disease and pest incidence, only mild occurrences of spot blotch disease were observed at the Hisar, Ludhiana, and Pantnagar centers. Overall, the crop status was rated as very good at all locations.

Grain yield across locations varied, with mean values ranging from 38.43 q/ha at Dholpur to 68.00 q/ha at Durgapura, yielding a zonal mean of 53.23 q/ha. Among the significantly superior genotypes, DWRB2312 ranked first with a yield of 61.41 q/ha, followed by DWRB2311 (58.30 q/ha), RD3105 (57.82 q/ha), PL958 (57.58 q/ha), PL959 (56.98 q/ha), DWRB2307 (56.39 q/ha), RD3086 (56.05 q/ha), DWRB2309 (55.91 q/ha), and RD3084 (55.80 q/ha). Although the feed barley variety DWRB137 yielded 58.65 q/ha, placing it second overall, it was excluded from comparisons with the malt barley entries.Among the malt barley check varieties, RD2849 was the top performer with a yield of 51.62 q/ha, ranking 15th overall.

Based on their significant superiority over the best malt check, nine test entries—DWRB2312, DWRB2311, RD3105, PL958, PL959, DWRB2307, RD3086, DWRB2309, and RD3084—are recommended for promotion to the AVT I trial of malt barley.

Table 2.9. Grain yield (q/ha) data of IVT-Malt Barley-NWPZ (2023-24).

Entry name	Entry code	Bawal			Hisar			Karnal			Bathinda			Ludhiana			Dholpur			Durgapura		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
BH-1055	IVT-MB-TS-14	54.46	21	0	49.04	6	1	56.23	5	0	47.94	4	1	53.75	8	1	23.50	25	0	64.88	16	0
BH-1056	IVT-MB-TS-12	64.22	7	0	51.83	4	1	55.89	7	0	46.35	7	1	55.00	6	1	34.08	18	0	71.75	9	0
BH-1057	IVT-MB-TS-13	57.79	17	0	46.71	11	1	41.33	21	0	51.86	1	1	46.67	18	0	35.08	17	0	71.58	10	0
DWRB-2307	IVT-MB-TS-23	69.51	4	0	35.21	21	0	61.13	2	0	40.50	18	0	49.17	16	0	59.29	3	0	55.50	23	0
DWRB-2308	IVT-MB-TS-11	62.24	8	0	45.58	14	0	59.35	3	0	40.85	15	0	55.83	4	1	36.40	8	0	67.79	15	0
DWRB-2309	IVT-MB-TS-5	60.81	11	0	47.25	9	1	55.58	8	0	46.23	8	1	55.42	5	1	35.85	14	0	76.75	2	1
DWRB-2310	IVT-MB-TS-15	54.11	22	0	41.73	16	0	58.00	4	0	35.80	22	0	46.67	19	0	47.62	4	0	63.54	20	0
DWRB-2311	IVT-MB-TS-8	60.37	12	0	46.75	10	1	56.20	6	0	49.13	2	1	62.92	1	1	42.98	5	0	73.25	7	1
DWRB-2312	IVT-MB-TS-17	70.13	2	0	52.92	2	1	75.12	1	1	41.96	14	0	53.75	8	1	64.87	1	1	64.08	18	0
PL-957	IVT-MB-TS-9	67.09	5	0	52.67	3	1	40.31	24	0	47.36	6	1	57.50	3	1	31.54	22	0	64.79	17	0
PL-958	IVT-MB-TS-19	53.80	23	0	47.38	8	1	42.48	20	0	44.43	11	1	62.08	2	1	36.06	12	0	72.58	8	1
PL-959	IVT-MB-TS-1	64.62	6	0	45.63	13	0	54.09	10	0	48.81	3	1	54.58	7	1	36.20	11	0	69.08	13	0
RD-3084	IVT-MB-TS-21	42.70	25	0	45.42	15	0	44.45	15	0	39.36	20	0	47.08	17	0	63.45	2	1	75.50	4	1
RD-3085	IVT-MB-TS-10	57.89	16	0	35.00	22	0	40.12	25	0	40.38	19	0	35.83	24	0	36.48	7	0	68.08	14	0
RD-3086	IVT-MB-TS-22	56.29	20	0	37.92	19	0	45.80	13	0	45.85	9	1	52.50	10	1	36.30	10	0	73.46	5	1
RD-3087	IVT-MB-TS-6	58.55	14	0	53.46	1	1	40.45	23	0	43.21	13	0	43.75	22	0	32.68	21	0	54.63	24	0
RD-3105	IVT-MB-TS-3	83.65	1	1	50.25	5	1	44.19	16	0	45.01	10	1	51.25	12	0	37.44	6	0	75.96	3	1
RD-3106	IVT-MB-TS-16	69.66	3	0	26.96	25	0	44.14	17	0	31.20	25	0	32.50	25	0	30.36	24	0	51.33	25	0
RD-3107	IVT-MB-TS-18	57.57	18	0	30.96	23	0	42.50	19	0	40.61	17	0	36.67	23	0	36.00	13	0	69.83	12	0
UPB-1124	IVT-MB-TS-24	58.32	15	0	47.83	7	1	40.67	22	0	40.64	16	0	51.25	12	0	35.47	16	0	61.58	22	0
UPB-1125	IVT-MB-TS-25	46.34	24	0	30.33	24	0	44.61	14	0	34.08	23	0	50.42	14	0	35.60	15	0	73.42	6	1
DWRUB-52 ©	IVT-MB-TS-7	59.22	13	0	40.33	17	0	47.37	12	0	43.46	12	0	45.00	21	0	33.09	19	0	71.25	11	0
DWRB-182 ©	IVT-MB-TS-2	56.43	19	0	38.21	18	0	42.81	18	0	39.04	21	0	45.83	20	0	31.31	23	0	63.92	19	0
RD-2849 ©	IVT-MB-TS-20	61.04	10	0	35.88	20	0	55.13	9	0	32.78	24	0	52.29	11	0	36.33	9	0	62.67	21	0
DWRB-137 ©*	IVT-MB-TS-4	61.09	9	0	45.88	12	1	51.48	11	0	47.53	5	1	50.42	14	0	32.70	20	0	82.67	1	1
	G.M.	60.32			43.24			49.58			42.57			49.93			38.43			68.00		
	S.E.(M)	4.11			3.22			2.31			3.21			4.17			0.95			4.32		
	C.D.	10.14			7.79			5.71			7.92			10.09			2.34			10.46		
	C.V.	9.63			10.53			6.59			10.65			11.81			3.48			8.99		
	DOS	07.11.23			10.11.23			15.11.23			15.11.23			05.11.24			18.11.24			06.11.24		

Table 2.10. Grain yield (q/ha) data of IVT-Malt Barley-NWPZ trial (2023-24).

Entry name	Entry code	Navgaon			Tabijji			SG Nagar			Modipuram			Pantnagar			**Zonal**		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
BH-1055	IVT-MB-TS-14	53.36	17	0	65.67	16	0	57.88	19	0	51.54	14	0	54.48	5	0	52.73	13	0
BH-1056	IVT-MB-TS-12	32.25	25	0	72.58	10	1	44.29	25	0	44.00	22	0	48.03	9	0	51.69	14	0
BH-1057	IVT-MB-TS-13	61.86	12	0	65.17	18	0	46.80	23	0	53.08	11	0	35.89	15	0	51.15	18	0
DWRB-2307	IVT-MB-TS-23	62.53	11	0	60.83	22	0	65.84	10	0	61.79	4	1	55.39	4	0	56.39*	7	0
DWRB-2308	IVT-MB-TS-11	50.90	19	0	58.42	24	0	45.84	24	0	61.13	7	1	33.30	19	0	51.47	16	0
DWRB-2309	IVT-MB-TS-5	61.61	13	0	73.25	7	1	65.79	11	0	63.50	2	1	28.86	24	0	55.91*	9	0
DWRB-2310	IVT-MB-TS-15	62.94	10	0	63.92	20	0	59.92	17	0	41.88	23	0	56.82	3	1	52.75	12	0
DWRB-2311	IVT-MB-TS-8	51.90	18	0	72.75	9	1	73.83	5	0	61.75	5	1	47.81	10	0	58.30*	3	0
DWRB-2312	IVT-MB-TS-17	48.63	21	0	65.67	16	0	87.08	1	1	63.58	1	1	49.16	7	0	61.41*	1	1
PL-957	IVT-MB-TS-9	63.64	9	0	71.42	11	1	55.42	21	0	46.79	20	0	39.92	11	0	53.20	11	0
PL-958	IVT-MB-TS-19	76.46	4	1	74.50	5	1	69.04	8	0	63.17	3	1	49.02	8	0	57.58*	5	0
PL-959	IVT-MB-TS-1	67.34	8	0	60.42	23	0	74.33	4	0	48.17	18	0	60.46	1	1	56.98*	6	0
RD-3084	IVT-MB-TS-21	77.58	1	1	76.33	3	1	68.17	9	0	55.54	9	0	34.02	17	0	55.80*	10	0
RD-3085	IVT-MB-TS-10	70.00	7	0	76.08	4	1	59.29	18	0	50.71	15	0	34.26	16	0	50.34	20	0
RD-3086	IVT-MB-TS-22	73.37	5	1	73.00	8	1	73.54	6	0	52.67	12	0	51.87	6	0	56.05*	8	0
RD-3087	IVT-MB-TS-6	59.39	14	0	64.08	19	0	60.96	16	0	52.08	13	0	31.88	22	0	49.59	21	0
RD-3105	IVT-MB-TS-3	77.12	2	1	76.42	2	1	63.79	12	0	57.29	8	0	31.42	23	0	57.82*	4	0
RD-3106	IVT-MB-TS-16	50.02	20	0	61.67	21	0	85.63	2	1	34.79	25	0	19.67	25	0	44.83	25	0
RD-3107	IVT-MB-TS-18	76.70	3	1	68.25	15	0	51.88	22	0	61.33	6	1	38.51	13	0	50.90	19	0
UPB-1124	IVT-MB-TS-24	38.48	24	0	55.00	25	0	63.00	14	0	49.88	17	0	32.26	21	0	47.86	23	0
UPB-1125	IVT-MB-TS-25	47.71	22	0	73.75	6	1	73.38	7	0	41.00	24	0	32.76	20	0	48.62	22	0
DWRUB-52 ©	IVT-MB-TS-7	57.73	15	0	71.08	12	1	57.17	20	0	50.67	16	0	39.63	12	0	51.33	17	0
DWRB-182 ©	IVT-MB-TS-2	39.34	23	0	71.08	12	1	61.71	15	0	45.71	21	0	38.26	14	0	47.80	24	0
RD-2849 ©	IVT-MB-TS-20	70.58	6	0	68.92	14	0	63.12	13	0	47.38	19	0	33.37	18	0	51.62	15	0
DWRB-137 © *	IVT-MB-TS-4	56.52	16	0	80.25	1	1	79.83	3	0	55.50	10	0	59.96	2	1	58.65	2	0
	G.M.	59.52			68.82			64.30			52.60			41.48			53.23		
	S.E.(M)	2.30			3.99			2.29			1.82			1.89			0.89		
	C.D.	5.67			9.67			5.54			4.41			4.57			2.06		
	C.V.	5.46			8.21			5.03			4.90			6.44					
	DOS	18.11.24			10.11.24			15.11.24			20.11.24			20.11.24					

Note: DWRB137, being a feed barley variety, was excluded from yield comparisons with the test entries.

The entries DWRB2312, DWRB2311, RD3105, PL958, PL959, DWRB2307, RD3086, DWRB2309, and RD3084 demonstrated significant superiority in grain yield compared to the best check variety.

Table 2.11. Ancillary Data of IVT- Malt Barley-NWPZ (2023-24).

SN	Entry name	Entry code	Agronomic traits						Grain traits			Diseases & Insects	
			Days to heading	Days to maturity	Plant height (cm)	No of tillers/m	Ear type	Spike length (cm)	Colour	H/Hl	1000-grains weight (g)	Spot blotch	Aphid
1	BH-1055	IVT-IR-MB-NWPZ-14	92(75-100)	134(120-150)	93 (82-109)	134 (121-150)	2R	8.5 (6.7-10.2)	LY	H	51.3(42.4-58.6)	24(12-45)	0
2	BH-1056	IVT-IR-MB-NWPZ-12	92(73-98)	133(125-148)	86 (65-110)	121 (115-159)	2R	8.5 (7.8-10.0)	LY	H	53.8(46.4-61.2)	34(12-67)	0
3	BH-1057	IVT-IR-MB-NWPZ-13	88(77-100)	132(119-149)	92 (74-99)	132 (103-143)	2R	8.4 (7.3-10.4)	LY	H	50.1(46.6-55.9)	22(11-23)	0
4	DWRB-2307	IVT-IR-MB-NWPZ-23	87(75-100)	131(120-151)	97 (88-100)	151 (131-183)	2R	7.7 (7.3-8.4)	LY	H	52.6(49.2-57.7)	12(11-23)	0
5	DWRB-2308	IVT-IR-MB-NWPZ-11	88(77-101)	133(123-153)	88 (83-107)	137(123-168)	2R	7.9 (7.2-8.8)	LY	H	49.1(42.6-54.6)	14(12-36)	0
6	DWRB-2309	IVT-IR-MB-NWPZ-5	87(75-106)	133(120-152)	96 (75-103)	141 (127-163)	2R	8.2 (7.7-10.0)	LY	H	48.3(38.1-54.2)	13(11-23)	0
7	DWRB-2310	IVT-IR-MB-NWPZ-15	86(78-98)	131(128-147)	92 (88-98)	131(118-149)	2R	7.3 (7.1-9.3)	LY	H	48.9(45.6-54.7)	24(12-36)	0
8	DWRB-2311	IVT-IR-MB-NWPZ-8	89(78-107)	134(122-153)	96 (80-97)	154 (136-161)	2R	7.9 (7.5-9.0)	LY	H	50.2(44.3-58.8)	13(12-23)	0
9	DWRB-2312	IVT-IR-MB-NWPZ-17	91(82-103)	132(119-146)	98 (89-107)	143 (129-174)	2R	8.0 (6.9-9.0)	LY	H	49.8(43.6-56.8)	24(15-34)	0
10	PL-957	IVT-IR-MB-NWPZ-9	86(76-94)	133(123-149)	80 (82-97)	131 (120-149)	2R	8.0 (6.9-10.0)	LY	H	56.1(44.1-61.2)	12(0-23)	0
11	PL-958	IVT-IR-MB-NWPZ-19	85(74-98)	134(122-153)	94 (72-108)	124 (119-143)	2R	7.7 (7.3-9.6)	LY	H	51.8(47.6-58.9)	24(16-45)	0
12	PL-959	IVT-IR-MB-NWPZ-1	82(74-97)	133(127-149)	91 (82-101)	133 (117-167)	2R	7.6 (7.0-9.0)	LY	H	51.4(46.5-56.8)	13(13-23)	0
13	RD-3084	IVT-IR-MB-NWPZ-21	86(79-98)	134(121-152)	98 (86-121)	134 (104-142)	2R	9.2 (7.3-10.9)	LY	H	52.5(47.8-61.2)	22(0-34)	0
14	RD-3085	IVT-IR-MB-NWPZ-10	88(76-103)	134(121-154)	85 (86-104)	122 (111-134)	2R	9.1 (7.3-10.4)	LY	H	51.0(42.2-62.2)	13(0-36)	0
15	RD-3086	IVT-IR-MB-NWPZ-22	89(77-98)	135(120-149)	98 (75-109)	135 (112-151)	2R	8.1 (7.0-9.4)	LY	H	49.9(43.6-60.2)	23(13-24)	0
16	RD-3087	IVT-IR-MB-NWPZ-6	90(79-104)	132(128-146)	89 (82-98)	127(107-143)	2R	7.3 (7.0-9.2)	LY	H	53.1(43.3-60.3)	12(12-23)	0
17	RD-3105	IVT-IR-MB-NWPZ-3	92(81-109)	135(120-150)	98 (89-113)	141(123-161)	2R	9.3 (7.6-10.2)	LY	H	49.8(44.7-60.9)	35(26-34)	0
18	RD-3106	IVT-IR-MB-NWPZ-16	81(81-104	132(120-150)	98 (85-115)	140 (127-159)	2R	9.3 (6.8-10.4)	LY	H	56.4(47.1-62.2)	24(23-26)	0
19	RD-3107	IVT-IR-MB-NWPZ-18	85(73-98)	136(123-154)	94 (85-96)	137 (115-154)	2R	8.8 (7.8-10.1)	LY	H	56.3(45.7-64.5)	14(13-23)	0
20	UPB-1124	IVT-IR-MB-NWPZ-24	91(80-101)	136(122-154)	93 (72-112)	143 (114-161)	2R	8.5 (7.2-9.9)	LY	H	49.0(43.1-54.0)	23(23-23)	0
21	UPB-1125	IVT-IR-MB-NWPZ-25	90(80-104)	135(123-148)	97 (87-103)	149 (131-157)	2R	8.2 (7.0-9.3)	LY	H	48.0(41.8-52.8)	12(11-23)	0
22	DWRUB-52 ©	IVT-IR-MB-NWPZ-7	90(76-107)	135(123-154)	92 (81-99)	141(133-167)	2R	7.7 (7.7-8.9)	LY	H	47.7(40.7-54.0)	13(0-34)	0
23	DWRB-182 ©	IVT-IR-MB-NWPZ-2	87(74-99)	132(125-149)	90 (83-99)	162(145-189)	2R	7.7 (7.0-9.9)	LY	H	44.0(39.2-51.0)	23(12-35)	0
24	RD-2849 ©	IVT-IR-MB-NWPZ-20	87(76-98)	133(120-149)	87 (78-99)	130 (117-149)	2R	8.5 (6.9-9.9)	LY	H	48.7(44.7-53.1)	13(11-23)	0
25	DWRB-137 ©	IVT-IR-MB-NWPZ-4	90(81-94)	130(121-148)	97 (88-105)	114 (96-126)	6R	7.6 (7.1-9.1)	LY	H	43.1(41.1-49.4)	23(25-35)	0

Initial Varietal Trial-Rainfed-NEPZ (2023-24)
(IVT-RF-NEPZ)

The Initial Varietal Trial for Rainfed Barley in the North Eastern Plain Zone was proposed at eight locations: Kanpur, Saini, Ayodhya, CAU Pusa, Chiyanki, Varanasi, Sabour, and Ranchi. While the trial was successfully conducted at all eight sites, data from Varanasi, Sabour, and Ranchi were excluded from the zonal mean analysis due to low site mean values. Consequently, only data from the remaining five locations were considered.

The trial evaluated 13 genotypes, consisting of 12 test entries and one check variety (K 603). Of the test entries, six (RD 3094, RD 3097, RD 3098, RD 3099, RD 3100, and RD 3108) were contributed by the Durgapura center, two (HUB 287 and HUB 288) by the Varanasi center, two (KB 2201 and KB 2231) by the Kanpur center, and two (NDB 1821 and NDB 1823) by the Ayodhya center.

The trial was monitored at the optimal growth stage across all locations, with no issues related to genetic purity or discrepancies reported. However, a severe germination problem was observed consistently across locations for one entry No. 5.

In terms of disease, spot blotch was prevalent at most centers, although no serious insect infestations were reported. Overall, the crop status was deemed satisfactory across all locations.

Grain yield varied significantly across sites, with location means ranging from 15.77 q/ha at Chiyanki to 41.28 q/ha at Kanpur, and a zonal mean of 27.01 q/ha. Among the test entries, RD 3098 achieved the highest grain yield at 33.54 q/ha, followed by HUB 288 at 33.32 q/ha, and the check variety K 603 at 32.92 q/ha. However, none of the test entries demonstrated significant superiority over the check variety K 603 in terms of yield.

Entries HUB 288 and RD 3098 demonstrated numerical superiority in yield compared to the check variety K 603 and exhibited favorable resistance to rust and blight diseases. These entries may be considered for promotion to AVT- I.

Table 2.12. Grain yield (q/ha) data of IVT-Rainfed-NEPZ (2023-24).

Entry name	Entry code	Kanpur			Saini			Ayodhya			Pusa CAU			Chiyanki			Zonal (NEPZ)		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
HU B287	IVT-RF-NEPZ-9	37.93	8	0	29.57	6	0	29.59	3	0	27.28	4	0	20.79	2	1	**29.03**	**4**	**0**
HUB 288	IVT-RF-NEPZ-10	58.30	1	1	25.29	9	0	33.51	1	1	32.43	2	1	17.07	4	0	**33.32***	**2**	**1**
KB 2201	IVT-RF-NEPZ-7	47.14	5	0	26.27	8	0	28.74	5	0	27.17	5	0	0.00	12	0	**25.86**	**8**	**0**
KB 2231	IVT-RF-NEPZ-5	0.00	13	0	0.00	13	0	0.00	13	0	0.00	13	0	0.00	12	0	**0.00**	**13**	**0**
NDB 1821	IVT-RF-NEPZ-12	43.48	6	0	29.91	3	0	28.50	6	0	25.98	6	0	15.96	5	0	**28.76**	**6**	**0**
NDB 1833	IVT-RF-NEPZ-6	42.66	7	0	26.99	7	0	24.70	8	0	20.62	9	0	14.66	7	0	**25.93**	**7**	**0**
RD 3094	IVT-RF-NEPZ-3	37.86	9	0	29.82	4	0	22.46	10	0	7.12	12	0	15.67	6	0	**22.59**	**10**	**0**
RD 3097	IVT-RF-NEPZ-8	10.87	12	0	33.22	1	1	20.98	11	0	18.04	10	0	7.52	11	0	**18.13**	**12**	**0**
RD 3098	IVT-RF-NEPZ-13	57.17	2	1	31.76	2	1	31.10	2	0	25.98	7	0	21.68	1	1	**33.54***	**1**	**1**
RD 3099	IVT-RF-NEPZ-2	49.02	4	0	23.30	11	0	24.76	7	0	33.35	1	1	14.07	9	0	**28.90**	**5**	**0**
RD 3100	IVT-RF-NEPZ-1	24.11	11	0	21.92	12	0	18.15	12	0	18.01	11	0	10.93	10	0	**18.62**	**11**	**0**
RD 3108	IVT-RF-NEPZ-4	33.30	10	0	24.02	10	0	23.55	9	0	21.81	8	0	14.42	8	0	**23.42**	**9**	**0**
K-603©	IVT-RF-NEPZ-11	53.48	3	0	29.67	5	0	29.17	4	0	31.63	3	1	20.65	3	1	**32.92**	**3**	**1**
	G.M.	41.28			27.64			26.27			24.12			15.77			**27.01**		
	S.E.(M)	1.20			1.27			0.80			1.19			0.97			**0.49**		
	C.D.	2.88			3.03			1.91			2.84			2.33			**1.15**		
	C.V.	5.84			9.16			6.08			9.85			12.30					
	DOS	7.11.23			7.11.23			8.11.23			10.11.23			7.11.23					

*Entries HUB 288 and RD 3098 were numerically superior in yield compared to the check variety K 603 and also exhibited favorable resistance to rust and blight diseases.

Table 2.13. Ancilary data of IVT-Rainfed-NEPZ (2023-24).

Entry name	Entry code	Agronomic Characteristics						Grain Characteristics		
		Days to heading	Days to maturity	Plant height (cm)	No of tillers/m	Ear type	Spike length (cm)	Colour	H/Hl	TGW (g)
HUB-287	IVT-RF-NEPZ-9	80(62-85)	121(112-135)	87(71-93)	91(78-151)	6-Row	8.1(7.1-9.2)	LY	H	42.1(36.0-48.6)
HUB-288	IVT-RF-NEPZ-10	76(71-83)	123(119-137)	74(59-84)	62(38-85)	6-Row	7.7(6.0-8.2)	LY	H	41.6(36.0-47.0)
KB-2201	IVT-RF-NEPZ-7	72(65-80)	126(116-130)	73(62-83)	89(61-108)	6-Row	7.6(6.6-8.0)	Y	H	42.8(37.0-49.0)
KB-2231	IVT-RF-NEPZ-5	75(69-78)	123(110-140)	78(68-94)	85(78-144)	6-Row	7.0(6.0-8.0)	LY	H	43.3(38.0-50.3)
NDB-1821	IVT-RF-NEPZ-12	82(63-84)	129(113-144)	75(55-95)	98(81-136)	6-Row	7.2(6.0-9.0)	LY	H	42.4(35.2-48.2)
NDB-1833	IVT-RF-NEPZ-6	80(62-85)	129(121-138)	86(77-91)	97(82-110)	6-Row	7.7(7.1-9.0)	LY	H	42.0(37.9-48.0)
RD-3094	IVT-RF-NEPZ-3	76(71-83)	130(123-140)	78(68-94)	93(76-105)	6-Row	8.4(7.8-9.0)	Y	H	43.2(39.0-49.0)
RD-3097	IVT-RF-NEPZ-8	72(65-80)	123(112-140)	81(63-93)	71(43-131)	6-Row	7.8(6.7-9.6)	LY	H	43.3(37.0-52.3)
RD-3098	IVT-RF-NEPZ-13	76(71-83)	127(116-131)	74(62-90)	92(59-117)	6-Row	8.2(7.0-9.0)	LY	H	41.8(34.0-47.0)
RD-3099	IVT-RF-NEPZ-2	73(65-80)	126(114-138)	78(68-94	89(61-108)	6-Row	7.6(7.0-8.2)	LY	H	41.9(37.0-46.9)
RD-3100	IVT-RF-NEPZ-1	81(62-91)	120(103-139)	72(58-90)	92(71-133)	6-Row	7.4(6.9-8.0)	Y	H	46.4(38.0-52.4)
RD-3108	IVT-RF-NEPZ-4	77(70-83)	117(110-139)	65(50-84)	79(63-91)	6-Row	7.6(7.0-9.0)	LY	H	43.5(38.0-50.1)
K-603©	IVT-RF-NEPZ-11	73(68-80)	127(118-142)	70(61-79)	87(66-118)	6-Row	8.1(7.3-9.0)	LY	H	40.5(37.0-49.0)

ADVANCED / INITIAL VARIETAL TRIAL
FOR SALINITY & ALKALINITY CONDITIONS (2023-24)
(AVT/IVT-SAL-ALK)-Plain Zones

The Advanced/Initial Varietal Trial for Salinity and Alkalinity Conditions was conducted during the 2023-24 season at seven locations across the North Western and North Eastern Plain Zones of India, including CSSRI Karnal, Hisar-I, Hisar-II, Fatehpur, Bhilwara, Dilip Nagar, and Ayodhya. The trial was completed at all locations except Bhilwara, with satisfactory results reported at all sites except two centers of Hisar.

The trial evaluated 18 genotypes, including 15 test entries and 3 check varieties (NDB1173, RD2794, and RD2907). Of the test entries, eight (RD3080, RD3104, RD3105, RD3104, RD3109, RD3110, RD3111) were contributed by the Durgapura center, two (BH1061 and BH1062) by CCSHAU Hisar, two (HUB293 and HUB294) by the Varanasi center, two (KB2031 and KB2203) by the Kanpur center, and one (NDB1829) by the Ayodhya center.

The trial was closely monitored at the optimal growth stages across all centers, with no issues related to genetic purity or other discrepancies reported. However, due to a very poor plant stand, the trial at Hisar-I & Hisar-II was rejected by the monitoring team.

In terms of disease and pest incidence, no major issues were reported at any center, except for a mild incidence of spot blotch disease at the Hisar-I center. Overall, the crop status was deemed satisfactory across all locations.

Grain yield varied significantly across locations, with mean values ranging from 23.57 q/ha at CSSRI Karnal to 59.82 q/ha at Fatehpur, resulting in a zonal mean of 36.68 q/ha. Among the entries, RD3102 achieved the highest grain yield at 41.58 q/ha, followed by RD3109 at 41.08 q/ha, and the check variety RD2794 at 39.90 q/ha. Based on these yield results, RD3102 was found to be significantly superior to the best check variety and is recommended for promotion to the AVT (I) trial of barley.

Entry RD 3102 demonstrated significant superiority over the check in yield, coupled with strong rust resistance. Entry RD 3109 was numerically superior to the check in yield and also exhibited strong rust resistance. Entry RD 3084 performed on par with the check, showing robust rust resistance with an almost immune reaction. Entry HUB 294 was on par with the check, displaying good resistance to blight. The AVT I entry, KB 2031, was on par with the check, demonstrating excellent rust resistance and moderate resistance to blight.

Table 2.14. Grain Yield (q/ha) data of AVT/IVT-Salinity & Alkalinity conditions (2023-24).

Entry name	Entry code	CSSRI Karnal			Dilipnagar			Ayodhaya			Fatehpur			Zonal		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH-1061	AVT/IVT-SAL-ALK -4	22.07	13	0	25.11	18	0	25.97	7	0	60.31	11	0	**33.37**	**16**	**0**
BH-1062	AVT/IVT-SAL-ALK -18	29.73	1	1	39.49	11	0	25.36	9	0	56.06	15	0	**37.66**	**10**	**0**
HUB-293	AVT/IVT-SAL-ALK -16	24.63	9	0	26.99	17	0	33.64	2	1	55.13	16	0	**35.10**	**14**	**0**
HUB-294@	AVT/IVT-SAL-ALK -11	21.47	14	0	51.78	1	1	23.01	10	0	59.57	13	0	**38.95**	**5**	**0**
KB-2031@	AVT/IVT-SAL-ALK -17	11.41	18	0	45.65	5	0	34.12	1	1	67.39	2	1	**39.64**	**4**	**0**
KB-2203	AVT/IVT-SAL-ALK -13	23.58	10	0	28.26	16	0	29.11	5	0	62.08	5	0	**35.76**	**12**	**0**
NDB-1829	AVT/IVT-SAL-ALK -8	22.43	12	0	34.78	12	0	8.64	18	0	62.86	4	0	**32.18**	**17**	**0**
RD-3080@	AVT/IVT-SAL-ALK -15	22.97	11	0	41.67	9	0	30.74	4	0	59.89	12	0	**38.82**	**6**	**0**
RD-3101	AVT/IVT-SAL-ALK -14	21.21	15	0	47.43	4	0	22.64	11	0	57.57	14	0	**37.21**	**11**	**0**
RD-3102*	AVT/IVT-SAL-ALK -10	27.83	6	1	50.00	2	1	20.59	13	0	67.90	1	1	**41.58***	**1**	**1**
RD-3103	AVT/IVT-SAL-ALK -6	14.12	16	0	31.38	14	0	16.67	16	0	43.24	18	0	**26.35**	**18**	**0**
RD-3104	AVT/IVT-SAL-ALK -9	26.85	8	0	44.75	6	0	25.85	8	0	53.54	17	0	**37.75**	**9**	**0**
RD-3109#	AVT/IVT-SAL-ALK -7	27.81	7	1	48.88	3	1	26.57	6	0	61.05	6	0	**41.08#**	**2**	**1**
RD-3110	AVT/IVT-SAL-ALK -1	28.36	4	1	32.79	13	0	19.44	15	0	60.33	10	0	**35.23**	**13**	**0**
RD-3111	AVT/IVT-SAL-ALK -12	13.04	17	0	43.84	7	0	15.73	17	0	60.90	8	0	**33.38**	**15**	**0**
NDB-1173©	AVT/IVT-SAL-ALK -3	29.52	2	1	41.87	8	0	19.99	14	0	60.60	9	0	**37.99**	**8**	**0**
RD-2794 ©	AVT/IVT-SAL-ALK -2	28.35	5	1	30.80	15	0	33.15	3	1	67.31	3	1	**39.90**	**3**	**0**
RD-2907©	AVT/IVT-SAL-ALK -5	28.84	3	1	40.76	10	0	22.52	12	0	61.05	6	0	**38.29**	**7**	**0**
	G.M.	23.57			39.23			24.10			59.82			**36.68**		
	S.E.(M)	1.17			1.31			0.81			1.71			**0.64**		
	C.D.	2.77			3.09			1.91			4.04			**1.5**		
	C.V.	9.91			6.66			6.69			5.70					
	DOS	15.11.23			20.11.23			25.11.23			18.11.23					

Note: *= AVT (I) **= AVT (II). *** Entry RD 3102**: Significantly superior to the check in yield with strong rust resistance. # **Entry RD 3109**: Numerically superior to the check in yield with strong rust resistance'@ **Entry RD 3080**: On par with the check, with strong resistance to rust and an almost immune reaction. **@ Entry HUB 294**: On par with the check, with good resistance to blight. **AVT I Entry**: @**KB 2031** On par with the check, demonstrating excellent rust resistance and moderate resistance to blight.

Table 2.15. Ancillary data of AVT/IVT-Salinity & Alkalinity conditions (2023-24).

Entry name	Entry code	Agronomic Characteristics						Grain Characteristics			Disease & Insects	
		Days to heading	Days to maturity	Plant height (cm)	No of tillers/m	Ear type	Spike length (cm)	Colour	H/Hl	TGW (g)	Spot Blotch	Aphid
BH-1061	AVT/IVT-SAL-ALK -4	91 (78-99)	132 (123-139)	84 (76-93)	67 (41-93)	6R	7.0 (6.8-8.2)	Y	H	35.2 (33.3-39.8)	0	2
BH-1062	AVT/IVT-SAL-ALK -18	90 (83-97)	125 (118-131)	83 (78-92)	78 (62-107)	6R	8.1 (7.4-9.0)	Y	H	40.5 (38.0-43.8)	0	1
HUB-293	AVT/IVT-SAL-ALK -16	88 (84-92)	130 (123-138)	80 (77-99)	89 (64-139)	6R	7.6 (6.8-8.8)	LY	H	41.5 (38.0-44.4)	24	1
HUB-294	AVT/IVT-SAL-ALK -11	84 (81-90)	131 (121-136)	81 (61-98)	69 (62-81)	6R	7.6 (6.4-8.2)	LY	H	39.9 (33.3-43.8)	0	2
KB-2031 **	AVT/IVT-SAL-ALK -17	93 (88-102)	138 (127-145)	91 (78-95)	69 (58-98)	6R	7.1 (6.0-8.2)	LY	H	39.2 (36.2-43.4)	0	1
KB-2203	AVT/IVT-SAL-ALK -13	85 (77-91)	127 (121-135)	88 (74-96)	83 (56-116)	6R	7.3 (7.0-8.5)	Y	H	44.0 (39.0-47.3)	0	1
NDB-1829	AVT/IVT-SAL-ALK -8	89 (74-91)	130 (121-141	94 (78-99)	76 (54-101)	6R	7.8 (7.1-8.2)	Y	H	40.5 (35.6-42.9)	24	2
RD-3080*	AVT/IVT-SAL-ALK -15	94 (78-99)	123 (114-132)	80 (63-87)	70 (63-93)	6R	7.1 (6.8-8.2)	LY	H	39.4 (36.0-43.4)	0	1
RD-3101	AVT/IVT-SAL-ALK -14	86 (77-91)	133 (121-141	88 (84-92)	73 (63-97)	6R	8.4 (7.8-10.3)	LY	H	40.4 (38.1-42.4)	0	1
RD-3102	AVT/IVT-SAL-ALK -10	90 (76-96)	136 (122-140)	84 (81-90)	97 (84-122)	6R	6.9 (5.8-8.2)	LY	H	38.9 (36.3-43.2)	0	2
RD-3103	AVT/IVT-SAL-ALK -6	85 (77-91)	130 (127-133)	90 (83-97)	84 (71-90)	6R	8.2 (6.8-9.0)	LY	H	41.2 (36.5-43.7)	99	1
RD-3104	AVT/IVT-SAL-ALK -9	86 (68-90)	132 (124-136)	86 (74-91)	88 (74-106)	6R	7.5 (6.2-8.2)	LY	H	43.2 (39.0-47.1)	15	1
RD-3109	AVT/IVT-SAL-ALK -7	89 (73-94)	131 (122-139)	84 (78-93)	94 (78-99)	6R	6.2 (5.8-8.2)	LY	H	39.0 (37.7-41.7)	0	2
RD-3110	AVT/IVT-SAL-ALK -1	85 (77-91)	131 (121-136)	89 (74-91)	98 (81-138)	6R	6.5 (6.0-8.7)	LY	H	38.9 (34.0-43.3)	0	3
RD-3111	AVT/IVT-SAL-ALK -12	84 (71-90)	130 (121-141	90 (88-95)	90 (83-97)	6R	7.7 (6.8-9.2)	Y	H	43.4 (36.0-46.2)	13	2
NDB-1173©	AVT/IVT-SAL-ALK -3	91 (78-95)	127 (117-138)	83 (76-96)	92 (63-97)	6R	7.0 (5.8-8.7)	Y	H	43.7 (41.0-45.4)	0	3
RD-2794 ©	AVT/IVT-SAL-ALK -2	84 (81-90)	134 (128-140)	88 (77-96)	68 (44-112)	6R	7.3 (6.8-8.2)	LY	H	39.9 (35.4-42.7)	0	1
RD-2907©	AVT/IVT-SAL-ALK -5	92 (78-99)	131 (120-137)	86 (78-99)	74 (51-95)	6R	8.2 (6.8-91)	Y	H	41.8 (36.7- 43.4)	0	1

Note: *= AVT (I) **= AVT (II)

Hulless Barley

Advanced Varietal Trials (I&II)- Irrigated-Timely Sown-Hulless Barley
[AVT-(I&II) Hulless Barley (NWPZ and Central Zone)]

The advanced varietal trial for naked barley was proposed across six locations in the North Western Plain Zone (NWPZ) and five locations in the Central Zone of the country. The trials were conducted in accordance with the specified technical program at each site. However, Pantnagar was excluded from the NWPZ zonal pooled analysis due to its low site mean (LSM: 21.46 q/ha). The remaining five NWPZ locations were considered for calculating the zonal mean. The trial comprised two test entries and three check varieties, specifically K1149 (Gitanjali), Karan16, and PL891. Zonal monitoring teams visited the trials at Ludhiana, Hisar, Durgapura, Modipuram, and Pantnagar in the NWPZ, and the trials were noted to be in favorable conditions.

In the NWPZ, the grain yield location means varied from 26.03 q/ha at Hisar to 54.49 q/ha at Durgapura, with an overall zonal mean of 39.91 q/ha. The AVT-2nd year entry DWRB223 ranked first, achieving a mean grain yield of 47.4 q/ha in the first non-significant group, significantly outperforming all check varieties. Meanwhile, DWRB244 from the AVT-1st year ranked second with a mean grain yield of 40.9 q/ha, also demonstrating significant superiority over all checks. DWRB 244 shows significant superior grain yield to the best check and strong rust resistance with 7.8% beta-glucan, 43.3 ppm iron and 38.2 ppm zinc contents in grains.

In central zone three locations—Gwalior and Vijapur (both with LSM of 19.43 q/ha) and Morena (due to delayed sowing)—were excluded from the zonal mean analysis. Grain yield location means in this zone ranged from 30.32 q/ha at Udaipur to 38.10 q/ha at Tikamgarh, resulting in a zonal mean of 34.21 q/ha. The check variety K1149 ranked first with a mean grain yield of 45.55 q/ha in the first. None of the genotype is advanced in this zone.

Table 2.16. AVT-(I&II) hulless barley (NWPZ) grain yield data (q/ha) *Rabi (2023-24)*

Entry **name**	Entry **c**ode	Hisar			Karnal			Ludhiana			Durgapura			Modipuram			Zonal Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
DWRB223**	AVT-IRTS-NB-4	35.62	1	1	46.17	1	1	35.14	1	1	64.93	1	1	55.11	1	1	47.4	1	1
DWRB244*	AVT-IRTS-NB-1	20.46	5	0	43.98	2	0	29.71	3	0	57.51	2	0	52.74	2	0	40.9	2	0
K1149(C)	AVT-IRTS-NB-3	26.32	2	0	33.60	4	0	27.17	5	0	48.13	5	0	43.63	5	0	35.8	5	0
Karan16(C)	AVT-IRTS-NB-5	24.79	3	0	34.86	3	0	29.06	4	0	50.25	4	0	50.28	3	0	37.8	3	0
PL891(C)	AVT-IRTS-NB-2	22.97	4	0	32.84	5	0	32.39	2	1	51.65	3	0	48.45	4	0	37.7	4	0
G.M.		26.03			**38.29**			30.70			54.49			50.04			39.91		
S.E.(M)		1.28			0.55			1.13			1.26			0.91			0.47		
C.D. (10%)		3.17			1.36			2.79			3.11			2.24			1.13		
C.V. (%)		11.02			3.21			8.23			5.17			4.05					
DOS		12.11.2023			7.11.2023			6.11.2023			6.11.2023			18.11.2023					

* AVT- I year, **AVT-II year

DWRB 244 shows significant superior grain yield to the best check and strong rust resistance with 7.8% beta-glucan, 43.3 ppm iron and 38.2 ppm zinc contents in grains.

Table 2.17. AVT-(I&II) Hulless Barley (NWPZ) ancillary and disease data *Rabi 2023-24.*

Entry name	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION							
	H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillers per meter Mean & Range	straw strenghth (%)	Two/ Six row	Spike length (cm)	Grain colour	1000 grain weight (g) Mean & Range	H/ N	RUST			SMUT		Hel. Disease		Aphid
											YL	BR	BL	L (%)	C (%)	Spot (%)	Leaf Blight	
DWRB223	97 (81-109)	138 (122-149)	105.5 (81.1-129.3)	93 (56-137)	30 (0-30)	6	8 (7-10)	A	37.9 (26.1-43.0)	N	0	0		R			24	0
DWRB244	96 (76-111)	141 (126-151)	99.0 (79.0-115.4)	75 (51-124)	10 (0-10)	6	9 (8-11)	A	36.9 (27.7-41.0)	N	0	0		TS			24	0
K1149 (C)	92 (82-101)	139 (124-151)	98.1 (83.8-115.9)	106 (66-136)	68 (20-95)	6	9 (7-11)	A	31.1 (19.6-38.0)	N	0	0		TS			35	0
Karan16 (C)	95 (66-109)	140 (121-151)	99.4 (76.9-121.5)	77 (56-122)	78 (0-80)	6	10 (8-12)	A	35.3 (24.6-42.0)	N	0	0		TS			35	0
PL891 (C)	99 (88-110)	139 (126-149)	105.3 (83.0-126.8)	97 (61-172)	22 (5-40)	2	11 (9-13)	A	45.5 (30.8-52.0)	N	0	0		R			23	0

Table 2.18. AVT-(I&II) hulless barley (CZ) grain yield data (q/ha) *Rabi 2023-24* .

Entry **name**	Entry Code	**Tikamgarh**			**Udaipur**			**Zonal mean**		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
K1149(C)	AVT-IRTS-NB-1	47.23	1	1	43.87	1	1	45.55	1	1
Karan16(C)	AVT-IRTS-NB-3	42.42	2	0	32.12	2	0	37.27	2	0
PL891(C)	AVT-IRTS-NB-2	30.50	5	0	22.59	5	0	26.55	5	0
DWRB244*	AVT-IRTS-NB-4	35.86	3	0	26.55	3	0	31.20	3	0
DWRB223**	AVT-IRTS-NB-5	34.48	4	0	26.46	4	0	30.47	4	0
G.M.		38.10			30.32			**34.21**		
S.E.(M)		1.25			1.10			0.83		
C.D. (10%)		3.09			2.71			2.03		
C.V. (%)		7.36			8.10					
DOS		18.11.2023			20.11.2023					

**AVT-II year; *AVT-I year

No check exists for this zone, as no variety of hulless barley has been released to date for the Central Zone.

Table 2.19. AVT-(I&II) hulless barley (CZ) ancillary and disease data *Rabi 2023-24.*

Entry name	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION				
	H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillers per meter Mean & Range	Straw strength (%)	Two / Six row	Spike length (cm)	Grain colour	1000 grain weight (g) Mean & Range	H/N	RUST		SMUT	Leaf Blight	Aphid
											YL	BR	L (%)		
DWRB223	76 (65-90)	115 (107-121)	91 (75-101)	88 (72-114)	0	6	7.8 (7-10)	A	38 (36-40)	N	0	0	R	26	4
DWRB244	78 (74-81)	115 (110-120)	92 (78-103)	92 (68-128)	0	6	8.0 (7-9)	A	38 (34-41)	N	0	0	R	14	3
K1149 (C)	70 (66-77)	115 (110-119)	94 (90-97)	90 (59-112)	0	6	7.9 (7-9)	A	37 (32-42)	N	0	0	R	15	2
Karan 16 (C)	77 (62-88)	115 (105-121)	94 (69-105)	87 (62-122)	0	6	8.3 (8.3-10)	A	35 (29-40)	N	0	0	R	15	3
PL891 (C)	80 (78-83)	117 (112-125)	99 (85-108)	99 (77-128)	0	2	10.1 (9-11)	A	45 (41-47)	N	0	0	R	26	2

Initial Varietal Trial-Irrigated-Timely Sown-Hulless Barley
[IVT-Hulless Barley (NWPZ, NEPZ and CZ)]

The trial was conducted at 15 locations across the country, distributed in the NWPZ (6 locations), NEPZ (4 locations), and Central Zone (5 locations). However, the Pantnagar location was excluded from the zonal mean analysis due to a low site mean of 19.88 q/ha. In the NEPZ, data from Varanasi (11.53 q/ha) and Ranchi (19.18 q/ha) were also excluded from the zonal pooled analysis because of low site mean grain yields. In the Central Zone, trials were conducted at five locations, but Morena (due to delayed sowing) and Vijapur (due to a low site mean of 16.29 q/ha) were not included in the zonal pooled analysis.

The trial included 10 test entries and 3 check varieties: K1149, Karan16, and PL891. Monitoring teams conducted site visits in the NWPZ (Hisar, Ludhiana, Durgapura, Modipuram, and Pantnagar), NEPZ (Kanpur, Ayodhya, and Varanasi), and Central Zone (Morena, Gwalior, Tikamgarh, Udaipur, and Vijapur). The trials were observed to be in good condition across all locations.

The grain yield location means ranged from 26.20 q/ha at Hisar to 54.17 q/ha at Durgapura, with an overall zonal mean of 36.55 q/ha in the NWPZ. The test entries PL960 and RD3091 ranked first and second, with mean grain yields of 43.10 q/ha and 41.85 q/ha, respectively. The check variety PL891 ranked third with a mean grain yield of 41.41 q/ha. Both PL960 and RD3091 demonstrated numerical superiority over the best check, PL891.

In the NEPZ, grain yield location means ranged from 25.08 q/ha at Ayodhya to 35.84 q/ha at Kanpur, with an overall zonal mean of 30.46 q/ha. Six test entries—RD 3088 (38 q/ha), PL960 (37.5 q/ha), RD3089 (35.1 q/ha), RD3091 (33.5 q/ha), DWRB2304 (33.0 q/ha), and DWRB 2306 (32.4 q/ha)—ranked first through sixth, respectively, and demonstrated significant superiority over the best check, Karan16 (28.9 q/ha), in terms of zonal mean grain yield.

In the Central Zone, data from three locations—Gwalior, Tikamgarh, and Udaipur—were included in the zonal pooled analysis. The location mean for grain yield in this zone ranged from 38.46 q/ha at Gwalior to 57.63 q/ha at Tikamgarh, with an overall mean of 47.81 q/ha. The test entries RD3088, PL960, RD3089, and UPB1121 ranked first through fourth, with mean grain yields of 62.9, 62.8, 58.6, and 50.1 q/ha, respectively, all significantly outperforming the check varieties. Additionally, two other test entries, DWRB2304 (49.2 q/ha) and DWRB2306 (49.5 q/ha), were numerically superior to the best check, Karan16, which had a mean grain yield of 46.6 q/ha.

Table 2.20. IVT-Hulless Barley (NWPZ) grain yield data (q/ha) *Rabi 2023-24.*

Entry name	Entry Code	Hisar			Karnal			Ludhiana			Durgapura			Modipuram			Zonal Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
DWRB2304	IVT-IRTS-NB-5	15.24	11	0	30.55	5	0	29.47	8	0	48.31	9	0	36.55	11	0	32.02	10	0
DWRB2305	IVT-IRTS-NB-7	6.26	13	0	19.30	13	0	22.22	12	0	36.23	13	0	32.29	13	0	23.26	13	0
DWRB2306	IVT-IRTS-NB-8	25.72	7	0	25.07	9	0	25.72	10	0	50.17	8	0	43.21	8	0	33.98	9	0
PL960	IVT-IRTS-NB-1	44.78	1	1	26.10	8	0	40.10	1	1	59.90	5	0	44.61	7	0	43.10*	1	1
RD3088	IVT-IRTS-NB-10	31.45	4	0	24.83	10	0	22.95	11	0	47.78	10	0	47.54	3	0	34.91	8	0
RD3089	IVT-IRTS-NB-13	34.81	3	0	37.94	1	1	33.57	4	0	56.33	6	0	32.63	12	0	39.06[#]	6	0
RD3090	IVT-IRTS-NB-3	21.01	10	0	29.64	6	0	29.23	9	0	74.30	1	1	38.89	10	0	38.61[$]	7	0
RD3091	IVT-IRTS-NB-4	40.43	2	1	36.59	2	1	33.33	5	0	52.22	7	0	46.67	4	0	41.85*	2	1
RD3092	IVT-IRTS-NB-2	30.85	5	0	24.55	11	0	31.64	6	0	61.88	4	0	55.36	1	1	40.86[@]	5	0
UPB1121	IVT-IRTS-NB-12	26.91	6	0	23.82	12	0	22.22	12	0	44.20	11	0	42.68	9	0	31.97	12	0
K1149(C)	IVT-IRTS-NB-6	15.12	12	0	27.20	7	0	30.92	7	0	42.42	12	0	50.29	2	0	33.19	11	0
Karan16 (C)	IVT-IRTS-NB-9	22.73	9	0	35.22	3	0	36.96	2	1	63.96	3	0	45.97	5	0	40.97	4	0
PL891(C)	IVT-IRTS-NB-11	25.34	8	0	35.10	4	0	34.78	3	0	66.52	2	0	45.29	6	0	41.41	3	1
G.M.		26.20			28.92			30.24			54.17			43.23			36.55		
S.E.(M)		1.82			1.04			1.64			2.09			1.59			0.75		
C.D.(10%)		4.41			2.53			3.97			5.06			3.84			1.76		
C.V. (%)		12.05			6.26			9.40			6.69			6.36					
DOS		12.11.2023			7.11.2023			6.11.2023			6.11.2023			18.11.2023					

*PL 960 and RD 3091 demonstrated numerical superiority over the best checkin grain yield, alonwith high rust resistance.
[@]RD 3092 exhibits numerical parity with the best check in terms of grain yield alongwith high rust resistance.
[#]RD 3089 shows enhanced stability in grain yield performance across various locations, coupled with strong rust resistance.
[$]RD 3090 offers a high yield potential of 74.30 quintals per hectare in just 103 days at Durgapura, alongside robust rust resistance

Table 2.21. IVT-IRTS-NB (Hulless Barley)–Central Zone Grain Yield Data (q/ha) *Rabi 2023-24.*

Entry **name**	Entry Code	**Gwalior**			**Tikamgarh**			**Udaipur**			**Zonal Mean**		
		Yield	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**
DWRB2304	IVT-IRTS-NB-5	42.11	4	0	36.79	13	0	68.79	1	1	49.2@	6	0
DWRB2305	IVT-IRTS-NB-7	17.91	13	0	49.97	10	0	47.97	7	0	38.6	12	0
DWRB2306	IVT-IRTS-NB-8	39.36	7	0	62.62	6	0	46.40	9	0	49.5@	5	0
PL960	IVT-IRTS-NB-1	58.18	2	1	63.76	5	0	66.55	2	1	62.8*	2	1
RD3088	IVT-IRTS-NB-10	60.98	1	1	72.15	1	1	55.68	3	0	62.9*	1	1
RD3089	IVT-IRTS-NB-13	57.97	3	1	66.54	3	0	51.23	4	0	58.6*	3	0
RD3090	IVT-IRTS-NB-3	30.97	10	0	48.69	11	0	42.22	10	0	40.6	10	0
RD3091	IVT-IRTS-NB-4	36.99	8	0	53.48	9	0	28.74	13	0	39.6	11	0
RD3092	IVT-IRTS-NB-2	34.17	9	0	64.67	4	0	29.78	11	0	42.9#	8	0
UPB1121	IVT-IRTS-NB-12	39.60	6	0	60.19	7	0	50.39	6	0	50.1*	4	0
K1149(C)	IVT-IRTS-NB-6	40.74	5	0	55.17	8	0	29.42	12	0	41.8	9	0
Karan16 (C)	IVT-IRTS-NB-9	19.88	12	0	69.27	2	1	50.72	5	0	46.6	7	0
PL891(C)	IVT-IRTS-NB-11	21.11	11	0	45.93	12	0	47.51	8	0	38.2	13	0
G.M.		38.46			57.63			47.34			**47.81**		
S.E.(M)		2.40			2.08			2.79			1.41		
C.D.(10%)		5.81			5.03			6.75			3.31		
C.V. (%)		10.82			6.25			10.21					
DOS		1.12.2023			17.11.2023			023					

No check exists for this zone, as no variety of hulless barley has been released to date for the Central Zone.

*Significantly superior to best check in terms of grain yield.

@ Exhibits numerical superiority over the best check in grain yield and demonstrates a better score of leaf blight."

This genotype has average 35 score of leaf bight.

Table 2.22. IVT-Hulless Barley (NEPZ) Grain Yield Data (q/ha) *Rabi 2023-24.*

Entry name	Entry code	Ayodhya			Kanpur			Zonal Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
DWRB2304	IVT-IRTS-NB-5	29.47	3	0	36.47	4	0	33.0*	5	0
DWRB2305	IVT-IRTS-NB-7	19.48	13	0	24.40	13	0	21.9	13	0
DWRB2306	IVT-IRTS-NB-8	30.31	2	0	34.54	6	0	32.4*	6	0
PL960	IVT-IRTS-NB-1	21.54	11	0	53.38	1	1	37.5*	2	1
RD3088	IVT-IRTS-NB-10	22.95	8	0	53.14	2	1	38.0*	1	1
RD3089	IVT-IRTS-NB-13	35.99	1	1	34.30	7	0	35.1*	3	1
RD3090	IVT-IRTS-NB-3	22.50	10	0	26.81	12	0	24.7	12	0
RD3091	IVT-IRTS-NB-4	23.19	7	0	43.72	3	0	33.5*	4	0
RD3092	IVT-IRTS-NB-2	25.60	5	0	36.23	5	0	30.9*	7	0
UPB1121	IVT-IRTS-NB-12	24.76	6	0	33.82	8	0	29.3*	8	0
K1149(C)	IVT-IRTS-NB-6	20.13	12	0	29.23	11	0	24.7	11	0
Karan16 (C)	IVT-IRTS-NB-9	27.62	4	0	30.19	9	0	28.9	9	0
PL891(C)	IVT-IRTS-NB-11	22.54	9	0	29.71	10	0	26.1	10	0
G.M.		25.08			35.84			30.46		
S.E.(M)		1.12			2.23			1.25		
C.D.(10%)		2.71			5.39			2.95		
C.V. (%)		7.72			10.77					
DOS		24.11.2023			17.11.2023					

*These entries are significantly superior to check of zone K1149 (Gitanjli) of NEPZ.

Table 2.23. IVT-Hulless Barley-NWPZ-ancillary and disease data Rabi 2023-24.

Entry name	Entry code	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION					
		H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillers per meter Mean & Range	straw strenghth (%)	Two/ Six row	Spike length (cm)	Grain colour	1000 grain weight (g) Mean & Range	H/ N	RUST			SMUT		LB Score
												YL	BR	BL	L (%)	C (%)	
DWRB2304	IVT-NB-5	90 (50-114)	139 (115-149)	103 (83-121)	104 (58-185)	35	6	9.9 (8.5-10.4)	A	41.0 (33.7-45.0)	N	0	0	0	0	TS	25
DWRB2305	IVT-NB-7	84 (74-94)	132 (124-144)	54 (43-68)	73 (23-128)	0	2	8.9 (8.0-10.0)	A	43.1 (39.0-49.0)	N	0	0	0	0	S	27
DWRB2306	IVT-NB-8	93 (83-100)	138 (122-149)	100 (81-115)	103 (53-135)	53	2	8.7 (7.8-9.5)	A	47.9 (35.0-54.0)	N	0	0	0	0	TS	25
PL960	IVT-NB-1	97 (80-107)	139 (119-149)	106 (91-123)	101 (91-114)	21	6	9.0 (7.2-10.2)	A	37.9 (32.9-42.8)	N	0	0	0	0	0	14
RD3088	IVT-NB-10	89 (82-97)	139 (124-149)	105 (83-122)	99 (85-107)	48	6	9.3 (6.0-11.8)	A	44.5 (32.6-46.0)	N	0	0	0	0	0	37
RD3089	IVT-NB-13	94 (83-103)	138 (123-148)	98 (94-110)	119 (110-130)	20	6	8.6 (7.0-10.5)	A	37.7 (33.4-46.0)	N	0	0	0	0	0	2
RD3090	IVT-NB-3	92 (64-106)	135 (103-150)	105 (82-127)	99 (47-166)	30	6	11.3 (9.0-13.6)	A	46.5 (39.8-51.2)	N	0	0	0	0	0	0
RD3091	IVT-NB-4	98 (84-104)	140 (123-148)	98 (83-111)	110 (23-162)	10	2	9.2 (8.2-10.0)	A	37.7 (31.3-44.7)	N	0	0	0	0	0	13
RD3092	IVT-NB-2	94 (70-107)	129 (90-149)	99 (86-120)	111 (80-143)	44	6	8.5 (7.3-9.7)	A	37.7 (31.0-47.6)	N	0	0	0	0	0	14
UPB1121	IVT-NB-12	97 (91-104)	138 (125-146)	114 (95-131)	117 (90-168)	67	6	9.9 (8.7-11.7)	A	40.5 (34.0-48.1)	N	0	0	0	0	0	12
K1149(C)	IVT-NB-6	97 ((82-107)	140 (122-152)	106 (92-129)	90 (29-137)	20	6	9.8 (8.4-11.0)	A	36.7 (34.0-40.0)	N	0	0	0	0	0	14
Karan16(C)	IVT-NB-9	100 (79-116)	138 (116-148)	102 (84-132)	96 (37-131)	50	6	8.4 (7.2-9.6)	A	36.9 (33.0-42.0)	N	0	0	0	0	0	13
PL891(C)	IVT-NB-11	97 (80-113)	137 (120-151)	100 (79-117)	106 (27-142)	32	2	9.6 (7.2-12.0)	A	40.4 (37.4-47.0)	N	0	0	0	0	TS	15

Table 2.24. IVT-Hulless Barley-NEPZ-ancillary and disease data Rabi 2023-24.

Entry name	Entry code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION				
		H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillers per meter Mean & Range	Two/ Six row	Spike length (cm)	Grain colour	1000 grain weight (g) Mean & Range	H/ N	RUST		SMUT		LB Score
											YL	BR	L (%)	C (%)	
DWRB2304	IVT-NB-5	86 (75-107)	123 (108-136)	90 (73-109)	69 (45-83)	6	8.4 (7.9-9.0)	A	40.6 (35.0-49.8)	N	0	0	0	0	24
DWRB2305	IVT-NB-7	75 (70-84)	117 (110-129)	56 (48-62)	88 (58-120)	2	8.1 (7.3-9.2)	A	38.0 (22.0-52.0)	N	0	0	0	0	24
DWRB2306	IVT-NB-8	86 (78-95)	124 (121-128)	91 (81-94)	107 (80-121)	2	8.8 (8.1-9.4)	A	32.4 (24.0-39.2)	N	0	0	0	5	36
PL960	IVT-NB-1	82 (73-90)	123 (120-125)	80 (69-96)	96 (63-129)	6	6.8 (6.2-7.4)	A	31.9 (28.0-34.0)	N	0	0	0	3	47
RD3088	IVT-NB-10	83 (78-91)	122 (110-126)	83 (75-88)	92 (68-116)	6	8.2 (6.6-10.3)	A	34.3 (23.0-42.0)	N	0	0	0	0	2
RD3089	IVT-NB-13	83 (68-92)	118 (105-127)	82 (48-104)	83 (71-90)	6	8.0 (7.1-9.6)	A	35.2 (20.0-46.6)	N	0	0	0	3	12
RD3090	IVT-NB-3	79 (69-90)	121 (119-124)	82 (74-92)	94 (53-134)	6	9.5 (8.5-10.7)	A	32.3 (27.0-41.0)	N	0	0	0	5	89
RD3091	IVT-NB-4	84 (79-89)	122 (116-128)	83 (71-91)	73 (25-128)	2	8.3 (7.8-8.8)	A	40.5 (39.5-41.0)	N	0	0	0	0	24
RD3092	IVT-NB-2	83 (73-91)	121 (113-124)	82 (72-94)	78 (40-118)	6	6.9 (6.2-7.6)	A	29.3 (24.0-35.0)	N	0	0	0	0	47
UPB1121	IVT-NB-12	85 (74-91)	124 (119-127)	86 (73-95)	89 (72-121)	6	8.4 (6.2-10.0)	A	35.5 (32.0-39.5)	N	0	0	0	3	36
K1149(C)	IVT-NB-6	87 (81-97)	124 (120-129)	88 (79-100)	96 (72-124)	6	8.4 (7.8-9.1)	A	32.7 (26.0-39.5)	N	0	0	0	0	12
Karan16(C)	IVT-NB-9	80 (63-87	123 (110-134)	85 (76-89)	78 (40-115)	6	8.1 (6.5-8.9)	A	35.5 (25.0-42.6)	N	0	0	0	0	12
PL891(C)	IVT-NB-11	88 (76-98)	126 (114-135)	82 (67-91)	78 (61-95)	2	7.8 (7.6-8.1)	A	29.3 (20.0-36.0)	N	0	0	0	0	24

Table 2.25. IVT-Hulless Barley-CZ-ancillary and disease data Rabi 2023-24.

Entry name	Entry code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION					
		H. days Mean & Range	**M. days Mean & Range**	**Height Mean & Range (cm)**	**Tillers per meter Mean & Range**	**Two/ Six row**	**Spike length (cm)**	**Grain colour**	**1000 grain weight (g) Mean & Range**	**H/N**	RUST		SMUT		**LB Score**	Aphid
											YL	**BR**	**L (%)**	**C (%)**		
DWRB2304	IVT-NB-5	76 (63-85)	114 (93-122)	106 (88-116)	93 (70-133)	6	8.5 (7.6-10.0)	A	38.9 (34.0-45.0)	N	0	0	0	0	0	1
DWRB2305	IVT-NB-7	72 (68-82)	116 (103-124)	59 (51-68)	131 (67-230)	2	8.0 (7.0-9.0)	A	44.7 (39.0-49.0)	N	0	0	0	0	17	2
DWRB2306	IVT-NB-8	78 (72-83)	118 (111-122)	89 (72-104)	104 (65-185)	6	8.6 (7.6-10.0)	A	47.9 (35.0-54.0)	N	0	0	0	0	0	2
PL960	IVT-NB-1	72 (67-76)	117 (111-122)	101 (88-110)	92 (55-151)	6	7.9 (6.0-9.0)	A	35.6 (32.0-41.0)	N	0	0	0	0	4	2
RD3088	IVT-NB-10	76 (69-80)	118 (107-127)	99 (84-110)	110 (59-192)	6	7.9 (6.1-12.0)	A	38.7 (32.6-46.0)	N	0	0	0	0	17	1
RD3089	IVT-NB-13	75 (65-85)	116 (107-121)	95 (82-108)	91 (64-132)	6	7.8 (7.0-9.0)	A	38.5 (33.4-46.0)	N	0	0	0	0	5	1
RD3090	IVT-NB-3	74 (54-82)	113 (87-125)	103 (81-123)	84 (46-127)	6	8.5 (7.0-11.0)	A	43.7 (32.0-48.5)	N	0	0	0	0	69	1
RD3091	IVT-NB-4	83 (76-93)	119 (111-124)	104 (97-112)	89 (69-112)	2	8.7 (7.5-10.0)	A	39.0 (34.0-46.0)	N	0	0	0	0	14	2
RD3092	IVT-NB-2	79 (67-84)	119 (112-127)	101 (74-121)	96 (44-162)	6	8.2 (6.3-11.0)	A	38.7 (32.0-47.0)	N	0	0	0	0	0	2
UPB1121	IVT-NB-12	70 (48-82)	112 (88-124)	104 (95-109)	108 (74-158)	6	8.7 (6.9-10.0)	A	41.0 (34.0-48.1)	N	0	0	0	0	14	1
K1149(C)	IVT-NB-6	73 (57-80)	115 (97-126)	97 (79-107)	94 (62-120)	6	7.8 (6.5-9.0)	A	37.1 (34.0-40.0)	N	0	0	0	0	4	3
Karan16(C)	IVT-NB-9	80 (77-84)	117 (109-123)	97 (90-104)	78 (63-92)	6	7.5 (6.3-8.3)	A	37.6 (33.0-42.0)	N	0	0	0	0	2	3
PL891(C)	IVT-NB-11	72 (53-92)	113 (94-120)	98 (71-112)	86 (43-115)	2	8.6 (6.9-11.0)	A	42.9 (37.4-47.0)	N	0	0	0	0	13	2

ADVANCED/INITIALVARIETAL TRIAL – RAINFED- NORTH HILLS ZONE [AVT/IVT-RAINFED (NHZ)]

The advanced varietal trial (Rainfed) for the North Hills Zone was proposed with specific modifications based on decisions from annual workshop. The trial integrated two components—normal barley evaluation and dual-purpose barley evaluation—into a single unified trial. Four replications were proposed: two replications (R1 and R3) designated for grain yield evaluation, and two replications (R2 and R4) designated for dual-purpose evaluation, assessing both grain yield and green fodder potential under rainfed conditions in the northern hills. In the dual-purpose replications, green fodder cutting was scheduled 70 days post-sowing.

The trial was implemented at 8 locations across Uttarakhand, Himachal Pradesh, and Jammu and Kashmir, with all centers successfully conducting the trial. The trial comprised 24 genotypes, including 19 test entries and 5 check varieties: HBL113, BHS352, BHS400, and VLB118 for grain evaluation, and BHS380 for dual-purpose evaluation.

Zonal monitoring was conducted at Almora, Gaja, Majhera, Bajaura, Malan, and Shimla during the crop season. The monitoring confirmed the absence of genetic purity issues at any of the centers, and the trial's performance was reported to be excellent at the monitored sites.

Although the trial was conducted at all 8 locations, data from only six locations were included in the zonal pooled analysis. The Gaja location was excluded from the zonal mean analysis due to the cutting of forage in all four replications, while the Majhera and Almora locations were excluded due to a low site mean (LSM: 13.29 q/ha).

Performance in No-Cut Replications (Normal)

In the normal trial, grain yield location means ranged from 14.4 q/ha at Malan to 47.3 q/ha at Wadura, with an overall zonal mean of 27.6 q/ha. The entry HBL884 ranked first, achieving a mean grain yield of 32.7 q/ha, followed closely by VLB187, which ranked second with a mean grain yield of 32.4 q/ha. Both entries were placed in the first non-significant group, with VLB187 demonstrating significant superiority over the best check, HBL113, which had a mean grain yield of 30.5 q/ha. Among the hulless barley entries, BHS499 ranked 19th with a mean grain yield of 25.2 q/ha, performing on par with the hulless check variety BHS352 (23.6 q/ha). Meanwhile, entries BHS497 (AVT-Ist Year) and BHS500 ranked 20th and 21st with mean grain yields of 24.4 q/ha and 24.3 q/ha, respectively, both showing numerical superiority over the hulless check BHS352 (23.6 q/ha).

Performance in dual purpose trial (Cut replication)

(a) Grain yield performance

The dual-purpose trial was proposed at eight locations and successfully conducted across all sites in the Northern Hills Zone. However, the Gaja location was excluded from statistical analysis due to cutting performed in all four replications. Following the analysis, data from Almora and Majhera were also excluded from the zonal mean analysis. Consequently, grain yield data from the remaining five locations were utilized for zonal pooled analysis after regeneration in the cut treatment. Accessory trait data for the cut replications are presented in the ancillary table. Grain yield location means ranged from 16.5 q/ha at Khudwani to 25.8 q/ha at Shimla, resulting in an overall zonal mean of 22.2 q/ha.

Among the test entries, HBL884 ranked first with a mean grain yield of 28.3 q/ha in the first non-significant group. Additionally, entries BHS498 (25.7 q/ha), UPB1118 (24.8 q/ha), BHS502 (24.4 q/ha), and VLB185 (24.3 q/ha) ranked 3rd, 4th, 5th, and 6th, respectively, all demonstrating significant superiority over the dual-purpose check variety BHS380, which had a mean grain yield of 22.5 q/ha.

(b) Green forage yield performance

In the IVT-RF-NHZ trial, forage cutting was conducted 70 days after sowing. Data from Almora, Majhera, and Gaja were excluded from the zonal mean analysis due to low site means (LSM: Almora at 18.73 q/ha, Majhera at 5.99 q/ha, and Gaja due to forage cutting across all replications). Green fodder yield location means varied from 20.2 q/ha at Bajaura to 58.3 q/ha at Khudwani, with an overall zonal mean of 31.7 q/ha.

Among the test entries, VLB185 ranked second with a mean fodder yield of 35.2 q/ha within the first non-significant group, while the dual-purpose check variety BHS380 ranked tenth with a mean fodder yield of 32.9 q/ha. Considering the overall dual-purpose performance—evaluating both grain and fodder yields—a joint ranking of all entries was developed. Based on this combined criterion, VLB185 demonstrated superior performance, with a grain yield of 24.3 q/ha and a fodder yield of 35.2 q/ha, outperforming the dual-purpose check variety BHS380, which recorded a grain yield of 22.5 q/ha and a fodder yield of 32.9 q/ha.

Table 2.26. AVT/IVT-RAINFED (NHZ) – Uncut Grain Yield q/ha Rabi 2023-24.

Entry name	Entry code	Almora			Bajaura			Khudwani			Malan		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS497*	IVT-RF-NHZ-8	13.4	23	0	26.5	13	0	21.7	21	0	10.5	17	0
BHS498	IVT-RF-NHZ-22	26.7	2	1	28.1	7	0	30.6	8	0	9.6	18	0
BHS499	IVT-RF-NHZ-2	18.2	17	0	25.8	16	0	27.5	12	0	7.4	21	0
BHS500	IVT-RF-NHZ-21	14.2	22	0	31.4	2	0	29.8	9	0	6.3	24	0
BHS501	IVT-RF-NHZ-4	19.3	13	0	27.0	11	0	21.2	22	0	6.8	23	0
BHS502	IVT-RF-NHZ-20	16.4	19	0	27.2	10	0	26.4	15	0	17.4	8	0
HBL884	IVT-RF-NHZ-15	20.0	11	0	41.4	1	1	34.2	6	0	19.6	6	0
HBL885	IVT-RF-NHZ-23	23.6	4	0	28.9	5	0	28.9	10	0	16.3	9	0
HBL886	IVT-RF-NHZ-5	19.4	12	0	23.4	19	0	36.0	4	0	14.1	12	0
HBL888	IVT-RF-NHZ-9	17.9	18	0	20.1	24	0	26.9	14	0	18.6	7	0
UPB1118	IVT-RF-NHZ-12	24.7	3	1	24.0	18	0	25.7	19	0	20.7	5	0
UPB1119	IVT-RF-NHZ-11	14.5	21	0	22.5	21	0	31.3	7	0	7.1	22	0
UPB1120	IVT-RF-NHZ-6	18.3	16	0	28.7	6	0	38.3	3	1	8.0	20	0
VLB184*	IVT-RF-NHZ-3	23.5	5	0	26.1	14	0	42.3	2	1	20.8	4	0
VLB185	IVT-RF-NHZ-19	21.1	8	0	27.8	8	0	26.3	16	0	14.4	11	0
VLB186	IVT-RF-NHZ-18	18.8	14	0	30.3	3	0	35.4	5	0	13.2	14	0
VLB187	IVT-RF-NHZ-24	20.2	10	0	26.9	12	0	43.8	1	1	16.2	10	0
VLB188	IVT-RF-NHZ-1	22.4	6	0	29.6	4	0	20.3	23	0	21.0	3	0
VLB189	IVT-RF-NHZ-17	16.0	20	0	20.4	23	0	18.9	24	0	8.9	19	0
BHS380(C)	IVT-RF-NHZ-10	21.2	7	0	27.5	9	0	27.5	12	0	24.4	2	1
BHS400(C)	IVT-RF-NHZ-7	26.9	1	1	21.9	22	0	28.0	11	0	13.4	13	0
BHS352(C)	IVT-RF-NHZ-14	13.4	23	0	24.5	17	0	26.1	17	0	11.8	16	0
HBL113(C)	IVT-RF-NHZ-16	18.4	15	0	26.0	15	0	25.2	20	0	25.2	1	1
VLB118(C)	IVT-RF-NHZ-13	20.3	9	0	23.3	20	0	26.0	18	0	13.2	15	0
G.M.		**19.5**			**26.6**			**29.1**			**14.4**		
S.E. (M)		1.1			0.8			2.3			1.6		
C.D.		2.7			1.8			5.6			3.9		
C.V.		8.1			4.0			11.3			15.8		
DOS		8.11.2023			31.10.2023			31.10.2023			6.11.2023		

*Entry in AVT-I.

Contd…..

Entry name	Entry code	Shimla			Wadura			Zonal Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS497*	IVT-RF-NHZ-8	28.6	12	0	45.8	15	0	24.4	20	0
BHS498	IVT-RF-NHZ-22	29.2	10	0	64.3	1	1	31.4	3	1
BHS499	IVT-RF-NHZ-2	25.3	23	0	47.1	13	0	25.2	19	0
BHS500	IVT-RF-NHZ-21	27.2	19	0	37.1	19	0	24.3	21	0
BHS501	IVT-RF-NHZ-4	33.1	1	1	18.6	24	0	21.0	24	0
BHS502	IVT-RF-NHZ-20	25.9	22	0	60.7	5	1	29.0	10	0
HBL884	IVT-RF-NHZ-15	29.6	9	0	51.2	11	0	32.7	1	1
HBL885	IVT-RF-NHZ-23	28.4	14	0	44.5	16	0	28.4	12	0
HBL886	IVT-RF-NHZ-5	28.2	15	0	63.5	3	1	30.8	4	0
HBL888	IVT-RF-NHZ-9	28.7	11	0	30.1	21	0	23.7	22	0
UPB1118	IVT-RF-NHZ-12	30.8	5	1	53.0	10	0	29.8	8	0
UPB1119	IVT-RF-NHZ-11	26.1	21	0	50.2	12	0	25.3	18	0
UPB1120	IVT-RF-NHZ-6	24.5	24	0	63.6	2	1	30.2	7	0
VLB184*	IVT-RF-NHZ-3	28.1	17	0	28.3	23	0	28.2	13	0
VLB185	IVT-RF-NHZ-19	31.5	3	1	62.1	4	1	30.5	5	0
VLB186	IVT-RF-NHZ-18	30.9	4	1	28.8	22	0	26.2	15	0
VLB187	IVT-RF-NHZ-24	27.5	18	0	59.7	6	1	32.4	2	1
VLB188	IVT-RF-NHZ-1	28.1	16	0	32.2	20	0	25.6	16	0
VLB189	IVT-RF-NHZ-17	31.5	2	1	56.1	8	0	25.3	17	0
BHS380(C)	IVT-RF-NHZ-10	27.0	20	0	43.1	17	0	28.4	11	0
BHS400(C)	IVT-RF-NHZ-7	29.8	8	0	54.5	9	0	29.1	9	0
BHS352(C)	IVT-RF-NHZ-14	28.5	13	0	37.4	18	0	23.6	23	0
HBL113(C)	IVT-RF-NHZ-16	30.0	7	0	58.1	7	0	30.5	6	0
VLB118(C)	IVT-RF-NHZ-13	30.2	6	0	46.1	14	0	26.5	14	0
G.M.		**28.7**			**47.3**			**27.6**		
S.E. (M)		1.1			2.4			0.7		
C.D.		2.6			5.7			1.6		
C.V.		5.3			7.0					
DOS		6.11.2023			30.10.2023					

*Entry in AVT-I.

Table 2.27. AVT/IVT-RAINFED-Dual Purpose Barley-Cut (NHZ) Grain Yield (q/ha) *Rabi 2023-24.*

Entry name	Entry Code	Bajaura			Khudwani			Malan			Shimla			Wadura			Zonal Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS497*	IVT-RF-NHZ-8	23.0	16	0	11.3	23	0	15.1	21	0	26.2	12	0	25.6	10	0	20.2	17	0
BHS498	IVT-RF-NHZ-22	27.4	5	0	16.3	11	0	22.9	12	0	28.0	5	1	33.7	2	1	25.7	3	0
BHS499	IVT-RF-NHZ-2	23.9	13	0	15.6	12	0	15.8	19	0	22.1	23	0	21.6	15	0	19.8	20	0
BHS500	IVT-RF-NHZ-21	29.3	2	0	14.5	17	0	15.3	20	0	27.5	6	0	20.0	17	0	21.3	14	0
BHS501	IVT-RF-NHZ-4	24.3	11	0	15.0	14	0	13.8	23	0	29.5	2	1	10.8	22	0	18.7	24	0
BHS502	IVT-RF-NHZ-20	24.9	10	0	14.2	19	0	26.0	5	0	24.2	18	0	32.8	3	1	24.4	5	0
HBL884	IVT-RF-NHZ-15	36.9	1	1	18.9	7	0	30.4	2	1	28.2	3	1	27.1	9	0	28.3	1	1
HBL885	IVT-RF-NHZ-23	23.3	15	0	14.6	16	0	30.3	3	1	25.4	16	0	23.6	12	0	23.4	7	0
HBL886	IVT-RF-NHZ-5	22.2	18	0	20.3	3	0	23.2	11	0	22.3	22	0	28.8	8	0	23.4	8	0
HBL888	IVT-RF-NHZ-9	19.2	23	0	14.4	18	0	24.6	10	0	25.7	13	0	16.8	18	0	20.1	18	0
UPB1118	IVT-RF-NHZ-12	22.0	19	0	14.8	15	0	25.9	6	0	29.5	1	1	31.7	5	1	24.8	4	0
UPB1119	IVT-RF-NHZ-11	19.1	24	0	15.1	13	0	24.8	8	0	22.9	21	0	30.0	7	0	22.4	12	0
UPB1120	IVT-RF-NHZ-6	26.0	6	0	23.3	2	1	18.5	15	0	21.0	24	0	10.0	23	0	19.8	21	0
VLB184*	IVT-RF-NHZ-3	24.0	12	0	27.1	1	1	27.1	4	0	25.6	14	0	12.6	21	0	23.3	9	0
VLB185	IVT-RF-NHZ-19	25.2	8	0	18.7	8	0	18.0	16	0	25.1	17	0	34.7	1	1	24.3	6	0
VLB186	IVT-RF-NHZ-18	27.7	4	0	19.0	6	0	22.1	13	0	26.6	9	0	15.8	19	0	22.3	13	0
VLB187	IVT-RF-NHZ-24	25.1	9	0	19.5	5	0	15.0	22	0	23.8	20	0	32.0	4	1	23.1	10	0
VLB188	IVT-RF-NHZ-1	28.3	3	0	19.7	4	0	20.4	14	0	24.1	19	0	9.6	24	0	20.4	16	0
VLB189	IVT-RF-NHZ-17	20.6	20	0	9.6	24	0	17.9	17	0	27.3	8	0	23.9	11	0	19.9	19	0
BHS380(C)	IVT-RF-NHZ-10	26.0	7	0	12.6	21	0	24.9	7	0	25.5	15	0	23.4	13	0	22.5	11	0
BHS400(C)	IVT-RF-NHZ-7	20.3	22	0	17.8	9	0	24.7	9	0	27.5	7	0	13.7	20	0	20.8	15	0
BHS352(C)	IVT-RF-NHZ-14	23.5	14	0	13.8	20	0	9.9	24	0	26.3	11	0	20.4	16	0	18.8	23	0
HBL113(C)	IVT-RF-NHZ-16	22.9	17	0	17.8	9	0	31.5	1	1	28.2	3	1	31.0	6	1	26.3	2	0
VLB118(C)	IVT-RF-NHZ-13	20.6	21	0	11.5	22	0	17.7	18	0	26.4	10	0	21.7	14	0	19.6	22	0
G.M.		24.4			16.5			21.5			25.8			23.0			22.2		
S.E.(M)		0.7			2.0			1.74			0.6			1.7			0.7		
C.D.		1.7			5.0			4.22			1.5			4.0			1.5		
C.V.		4.1			17.6			11.45			3.4			10.2					
DOS		31.10.2023			31.10.2023			6.11.2023			6.11.2023			30.10.2023					

Table 2.28. Initial Varietal Trial - Dual Purpose Barley (NHZ) - Income from grain yield and forage yield per hectare

S.N.	Entry		Grain yield ZM	Grain CD	Check Yield + CD	Forage Yield ZM	Forage CD	Check forage Yield + CD	Grain rates/Qtls MSP	Forage rates/qtls	Income from grain (Rs.)	Income from forage (Rs.)	Total Income
1	BHS497	HULLESS	20.2		20.2	30.3		30.3	1850	400	37370	12120	49490
2	BHS498*		25.7		25.7	33.6		33.6	1850	400	47545	13440	60985
3	BHS499	HULLESS	19.8		19.8	30.4		30.4	1850	400	36630	12160	48790
4	BHS500	HULLESS	21.3		21.3	31.4		31.4	1850	400	39405	12560	51965
5	BHS501		18.7		18.7	31.7		31.7	1850	400	34595	12680	47275
6	BHS502*		24.4		24.4	30.7		30.7	1850	400	45140	12280	57420
7	HBL884*		28.3		28.3	31.8		31.8	1850	400	52355	12720	65075
8	HBL885		23.4		23.4	30.2		30.2	1850	400	43290	12080	55370
9	HBL886		23.4		23.4	33.9		33.9	1850	400	43290	13560	56850
10	HBL888		20.1		20.1	30.3		30.3	1850	400	37185	12120	49305
11	UPB1118*		24.8		24.8	33.1		33.1	1850	400	45880	13240	59120
12	UPB1119		22.4		22.4	26.2		26.2	1850	400	41440	10480	51920
13	UPB1120		19.8		19.8	27.5		27.5	1850	400	36630	11000	47630
14	VLB184		23.3		23.3	32.1		32.1	1850	400	43105	12840	55945
15	VLB185*		24.3		24.3	35.2		35.2	1850	400	44955	14080	59035
16	VLB186		22.3		22.3	33		33	1850	400	41255	13200	54455
17	VLB187		23.1		23.1	34.8		34.8	1850	400	42735	13920	56655
18	VLB188		20.4		20.4	30.7		30.7	1850	400	37740	12280	50020
19	VLB189		19.9		19.9	32.9		32.9	1850	400	36815	13160	49975
20	BHS380	DP ©	22.5	1.5	24	32.9	2.2	35.1	1850	400	44400	13160	57560
21	BHS400	FB©	20.8		20.8	30.1		30.1	1850	400	38480	12040	50520
22	BHS352	NB ©	18.8		18.8	33.3		33.3	1850	400	34780	13320	48100
23	HBL113	FB©	26.3		26.3	28.5		28.5	1850	400	48655	11400	60055
24	VLB118	FB©	19.6		19.6	35.8		35.8	1850	400	36260	14320	50580
			22.2			**31.7**							
			0.7			0.9							
			1.5			2.2							

*Entries BHS498, BHS502, HBL884, UPB1118 and VLB 185 gave significantly higher income per hectare than check BHS380.

Table 2.29. AVT/IVT-RAINFED-Dual Purpose Barley-Cut (NHZ) - Forage Yield (q/ha) *Rabi 2023-24*.

Entry name	Entry Code	Bajaura			Khudwani			Malan			Shimla			Wadura			Zonal mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS497*	IVT-RF-NHZ-8	20.1	13	0	39.8	24	0	33.4	5	0	36.2	1	1	22.3	9	0	30.3	18	0
BHS498	IVT-RF-NHZ-22	21.0	8	0	63.6	7	1	25.8	15	0	32.6	4	0	24.9	5	0	33.6	5	0
BHS499	IVT-RF-NHZ-2	20.2	12	0	57.6	15	0	26.6	14	0	26.2	19	0	21.3	14	0	30.4	17	0
BHS500	IVT-RF-NHZ-21	24.1	1	1	60.0	12	0	20.7	21	0	31.5	6	0	20.9	18	0	31.4	14	0
BHS501	IVT-RF-NHZ-4	21.1	7	0	62.6	10	1	20.8	20	0	36.2	1	1	17.6	22	0	31.7	13	0
BHS502	IVT-RF-NHZ-20	22.2	5	0	55.7	18	0	30.8	8	0	25.9	20	0	18.8	20	0	30.7	16	0
HBL884	IVT-RF-NHZ-15	22.8	2	1	63.5	8	1	27.6	12	0	28.3	13	0	17.1	24	0	31.8	12	0
HBL885	IVT-RF-NHZ-23	22.0	6	0	56.5	17	0	15.1	24	0	35.1	3	1	22.2	10	0	30.2	20	0
HBL886	IVT-RF-NHZ-5	19.3	16	0	64.7	6	1	36.6	3	0	28.9	10	0	20.2	19	0	33.9	4	1
HBL888	IVT-RF-NHZ-9	16.7	23	0	66.9	3	1	21.4	19	0	28.4	12	0	18.1	21	0	30.3	19	0
UPB1118	IVT-RF-NHZ-12	19.3	16	0	54.8	19	0	21.9	18	0	31.8	5	0	37.8	2	1	33.1	7	0
UPB1119	IVT-RF-NHZ-11	17.8	21	0	49.7	20	0	17.0	23	0	24.9	23	0	21.7	11	0	26.2	24	0
UPB1120	IVT-RF-NHZ-6	22.3	4	0	41.0	23	0	22.5	17	0	27.1	18	0	24.5	7	0	27.5	23	0
VLB184*	IVT-RF-NHZ-3	18.8	20	0	56.9	16	0	36.0	4	0	27.4	17	0	21.5	13	0	32.1	11	0
VLB185	IVT-RF-NHZ-19	19.7	15	0	59.4	14	0	28.2	10	0	28.4	11	0	40.5	1	1	35.2	2	1
VLB186	IVT-RF-NHZ-18	20.6	10	0	66.8	4	1	28.2	10	0	25.7	21	0	23.9	8	0	33.0	8	0
VLB187	IVT-RF-NHZ-24	20.0	14	0	62.9	9	1	42.0	1	1	27.5	16	0	21.5	12	0	34.8	3	1
VLB188	IVT-RF-NHZ-1	21.0	8	0	48.7	21	0	32.7	6	0	30.3	7	0	21.0	17	0	30.7	15	0
VLB189	IVT-RF-NHZ-17	16.6	24	0	59.6	13	0	39.3	2	1	27.9	15	0	21.3	15	0	32.9	9	0
BHS380(C)	IVT-RF-NHZ-10	22.7	3	1	61.4	11	1	27.5	13	0	28.3	13	0	24.5	6	0	32.9	10	0
BHS400(C)	IVT-RF-NHZ-7	16.9	22	0	69.5	1	1	18.1	22	0	24.8	24	0	21.3	15	0	30.1	21	0
BHS352(C)	IVT-RF-NHZ-14	20.6	10	0	64.8	5	1	24.7	16	0	29.0	9	0	27.2	4	0	33.3	6	0
HBL113(C)	IVT-RF-NHZ-16	19.1	18	0	46.1	22	0	30.4	9	0	29.6	8	0	17.2	23	0	28.5	22	0
VLB118(C)	IVT-RF-NHZ-13	18.9	19	0	67.3	2	1	31.4	7	0	25.4	22	0	36.0	3	0	35.8	1	1
G.M.		**20.2**			**58.3**			**27.5**			**29.1**			**23.5**			**31.7**		
S.E.(M)		0.6			3.8			1.9			0.9			1.6			0.9		
C.D.		1.5			9.2			4.7			2.2			3.8			2.2		
C.V.		4.3			9.2			9.9			4.4			9.4					
DOS		31.10.2023			31.10.2023			6.11.2023			6.11.2023			30.10.2023					

Table 2.31. AVT/IVT-RAINFED (NHZ) ancillary and disease data *Rabi 2023-24.*

Entry Name	Entry code	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS		
		H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillers per meter Mean & Range	Straw strenghth (%)	Two/ Six row	Spike length (cm)	Grain colour	1000 grain weight (g) Mean & Range	H/N
BHS497	IVT-RF-NHZ-8	137 (117-172)	186 (156-226)	82 (61-110)	98 (56-206)	28	6	8.4 (7-10)	A	30.4 (25-34)	N
BHS498	IVT-RF-NHZ-22	135 (109-171)	183 (164-223)	79 (59-96)	87 (53-156)	0	6	7.6 (5-9)	Y	40.1 (38-44)	H
BHS499	IVT-RF-NHZ-2	133 (117-172)	182 (156-226)	83 (60-104)	90 (57-167)	30	6	8.2 (5-11)	A	33.0 (28-42)	N
BHS500	IVT-RF-NHZ-21	136 (118-173)	184 (156-227)	77 (62-99)	130 (63-298)	25	6	8.9 (6-12)	A	34.1 (25-45)	N
BHS501	IVT-RF-NHZ-4	143 (125-174)	189 (166-228)	73 (49-113)	105 (62-220)	0	2	8.3 (7-12)	Y	45.9 (41-52)	H
BHS502	IVT-RF-NHZ-20	134 (108-170)	185 (160-224)	75 (55-92)	105 (62-198)	0	6	6.8 (4-10)	Y	35.8 (33-40)	H
HBL884	IVT-RF-NHZ-15	138 (113-167)	186 (164-221)	75 (53-101)	107 (73-180)	0	2	7.7 (6-10)	Y	42.4 (34-50)	H
HBL885	IVT-RF-NHZ-23	134 (114-173)	182 (157-223)	77 (59-96)	90 (65-135)	0	6	7.7 (6-9)	Y	33.3 (27-46)	H
HBL886	IVT-RF-NHZ-5	125 (104-167)	181 (157-221)	67 (46-93)	121 (75-252)	0	2	6.4 (5-7)	Y	42.2 (31-52)	H
HBL888	IVT-RF-NHZ-9	136 (115-174)	185 (163-228)	77 (59-99)	132 (78-265)	0	2	7.3 (6-8)	Y	36.2 (30-41)	H
UPB1118	IVT-RF-NHZ-12	127 (100-167)	180 (159-223)	66 (49-90)	87 (66-133)	20	2	5.9 (5-7)	Y	43.5 (39-47)	H
UPB1119	IVT-RF-NHZ-11	133 (111-171)	184 (158-221)	65 (48-90)	73 (50-118)	0	6	6.3 (4-8)	Y	38.3 (32-41)	H
UPB1120	IVT-RF-NHZ-6	131 (103-168)	183 (162-222)	59 (42-91)	99 (70-137)	0	6	5.8 (4-8)	Y	36.7 (33-40)	H

Table 2.32. IVT/AVT– RAINFED-NHZ ancillary and disease data *Rabi 2023-24.*

Entry	Code	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			Disease reaction	
		H. days Mean & Range	**M. days Mean & Range**	**Height Mean & Range (cm)**	**Tillers per meter Mean & Range**	Straw strenghth (%)	**Two/ Six row**	**Spike length (cm)**	**Grain colour**	**1000 grain weight (g) Mean & Range**	**H/N**	**RUST**	
												YL	**BR**
VLB184	IVT-RF-NHZ-3	137 (115-170)	183 (158-224)	71 (51-97)	106 (80-192)	0	6	6.5 (4-8)	Y	38.3 (26-50)	H	0	0
VLB185	IVT-RF-NHZ-19	133 (113-168)	185 (164-221)	70 (54-94)	125 (84-210)	0	2	7.8 (5-10)	Y	42.8 (30-49)	H	0	0
VLB186	IVT-RF-NHZ-18	130 (101-175)	185 (158-224)	74 (53-103)	119 (50-285)	25	6	6.7 (5-9)	Y	37.0 (31-42)	H	0	0
VLB187	IVT-RF-NHZ-24	134 (108-171)	185 (158-224)	69 (52-94)	124 (61-280)	0	6	7.3 (5-9)	Y	37.5 (31-47)	H	0	0
VLB188	IVT-RF-NHZ-1	134 (118-168)	186 (162-221)	74 (48-109)	120 (68-191)	0	2	7.4 (5-9)	Y	45.8 (42-51)	H	0	0
VLB189	IVT-RF-NHZ-17	131 (103-175)	183 (159-221)	76 (57-91)	109 (79-179)	0	2	7.4 (4-11)	Y	46.0 (41-57)	H	0	0
BHS352 (C)	IVT-RF-NHZ-14	133 (113-171)	183 (157-225)	76 (59-96)	109 (51-275)	0	6	8.1 (7-10)	A	33.9 (30-38)	N	0	0
BHS380(C)	IVT-RF-NHZ-10	134 (114-171)	184 (157-225)	79 (59-97)	84 (64-114)	0	6	5.9 (5-7)	Y	39.5 (33-48)	H	0	0
BHS400(C)	IVT-RF-NHZ-7	136 (110-136)	185 (160-228)	82 (58-110)	97 (63-142)	0	6	6.7 (4-9)	Y	38.9 (27-45)	H	0	0
HBL113(C)	IVT-RF-NHZ-16	141 (122-175)	187 (164-229)	72 (53-96)	123 (81-223)	0	2	7.6 (5-10)	Y	33.3 (30-40)	H	0	0
VLB118(C)	IVT-RF-NHZ-13	131 (104-169)	181 (159-223)	70 (53-100)	99 (60-168)	0	6	6.6 (5-8)	Y	40.5 (38-43)	H	0	0

ADVANCED VARIETAL TRIAL II – IRRIGATED TIMELY SOWN FEED BARLEY – NEPZ (AVT-FB-NEPZ)

The Advanced Varietal Trial II for irrigated, timely sown feed barley was conducted at six locations within the NEPZ, specifically at Kanpur, Kumarganj, Pusa, Samastipur, Varanasi, and Sabour. Data was successfully gathered from all these locations. However, for the zonal pooled analysis, results from only four locations—Kanpur, Kumarganj, Pusa, and Samastipur—were considered, as Varanasi and Sabour were excluded due to their low site means (Varanasi: 17.7 q/ha; Sabour: 25.9 q/ha).

The trial featured one test entry, UPB1106, alongside four check varieties: BH946, DWRB137, HUB113, and BH393. Grain yield across the locations ranged from 31.8 q/ha at RPCAU, Pusa, to 49.1 q/ha at Kanpur, with a zonal mean of 37.2 q/ha. UPB1106 emerged as the highest-yielding entry with a mean of 39.9 q/ha, followed closely by BH946 at 38.9 q/ha, though both entries fell within the same non-significant group. Among the zonal checks, HUB113 performed best, ranking third overall, yet UPB1106 demonstrated significant superiority over HUB113.

Table 2.32. Advance Varietal Trial II –IRTS-FB – NEPZ-Grain Yield Data (q/ha) *Rabi* – 2023-24.

Name of Entry	Entry Code	Kanpur			Kumarganj			RPCAU, Pusa			BISA, Samastipur			Zonal Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
UPB 1106	AVT-IRTS-FB-1	44.9	4	0	37.6	4	0	47.2	1	1	30.0	4	0	**39.9***	**1**	**1**
BH 946 (C)	AVT-IRTS-FB-2	55.1	1	1	39.4	3	0	34.3	2	0	26.9	5	0	**38.9**	**2**	**1**
HUB113 (C)	AVT-IRTS-FB-3	52.2	2	1	43.0	2	1	24.9	4	0	32.9	3	1	**38.2**	**3**	**0**
DWRB137 (C)	AVT-IRTS-FB-4	43.3	5	0	44.9	1	1	19.8	5	0	35.7	1	1	**35.9**	**5**	**0**
BH393 (Filler)	AVT-IRTS-FB-5	49.1	3	0	33.3	5	0	31.8	3	0	34.4	2	1	**37.2**	**4**	**0**
	G.M.	49.0			39.6			31.6			32.0			**38.0**		
	S.E.(M)	1.5			0.9			0.8			1.9			**0.678**		
	C.D. (10%)	3.6			2.3			2.1			4.7			**1.6**		
	C.V. (%)	6.7			5.2			5.9			13.4					
	DOS	12.11.23			17.11.23			15.11.23			15.11.23					

***UPB1106 significantly superior in grain yield to best zonal check HUB113.**

Table 2.33. Advance Varietal Trial –FB- IRTS- NEPZ- ancillary and disease data *Rabi* – 2023-24.

Name of Entry	Entry Code	Agronomic Characteristics							Grain Characteristics			Disease & Insects Reactions			
		Days to Heading	Days to Maturity	Plant Height (cm)	Lodging (%)	Tillers/ meter	Two/ Six Row	Spike length (cm)	Color (Y,LY,P,A)	Hulled/ Hulless (H/N)	1000 GW (gm)	Yl	Br	LB	Aphids (1- 5)
UPB 1106	AVT-IRTS-FB-1	86 (82-89)	124 (120-127)	97 (80-104)	53 (0-100)	201 (88-380)	6	9 (7-10)	LY	H	42 (40-44)	-	-	45 (23-89)	-
BH 946 (C)	AVT-IRTS-FB-2	86 (80-88)	124 (121-128)	94 (85-100)	43 (0-80)	184 (90-308)	6	7 (7-8)	y	H	37 (33-41)	-	-	35 (24-56)	-
HUB113 (C)	AVT-IRTS-FB-3	84 (78-90)	124 (120-129)	85 (75-100)	43 (0-90)	206 (106-370)	6	8 (6-9)	y	H	42 (38-46)	-	-	35 (13-56)	-
DWRB137 (C)	AVT-IRTS-FB-4	88 (83-91)	127 (125-129)	96 (91-105)	48 (0-100)	165 (98-234)	6	7 (7-8)	y	H	40 (35-43)	-	-	24 (12-36)	-
BH393 (Filler) (C)	AVT-IRTS-FB-5	78 (70-88)	123 (117-129)	88 (75-101)	46 (0-90)	185 (80-326)	6	8 (7-9)	LY	H	38 (34-44)	-	-	35 (24-47)	-

INITIAL VARIETAL TRIAL (IRRIGATED) FEED BARLEY (IVT-DP-NWPZ, NEPZ and CZ)

The trial was proposed at 21 locations distributed across the NWPZ (8 locations: Hisar, Karnal, Ludhiana, Durgapura, Tabiji, Pantnagar, Modipuram, and Dholpur), NEPZ (7 locations: Kanpur, Kumarganj, Pusa, Samastipur, Varanasi, Sabour, and Ranchi), and the Central Zone (6 locations: Udaipur, Gwalior, Tikamgarh, Banda, Morena, and Vijapur). The trial was successfully conducted at all 21 locations, and data was collected from each site.

The trial comprised 19 test entries and four zonal checks: DWRB137 (for NWPZ, NEPZ, and CZ), BH946 (for NWPZ), RD2899 (for CZ), and HUB113 (for NEPZ). One test entry proposed by the Hisar center was excluded from the trial due to complete seed damage by insects. To fulfill the requirements of the Lattice Square Design, the genotypes RD2907 and DWRB64 were included as filler entries, bringing the total number of entries to 25.

The results from all eight locations in the NWPZ were included in the zonal pooled analysis. Grain yields at locations ranged from 34.7 q/ha at Hisar to 76.9 q/ha at Durgapura, with a zonal mean of 48.9 q/ha for the region. Notably, the yields at the Durgapura center were exceptionally high. Among the two NWPZ checks, DWRB137 and BH946, DWRB137 emerged as the top-performing check with a yield of 53.2 q/ha, ranking fifth overall. Among the test entries, RD 3095 (57.6 q/ha), BH1059 (55.9 q/ha), and PL 955 (55.9 q/ha) ranked first, second, and third, respectively, each demonstrating significant superiority over the best check in the zone.

In the NEPZ, data from the Varanasi (26.1 q/ha) and Sabour (12.1 q/ha) locations were excluded from the zonal pooled analysis due to low site means for grain yield. The pooled analysis was conducted using data from the remaining five locations. Grain yields ranged from 32.4 q/ha at BISA, Samastipur to 48.7 q/ha at Kanpur, with an overall zonal mean of 36.9 q/ha. Among the zonal checks, DWRB137 (42.5 q/ha) and HUB113 (39.5 q/ha), DWRB137, which ranked seventh overall, was identified as the best check variety. Three test entries—BH1059 (46.4 q/ha), HUB290 (46.3 q/ha), and PL955 (45.8 q/ha)—ranked first, second, and third, respectively, all demonstrating significant superiority over the best zonal check variety.

In the Central Zone, data from the Morena and Vijapur locations were excluded from the zonal pooled analysis. The trial at Morena was sown very late (December 16, 2023), and the Vijapur location had a low site mean of 24.8 q/ha. The pooled analysis was conducted using data from the remaining four locations. Grain yields ranged from 31.1 q/ha at Gwalior to 66.0 q/ha at Tikamgarh, with an overall zonal mean of 50.4 q/ha. The zonal check variety RD2899 ranked first with a grain yield of 58.3 q/ha, followed closely by DWRB2302 (58.2 q/ha), RD3096 (56.4 q/ha), PL954 (55.9 q/ha), PL955 (55.6 q/ha), and BH1059 (55.4 q/ha). However, none of the test entries showed significant superiority over the best check variety in this zone.

A monitoring team conducted visits to the barley trials at Dholpur (NWPZ) and at the Morena, Gwalior, Tikamgarh, and Banda locations in the Central Zone. All barley trials were found to be free from rust. However, incidences of leaf blight were observed in two entries, GB1 (56) and RD3096 (35), within the IVT-IRTS-FB trial at the Gwalior, Tikamgarh, and Banda centers.

Table 2.34. IVT– IRTS-FB-NWPZ-Grain Yield Data (q/ha) *Rabi* – 2023-24.

Name of Entry	Entry Code	Hisar			Karnal			Ludhiana			Durgapura			Tabiji		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
HUB 291	IVT-IRTS-FB-1	24.7	23	0	22.8	25	0	38.3	14	0	60.6	23	0	62.2	20	0
DWRB 2303	IVT-IRTS-FB-2	31.7	17	0	39.2	5	1	32.2	22	0	66.4	20	0	57.5	24	0
RD 3093	IVT-IRTS-FB-3	37.2	11	0	23.8	24	0	33.8	20	0	87.4	6	0	76.2	3	1
*RD2907	IVT-IRTS-FB-4	31.8	16	0	38.8	7	1	45.4	7	0	68.7	19	0	59.0	22	0
PL 954	IVT-IRTS-FB-5	43.4	4	1	37.0	10	1	55.3	1	1	81.7	9	0	79.3	2	1
BH1059	IVT-IRTS-FB-6	39.7	7	0	37.9	8	1	47.2	6	0	90.6	5	0	72.7	10	0
UPB 1123	IVT-IRTS-FB-7	48.4	1	1	41.1	3	1	41.7	12	0	61.6	22	0	73.7	8	1
BH1058	IVT-IRTS-FB-8	42.0	5	0	41.8	1	1	43.5	8	0	70.7	16	0	73.7	9	1
HUB 290	IVT-IRTS-FB-9	37.3	10	0	34.3	17	0	42.1	11	0	65.1	21	0	66.6	19	0
GB1	IVT-IRTS-FB-10	27.1	22	0	39.1	6	1	29.9	25	0	60.6	24	0	57.7	23	0
DWRB 2302	IVT-IRTS-FB-11	35.9	12	0	28.7	22	0	42.2	10	0	72.7	14	0	71.4	14	0
PL 956	IVT-IRTS-FB-12	18.5	25	0	24.0	23	0	38.0	15	0	81.4	10	0	67.4	18	0
DWRB2319	IVT-IRTS-FB-13	30.0	19	0	35.8	15	1	33.1	21	0	83.4	7	0	75.5	5	1
UPB 1122	IVT-IRTS-FB-14	31.3	18	0	32.9	18	0	37.8	16	0	74.1	13	0	67.6	17	0
PL 955	IVT-IRTS-FB-15	39.6	8	0	36.8	12	1	52.5	2	1	96.5	2	1	71.3	15	0
RD3096	IVT-IRTS-FB-17	28.4	21	0	35.1	16	0	32.0	23	0	82.7	8	0	74.9	6	1
DWRB 2301	IVT-IRTS-FB-18	34.9	13	0	31.9	19	0	32.0	24	0	76.3	12	0	60.7	21	0
*DWRB64	IVT-IRTS-FB-19	24.0	24	0	31.7	20	0	36.1	18	0	68.7	18	0	71.7	13	0
RD 3095	IVT-IRTS-FB-20	38.5	9	0	40.1	4	1	48.6	4	0	103.4	1	1	82.5	1	1
KB 2212	IVT-IRTS-FB-21	29.7	20	0	37.2	9	1	36.7	17	0	60.4	25	0	52.0	25	0
GB2	IVT-IRTS-FB-23	31.8	15	0	41.2	2	1	36.1	19	0	71.9	15	0	68.0	16	0
DWRB137 (C)	IVT-IRTS-FB-16	40.9	6	0	29.7	21	0	38.4	13	0	95.9	3	1	76.0	4	1
HUB113 (C)	IVT-IRTS-FB-22	32.1	14	0	36.9	11	1	48.4	5	0	92.2	4	0	72.2	11	0
RD2899 (C)	IVT-IRTS-FB-24	43.8	3	1	36.3	14	1	50.4	3	1	80.8	11	0	72.2	12	0
BH 946 (C)	IVT-IRTS-FB-25	45.5	2	1	36.7	13	1	43.1	9	0	68.8	17	0	74.8	7	1
	G.M.	34.7			34.8			40.6			76.9			69.5		
	S.E.(M)	2.3			2.5			2.6			4.3			3.9		
	C.D. (10%)	5.6			6.2			6.4			10.7			9.6		
	C.V. (%)	9.4			10.1			9.1			7.9			7.9		
	DOS	11.11.23			6.11.23			5.11.23			6.11.23			9.11.23		

*Filler

Continued in next page…..

Name of Entry	Entry Code	Pantnagar			Modipuram			Dholpur			Zonal Mean		
		Yield	RK	G	Yield	RK	G	Yield	Rk	G	Yield	Rk	G
HUB 291	IVT-IRTS-FB-1	35.3	18	0	43.8	23	0	44.9	4	0	**41.6**	**23**	**0**
DWRB 2303	IVT-IRTS-FB-2	53.5	2	0	51.0	21	0	39.9	10	0	**46.4**	**19**	**0**
RD 3093	IVT-IRTS-FB-3	46.5	7	0	62.9	3	1	30.3	21	0	**49.8**	**13**	**0**
*RD2907	IVT-IRTS-FB-4	44.1	10	0	52.9	19	0	31.6	19	0	**46.5**	**18**	**0**
PL 954	IVT-IRTS-FB-5	34.6	20	0	56.4	12	0	36.7	15	0	**53.0**	**6**	**0**
BH1059	IVT-IRTS-FB-6	49.1	5	0	61.5	6	1	48.3	3	0	**55.9***	**2**	**1**
UPB 1123	IVT-IRTS-FB-7	52.8	4	0	56.4	12	0	31.8	18	0	**51.0**	**8**	**0**
BH1058	IVT-IRTS-FB-8	62.5	1	1	54.0	16	0	31.3	20	0	**52.4**	**7**	**0**
HUB 290	IVT-IRTS-FB-9	32.3	22	0	54.9	15	0	40.8	9	0	**46.7**	**16**	**0**
GB1	IVT-IRTS-FB-10	23.7	25	0	51.4	20	0	23.3	25	0	**39.1**	**25**	**0**
DWRB 2302	IVT-IRTS-FB-11	48.9	6	0	59.4	10	0	43.6	6	0	**50.3**	**11**	**0**
PL 956	IVT-IRTS-FB-12	35.7	16	0	59.6	9	0	37.3	13	0	**45.2**	**20**	**0**
DWRB2319	IVT-IRTS-FB-13	35.1	19	0	57.8	11	0	43.0	7	0	**49.2**	**14**	**0**
UPB 1122	IVT-IRTS-FB-14	32.1	23	0	44.8	22	0	36.9	14	0	**44.7**	**21**	**0**
PL 955	IVT-IRTS-FB-15	43.6	11	0	63.9	1	1	42.8	8	0	**55.9***	**3**	**1**
RD3096	IVT-IRTS-FB-17	41.6	12	0	53.8	17	0	49.7	2	0	**49.8**	**12**	**0**
DWRB 2301	IVT-IRTS-FB-18	40.6	13	0	63.4	2	1	32.3	17	0	**46.5**	**17**	**0**
*DWRB64	IVT-IRTS-FB-19	27.2	24	0	39.1	25	0	34.4	16	0	**41.6**	**22**	**0**
RD 3095	IVT-IRTS-FB-20	46.5	8	0	61.4	7	1	39.5	11	0	**57.6***	**1**	**1**
KB 2212	IVT-IRTS-FB-21	33.0	21	0	43.3	24	0	38.7	12	0	**41.4**	**24**	**0**
GB2	IVT-IRTS-FB-23	53.0	3	0	52.9	18	0	29.9	23	0	**48.1**	**15**	**0**
DWRB137 (C)	IVT-IRTS-FB-16	39.2	14	0	62.0	4	1	43.7	5	0	**53.2**	**5**	**0**
HUB113 (C)	IVT-IRTS-FB-22	38.5	15	0	55.5	14	0	53.7	1	1	**53.7**	**4**	**0**
RD2899 (C)	IVT-IRTS-FB-24	35.3	17	0	61.0	8	1	27.1	24	0	**50.9**	**10**	**0**
BH 946 (C)	IVT-IRTS-FB-25	45.9	9	0	62.0	5	1	30.1	22	0	**50.9**	**9**	**0**
	G.M.	41.2			55.4			37.7			**48.9**		
	S.E.(M)	1.4			1.8			1.3			**0.959**		
	C.D. (10%)	3.4			4.2			3.3			**2.2**		
	C.V. (%)	4.9			4.5			5.0					
	DOS	20.11.23			18.11.23			19.11.23					

*Filler

*Entries BH 1059, PL955 and RD 3095 are significantly superior to zonal best check DWRB 137.

Table 2.35. IVT –FB-(IR)-NWPZ- ancillary and disease data *Rabi* – 2023-24.

Name of Entry	Entry Code	Agronomic Characteristics						
		Days to Heading	Days to Maturity	Plant height (cm)	Lodging (%)	Tillers/ meter	Two/ Six Row	Spike length (cm)
HUB 291	IVT-IRTS-FB-1	90 (79-108)	134 (120-153)	112 (103-28)	6 (0-25)	106 (89-128)	6	8 (6-9)
DWRB 2303	IVT-IRTS-FB-2	86 (67-98)	133 (116-155)	90 (73-105)	4 (0-20)	94 (73-117)	6	8 (6-11)
RD 3093	IVT-IRTS-FB-3	90 (72-111)	135 (114-157)	103 (90-117)	3 (0-10)	114 (74-139)	6	9 (7-10)
*RD2907	IVT-IRTS-FB-4	89 (78-107)	136 (115-158)	98 (89-110)	21 (0-45)	106 (61-147)	6	8 (6-9)
PL 954	IVT-IRTS-FB-5	89 (70-111)	136 (114-155)	102 (89-121)	5 (0-20)	109 (84-141)	6	8 (6-10)
BH1059	IVT-IRTS-FB-6	87 (70-105)	136 (119-153)	101 (78-118)	0 (00)	101 (72-135)	6	8 (5-9)
UPB 1123	IVT-IRTS-FB-7	89 (70-109)	135 (117-156)	96 (80-112)	13 (0-45)	113 (91-130)	6	7 (5-8)
BH1058	IVT-IRTS-FB-8	85 (67-101)	134 (114-155)	98 (82-120)	0 (00)	113 (90-143)	6	8 (7-11)
HUB 290	IVT-IRTS-FB-9	90 (79-106)	135 (118-155)	113 (93-137)	15 (0-40)	103 (79-122)	6	9 (7-10)
GB1	IVT-IRTS-FB-10	89 (76-105)	133 (113-157)	94 (76-117)	0 (00)	90 (58-130)	6	9 (7-11)
DWRB 2302	IVT-IRTS-FB-11	82 (69-93)	132 (116-157)	96 (86-109)	0 (00)	109 (82.5-144)	6	8 (7-10)
PL 956	IVT-IRTS-FB-12	84 (68-96)	134 (116-156)	106 (85-121)	15 (0-50)	112 (93.5-129)	6	8 (7-10)
DWRB2319	IVT-IRTS-FB-13	87 (70-106)	133 (115-156)	98 (81-119)	0 (00)	97 (69-119)	6	8 (6-9)
UPB 1122	IVT-IRTS-FB-14	87 (70-105)	135 (119-156)	93 (83-112)	15 (0-60)	122 (78.5-138)	6	7 (6-8)
PL 955	IVT-IRTS-FB-15	88 (73-107)	138 (122-158)	107 (92-124)	35 (0-60)	107 (64-137)	6	8 (6-9)
RD3096	IVT-IRTS-FB-17	90 (72-113)	138 (123-157)	107 (93-122)	0 (00)	109 (62-135)	6	10 (9-11)
DWRB 2301	IVT-IRTS-FB-18	80 (63-94)	133 (115-157)	94 (73-107)	11 (0-45)	111 (72.5-150)	6	8 (7-11)
*DWRB64	IVT-IRTS-FB-19	87 (65-103)	135 (115-157)	87 (77-96)	56 (0-90)	102 (66.5-150)	6	8 (7-9)
RD 3095	IVT-IRTS-FB-20	87 (66-108)	135 (116-157)	103 (94-122)	0 (00)	111 (72-144)	6	9 (8-10)
KB 2212	IVT-IRTS-FB-21	93 (82-107)	136 (122-158)	104 (88-120)	0 (00)	100 (68-150)	6	9 (7-10)
GB2	IVT-IRTS-FB-23	90 (71-110)	134 (117-156)	108 (96-122)	36 (0-80)	90 (56.5-125)	6	9 (7-10)
DWRB137 (C)	IVT-IRTS-FB-16	82 (62-99)	134 (120-153)	89 (77-108)	10 (0-40)	113 (74-158)	6	9 (7-10)
HUB113 (C)	IVT-IRTS-FB-22	89 (73-107)	137 (123-157)	99 (87-118)	36 (0-80)	114 (94-144)	6	7 (5-10)
RD2899 (C)	IVT-IRTS-FB-24	90 (72-110)	136 (117-154)	95 (80-117)	0 (00)	111 (59.5-146)	6	7 (6-9)
BH 946 (C)	IVT-IRTS-FB-25	87 (68-109)	134 (118-155)	102 (88-119)	0 (00)	106 (75.5-134)	6	8 (7-9)

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Name of Entry	Entry Code	Grain Characteristics			Disease Reactions			
		Color (Y,LY,P,A)	Hulled/ Hulless (H/N)	1000 Gr. Wt. (gm)	Yl	Br	LB	SMUT (R,Ts,S, HS)
HUB 291	IVT-IRTS-FB-1	LY	H	44 (37-51)	0 (00)	0 (00)	20 (13-35)	0 (00)
DWRB 2303	IVT-IRTS-FB-2	Y	H	46 (38-52)	0 (00)	0 (00)	31 (23-35)	0 (00)
RD 3093	IVT-IRTS-FB-3	LY	H	43 (31-52)	0 (00)	0 (00)	45 (13-67)	0 (00)
*RD2907	IVT-IRTS-FB-4	LY	H	46 (40-52)	0 (00)	0 (00)	31 (23-45)	0 (00)
PL 954	IVT-IRTS-FB-5	LY	H	45 (34-51)	0 (00)	0 (00)	29 (14-46)	0 (00)
BH1059	IVT-IRTS-FB-6	Y	H	48 (43-51)	0 (00)	0 (00)	32 (25-36)	0 (00)
UPB 1123	IVT-IRTS-FB-7	LY	H	38 (29-54)	0 (00)	0 (00)	24 (13-35)	0 (00)
BH1058	IVT-IRTS-FB-8	A	H	49 (41-54)	0 (00)	0 (00)	24 (12-36)	0 (00)
HUB 290	IVT-IRTS-FB-9	A	H	47 (42-53)	0 (00)	0 (00)	24 (14-35)	0 (00)
GB1	IVT-IRTS-FB-10	LY	H	48 (37-56)	0 (00)	0 (00)	56 (34-78)	0 (00)
DWRB 2302	IVT-IRTS-FB-11	Y	H	44 (39-50)	0 (00)	0 (00)	35 (25-45)	0 (00)
PL 956	IVT-IRTS-FB-12	Y	H	46 (38-54)	0 (00)	0 (00)	32 (23-46)	0 (00)
DWRB2319	IVT-IRTS-FB-13	LY	H	39 (32-44)	0 (00)	0 (00)	35 (13-46)	0 (00)
UPB 1122	IVT-IRTS-FB-14	Y	H	41 (36-47)	0 (00)	0 (00)	31 (14-46)	0 (00)
PL 955	IVT-IRTS-FB-15	A	H	45 (38-52)	0 (00)	0 (00)	32 (16-56)	0 (00)
RD3096	IVT-IRTS-FB-17	A	H	43 (38-49)	0 (00)	0 (00)	46 (13-78)	0 (00)
DWRB 2301	IVT-IRTS-FB-18	LY	H	40 (36-46)	0 (00)	0 (00)	38 (24-67)	0 (00)
*DWRB64	IVT-IRTS-FB-19	A	H	44 (35-52)	0 (00)	0 (00)	43 (27-67)	0 (00)
RD 3095	IVT-IRTS-FB-20	LY	H	46 (35-53)	0 (00)	0 (00)	27 (11-36)	0 (00)
KB 2212	IVT-IRTS-FB-21	Y	H	43 (34-54)	0 (00)	0 (00)	27 (11-35)	0 (00)
GB2	IVT-IRTS-FB-23	LY	H	43 (34-51)	0 (00)	0 (00)	49 (45-56)	0 (00)
DWRB137 (C)	IVT-IRTS-FB-16	LY	H	47 (36-56)	0 (00)	0 (00)	38 (23-57)	0 (00)
HUB113 (C)	IVT-IRTS-FB-22	Y	H	39 (32-46)	0 (00)	0 (00)	24 (14-36)	0 (00)
RD2899 (C)	IVT-IRTS-FB-24	A	H	41 (30-48)	0 (00)	0 (00)	28 (15-35)	0 (00)
BH 946 (C)	IVT-IRTS-FB-25	LY	H	43 (37-51)	0 (00)	0 (00)	24 (13-34)	0 (00)

*Filler

Table 2.36. IVT–IRTS-FB-NEPZ-Grain Yield Data (q/ha) *Rabi* – 2023-24.

Name of Entry	Entry Code	Kanpur			Kumarganj			Pusa		
		Yield	RK	G	Yield	RK	G	Yield	RK	G
HUB 291	IVT-IRTS-FB-1	50.7	12	0	32.8	13	0	37.9	8	0
DWRB 2303	IVT-IRTS-FB-2	31.5	25	0	22.1	22	0	38.7	7	0
RD 3093	IVT-IRTS-FB-3	51.1	11	0	20.8	24	0	15.7	25	0
*RD2907	IVT-IRTS-FB-4	56.5	5	1	30.4	15	0	32.3	14	0
PL 954	IVT-IRTS-FB-5	55.8	6	1	40.3	7	0	25.4	21	0
BH1059	IVT-IRTS-FB-6	62.0	1	1	47.2	2	1	31.0	16	0
UPB 1123	IVT-IRTS-FB-7	38.4	22	0	30.0	16	0	27.0	19	0
BH1058	IVT-IRTS-FB-8	55.4	8	1	34.4	12	0	41.4	5	1
HUB 290	IVT-IRTS-FB-9	52.9	10	1	49.9	1	1	44.3	2	1
GB1	IVT-IRTS-FB-10	32.6	24	0	19.6	25	0	34.9	12	0
DWRB 2302	IVT-IRTS-FB-11	55.8	6	1	31.7	14	0	39.8	6	0
PL 956	IVT-IRTS-FB-12	43.5	17	0	22.0	23	0	34.8	13	0
DWRB2319	IVT-IRTS-FB-13	48.6	13	0	23.9	21	0	27.4	18	0
UPB 1122	IVT-IRTS-FB-14	47.5	14	0	45.5	5	0	43.3	3	1
PL 955	IVT-IRTS-FB-15	59.4	2	1	37.6	8	0	46.0	1	1
RD3096	IVT-IRTS-FB-17	47.5	15	0	26.0	20	0	18.1	24	0
DWRB 2301	IVT-IRTS-FB-18	36.2	23	0	29.9	17	0	26.5	20	0
*DWRB64	IVT-IRTS-FB-19	43.5	17	0	26.2	19	0	36.5	9	0
RD 3095	IVT-IRTS-FB-20	58.0	3	1	37.1	9	0	29.4	17	0
KB 2212	IVT-IRTS-FB-21	43.5	17	0	29.1	18	0	22.8	23	0
GB2	IVT-IRTS-FB-23	55.1	9	1	35.4	11	0	35.3	11	0
DWRB137 (C)	IVT-IRTS-FB-16	58.0	3	1	36.0	10	0	35.7	10	0
HUB113 (C)	IVT-IRTS-FB-22	43.5	17	0	46.4	3	1	32.2	15	0
RD2899 (C)	IVT-IRTS-FB-24	47.1	16	0	45.9	4	0	43.2	4	1
BH 946 (C)	IVT-IRTS-FB-25	43.5	17	0	42.6	6	0	24.4	22	0
	G.M.	48.7			33.7			33.0		
	S.E.(M)	3.3			1.4			2.1		
	C.D. (10%)	8.1			3.5			5.1		
	C.V. (%)	9.7			6.0			8.9		
	DOS	7.11.23			10.11.23			15.11.23		

*Filler

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Name of Entry	Entry Code	BISA, Samastipur			Zonal Mean		
		Yield	RK	G	Yield	RK	G
HUB 291	IVT-IRTS-FB-1	29.4	19	0	37.7	15	0
DWRB 2303	IVT-IRTS-FB-2	30.9	18	0	30.8	21	0
RD 3093	IVT-IRTS-FB-3	2.6	25	0	22.5	25	0
*RD2907	IVT-IRTS-FB-4	38.3	9	0	39.4	11	0
PL 954	IVT-IRTS-FB-5	31.2	16	0	38.2	13	0
BH1059	IVT-IRTS-FB-6	45.3	2	1	46.4*	1	1
UPB 1123	IVT-IRTS-FB-7	31.0	17	0	31.6	20	0
BH1058	IVT-IRTS-FB-8	42.1	4	1	43.3	6	0
HUB 290	IVT-IRTS-FB-9	38.3	10	0	46.3*	2	1
GB1	IVT-IRTS-FB-10	4.5	24	0	22.9	24	0
DWRB 2302	IVT-IRTS-FB-11	35.6	14	0	40.7	9	0
PL 956	IVT-IRTS-FB-12	28.3	20	0	32.1	19	0
DWRB2319	IVT-IRTS-FB-13	36.0	12	0	34.0	17	0
UPB 1122	IVT-IRTS-FB-14	42.3	3	1	44.6	4	1
PL 955	IVT-IRTS-FB-15	40.1	7	1	45.8*	3	1
RD3096	IVT-IRTS-FB-17	10.9	23	0	25.6	23	0
DWRB 2301	IVT-IRTS-FB-18	24.6	22	0	29.3	22	0
*DWRB64	IVT-IRTS-FB-19	46.3	1	1	38.1	14	0
RD 3095	IVT-IRTS-FB-20	40.1	6	1	41.1	8	0
KB 2212	IVT-IRTS-FB-21	37.8	11	0	33.3	18	0
GB2	IVT-IRTS-FB-23	27.6	21	0	38.4	12	0
DWRB137 (C)	IVT-IRTS-FB-16	40.4	5	1	42.5	7	0
HUB113 (C)	IVT-IRTS-FB-22	35.8	13	0	39.5	10	0
RD2899 (C)	IVT-IRTS-FB-24	38.9	8	1	43.8	5	1
BH 946 (C)	IVT-IRTS-FB-25	31.3	15	0	35.5	16	0
	G.M.	32.4			36.9		
	S.E.(M)	2.6			1.232		
	C.D. (10%)	6.3			2.9		
	C.V. (%)	11.4					
	DOS	15.11.23					

*Filler

*Entries BH1059, HUB290 and PL 955 are significantlyoutyielded the best zonal check DWRB 137.

Table 2.37. IVT–FB - (IR)- NEPZ-ancillary and disease data *Rabi* – 2023-24.

Name of Entry	Entry Code	Agronomic Characteristics					
		Days to Heading	Days to Maturity	Plant height (cm)	Tillers/ meter	Two/ Six Row	Spike length (cm)
HUB 291	IVT-IRTS-FB-1	86 (75-91)	124 (120-131)	103 (95-117)	162 (80-280)	6	7 (6-8)
DWRB 2303	IVT-IRTS-FB-2	86 (76-93)	126 (123-134)	87 (74-100)	182 (60-360)	6	8 (7-9)
RD 3093	IVT-IRTS-FB-3	86 (74-98)	123 (117-135)	90 (86-94)	165 (55-300)	6	8 (7-10)
*RD2907	IVT-IRTS-FB-4	86 (75-100)	127 (118-141)	97 (86-114)	204 (76-410)	6	8 (7-9)
PL 954	IVT-IRTS-FB-5	89 (76-97)	127 (121-138)	90 (79-99)	177 (85-276)	6	7 (6-9)
BH1059	IVT-IRTS-FB-6	83 (75-95)	126 (117-135)	92 (85-98)	184 (94-296)	6	7 (6-8)
UPB 1123	IVT-IRTS-FB-7	83 (70-89)	126 (119-132)	94 (84-99)	184 (83-312)	6	7 (6-8)
BH1058	IVT-IRTS-FB-8	82 (74-97)	128 (118-140)	87 (79-99)	161 (90-244)	6	7 (5-9)
HUB 290	IVT-IRTS-FB-9	84 (74-92)	126 (120-134)	99 (88-117)	184 (96-320)	6	7 (6-9)
GB1	IVT-IRTS-FB-10	87 (77-93)	125 (120-133)	86 (74-90)	148 (55-312)	6	9 (8-10)
DWRB 2302	IVT-IRTS-FB-11	81 (76-92)	123 (116-132)	84 (74-91)	195 (84-374)	6	8 (8-8)
PL 956	IVT-IRTS-FB-12	85 (74-94)	126 (123-137)	90 (82-100)	201 (65-390)	6	8 (7-9)
DWRB2319	IVT-IRTS-FB-13	84 (78-93)	127 (118-134)	87 (78-95)	174 (74-316)	6	8 (7-8)
UPB 1122	IVT-IRTS-FB-14	85 (75-92)	126 (123-134)	84 (80-92)	186 (92-358)	6	7 (6-8)
PL 955	IVT-IRTS-FB-15	85 (74-91)	128 (125-134)	93 (87-96)	167 (84-240)	6	8 (7-9)
RD3096	IVT-IRTS-FB-17	83 (73-91)	126 (120-138)	92 (85-100)	190 (61-370)	6	9 (7-10)
DWRB 2301	IVT-IRTS-FB-18	79 (75-89)	121 (114-129)	88 (81-101)	181 (79-312)	6	8 (6-10)
*DWRB64	IVT-IRTS-FB-19	83 (78-89)	125 (119-132)	87 (74-99)	179 (66-320)	6	7 (6-9)
RD 3095	IVT-IRTS-FB-20	82 (76-89)	126 (118-133)	88 (80-95)	175 (72-304)	6	8 (7-9)
KB 2212	IVT-IRTS-FB-21	88 (77-93)	129 (125-137)	94 (88-103)	159 (71-276)	6	8 (7-9)
GB2	IVT-IRTS-FB-23	83 (75-88)	126 (120-133)	101 (95-114)	165 (75-272)	6	8 (7-9)
DWRB137 (C)	IVT-IRTS-FB-16	82 (77-87)	122 (120-125)	81 (71-97)	156 (79-217)	6	7 (4-9)
HUB113 (C)	IVT-IRTS-FB-22	85 (78-89)	127 (122-133)	88 (80-98)	212 (95-420)	6	7 (6-8)
RD2899 (C)	IVT-IRTS-FB-24	87 (77-94)	128 (119-139)	88 (77-94)	207 (98-400)	6	7 (6-9)
BH 946 (C)	IVT-IRTS-FB-25	84 (74-88)	125 (121-131)	88 (82-94)	196 (85-360)	6	8 (7-10)

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Name of Entry	Entry Code	Grain Characteristics			Disease Reactions
		Color (Y,LY,P, A)	Hulled/ Hulless (H/N)	1000 Gr. Wt. (gm)	LB
HUB 291	IVT-IRTS-FB-1	LY	H	38 (33-41)	31 (24-35)
DWRB 2303	IVT-IRTS-FB-2	LY	H	39 (35-44)	46 (34-57)
RD 3093	IVT-IRTS-FB-3	Y	H	30 (21-35)	60 (2-99)
*RD2907	IVT-IRTS-FB-4	Y	H	42 (38-48)	34 (2-56)
PL 954	IVT-IRTS-FB-5	LY	H	36 (33-38)	39 (24-47)
BH1059	IVT-IRTS-FB-6	Y	H	45 (42-50)	34 (12-46)
UPB 1123	IVT-IRTS-FB-7	LY	H	31 (29-36)	42 (24-67)
BH1058	IVT-IRTS-FB-8	LY	H	42 (38-47)	42 (34-57)
HUB 290	IVT-IRTS-FB-9	LY	H	44 (42-47)	35 (24-45)
GB1	IVT-IRTS-FB-10	Y	H	37 (28-46)	92 (79-99)
DWRB 2302	IVT-IRTS-FB-11	LY	H	33 (26-37)	35 (24-45)
PL 956	IVT-IRTS-FB-12	Y	H	41 (35-45)	30 (0-57)
DWRB2319	IVT-IRTS-FB-13	Y	H	41 (33-50)	27 (0-56)
UPB 1122	IVT-IRTS-FB-14	Y	H	37 (34-42)	23 (0-45)
PL 955	IVT-IRTS-FB-15	LY	H	42 (38-48)	27 (0-46)
RD3096	IVT-IRTS-FB-17	LY	H	31 (24-39)	63 (12-89)
DWRB 2301	IVT-IRTS-FB-18	Y	H	38 (36-42)	31 (2-47)
*DWRB64	IVT-IRTS-FB-19	LY	H	40 (34-45)	34 (12-57)
RD 3095	IVT-IRTS-FB-20	Y	H	44 (40-47)	27 (2-46)
KB 2212	IVT-IRTS-FB-21	LY	H	42 (34-51)	31 (12-56)
GB2	IVT-IRTS-FB-23	LY	H	43 (40-47)	42 (36-46)
DWRB137 (C)	IVT-IRTS-FB-16	LY	H	42 (38-44)	30 (0-46)
HUB113 (C)	IVT-IRTS-FB-22	LY	H	39 (34-43)	31 (24-35)
RD2899 (C)	IVT-IRTS-FB-24	LY	H	40 (37-43)	27 (12-45)
BH 946 (C)	IVT-IRTS-FB-25	y	H	39 (34-42)	25 (24-25)

*Filler

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Table 2.38. IVT-IRTS-FB-CZ Grain Yield Data (q/ha) *Rabi* – 2023-24.

Name of Entry	Entry Code	Udaipur			Gwalior		
		Yield	RK	G	Yield	RK	G
HUB 291	IVT-IRTS-	44.3	19	0	27.3	21	0
DWRB 2303	IVT-IRTS-	38.5	23	0	28.1	20	0
RD 3093	IVT-IRTS-	64.8	5	1	28.2	18	0
*RD2907	IVT-IRTS-	54.8	10	0	28.2	19	0
PL 954	IVT-IRTS-	54.4	11	0	36.2	4	1
BH1059	IVT-IRTS-	63.8	6	1	30.2	13	0
UPB 1123	IVT-IRTS-	49.4	17	0	29.8	15	0
BH1058	IVT-IRTS-	51.8	13	0	32.8	9	0
HUB 290	IVT-IRTS-	36.5	25	0	26.4	22	0
GB1	IVT-IRTS-	65.4	4	1	19.4	25	0
DWRB 2302	IVT-IRTS-	67.4	2	1	31.5	12	0
PL 956	IVT-IRTS-	40.0	22	0	31.9	11	0
DWRB2319	IVT-IRTS-	56.1	9	0	35.2	6	0
UPB 1122	IVT-IRTS-	51.8	14	0	32.0	10	0
PL 955	IVT-IRTS-	48.1	18	0	37.8	3	1
RD3096	IVT-IRTS-	69.2	1	1	35.7	5	1
DWRB 2301	IVT-IRTS-	60.2	7	1	30.1	14	0
*DWRB64	IVT-IRTS-	36.7	24	0	33.2	7	0
RD 3095	IVT-IRTS-	51.1	15	0	33.1	8	0
KB 2212	IVT-IRTS-	41.1	21	0	28.6	17	0
GB2	IVT-IRTS-	41.8	20	0	41.6	1	1
DWRB137 (C)	IVT-IRTS-	52.4	12	0	26.2	23	0
HUB113 (C)	IVT-IRTS-	57.0	8	0	25.3	24	0
RD2899 (C)	IVT-IRTS-	66.5	3	1	29.6	16	0
BH 946 (C)	IVT-IRTS-	50.0	16	0	40.1	2	1
	G.M.	52.5			31.1		
	S.E.(M)	3.7			2.6		
	C.D. (10%)	9.2			6.3		
	C.V. (%)	10.0			11.7		
	DOS	20.11.23			25.11.23		

*Filler

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Name of Entry	Entry Code	Tikkamgarh			Banda			Zonal Mean		
		Yield	**RK**	**G**	**Yield**	**RK**	**G**	Yield	Rk	G
HUB 291	IVT-IRTS-FB-1	56.4	21	0	57.3	7	1	**46.3**	**20**	**0**
DWRB 2303	IVT-IRTS-FB-2	48.9	24	0	47.9	19	0	**40.8**	**24**	**0**
RD 3093	IVT-IRTS-FB-3	72.3	9	0	51.8	16	0	**54.3**	**7**	**0**
*RD2907	IVT-IRTS-FB-4	74.3	7	0	54.7	10	1	**53.0**	**8**	**0**
PL 954	IVT-IRTS-FB-5	80.6	2	1	52.4	14	0	**55.9**	**4**	**1**
BH1059	IVT-IRTS-FB-6	66.7	12	0	61.0	3	1	**55.4**	**6**	**1**
UPB 1123	IVT-IRTS-FB-7	60.5	19	0	44.3	22	0	**46.0**	**21**	**0**
BH1058	IVT-IRTS-FB-8	57.0	20	0	56.8	8	1	**49.6**	**16**	**0**
HUB 290	IVT-IRTS-FB-9	63.2	15	0	62.1	1	1	**47.1**	**19**	**0**
GB1	IVT-IRTS-FB-10	40.9	25	0	44.0	23	0	**42.4**	**23**	**0**
DWRB 2302	IVT-IRTS-FB-11	72.5	8	0	61.5	2	1	**58.2**	**2**	**1**
PL 956	IVT-IRTS-FB-12	77.6	5	1	53.7	12	0	**50.8**	**13**	**0**
DWRB2319	IVT-IRTS-FB-13	66.3	13	0	52.7	13	0	**52.6**	**9**	**0**
UPB 1122	IVT-IRTS-FB-14	74.5	6	0	48.1	18	0	**51.6**	**11**	**0**
PL 955	IVT-IRTS-FB-15	80.8	1	1	55.6	9	1	**55.6**	**5**	**1**
RD3096	IVT-IRTS-FB-17	69.9	10	0	50.9	17	0	**56.4**	**3**	**1**
DWRB 2301	IVT-IRTS-FB-18	62.9	16	0	52.3	15	0	**51.4**	**12**	**0**
*DWRB64	IVT-IRTS-FB-19	56.1	22	0	33.0	25	0	**39.8**	**25**	**0**
RD 3095	IVT-IRTS-FB-20	78.3	4	1	39.7	24	0	**50.5**	**14**	**0**
KB 2212	IVT-IRTS-FB-21	55.4	23	0	53.8	11	0	**44.7**	**22**	**0**
GB2	IVT-IRTS-FB-23	67.0	11	0	47.0	20	0	**49.3**	**17**	**0**
DWRB137 (C	IVT-IRTS-FB-16	66.2	14	0	46.5	21	0	**47.8**	**18**	**0**
HUB113 (C)	IVT-IRTS-FB-22	61.5	18	0	57.6	5	1	**50.4**	**15**	**0**
RD2899 (C)	IVT-IRTS-FB-24	79.2	3	1	57.7	4	1	**58.3**	**1**	**1**
BH 946 (C)	IVT-IRTS-FB-25	61.7	17	0	57.3	6	1	**52.3**	**10**	**0**
	G.M.	66.0			52.0			**50.4**		
	S.E.(M)	3.2			3.1			**1.6**		
	C.D. (10%)	7.6			7.5			**3.7**		
	C.V. (%)	6.8			8.5					
	DOS	17.11.23			21.11.23					

*Filler

Table 2.39. IVT–FB-(IR)-CZ-ancillary and disease data *Rabi* – 2023-24.

Name of Entry	Entry Code	Agronomic Characteristics					
		Days to Heading	Days to Maturity	Plant height (cm)	Tillers/ meter	Two/ Six Row	Spike length (cm)
HUB 291	IVT-IRTS-FB-1	79 (74-85)	118 (116-120)	99 (94-103)	108 (58-161)	6	8 (7-9)
DWRB 2303	IVT-IRTS-FB-2	74 (73-76)	116 (111-120)	91 (75-101)	102 (63-138)	6	9 (8-10)
RD 3093	IVT-IRTS-FB-3	79 (73-84)	120 (117-122)	104 (99-108)	90 (55-117)	6	9 (8-10)
*RD2907	IVT-IRTS-FB-4	78 (73-85)	122 (113-129)	94 (87-99)	111 (71-150)	6	9 (8-9)
PL 954	IVT-IRTS-FB-5	75 (68-81)	119 (115-125)	89 (74-98)	106 (66-148)	6	8 (7-10)
BH1059	IVT-IRTS-FB-6	74 (69-77)	120 (116-126)	98 (93-103)	104 (70-128)	6	8 (7-9)
UPB 1123	IVT-IRTS-FB-7	73 (68-76)	118 (114-123)	89 (80-95)	145 (65-222)	6	8 (7-9)
BH1058	IVT-IRTS-FB-8	73 (70-77)	120 (112-126)	97 (86-104)	115 (54-179)	6	8 (6-11)
HUB 290	IVT-IRTS-FB-9	78 (74-82)	120 (115-127)	103 (99-106)	100 (48-155)	6	9 (8-10)
GB1	IVT-IRTS-FB-10	78 (75-82)	115 (113-118)	97 (83-104)	86 (51-110)	6	9 (9-10)
DWRB 2302	IVT-IRTS-FB-11	70 (65-75)	116 (111-120)	92 (88-97)	98 (46-125)	6	9 (8-10)
PL 956	IVT-IRTS-FB-12	72 (66-81)	116 (110-124)	100 (97-103)	109 (63-135)	6	9 (8-10)
DWRB2319	IVT-IRTS-FB-13	73 (68-77)	115 (111-117)	93 (90-95)	83 (44-115)	6	8 (7-10)
UPB 1122	IVT-IRTS-FB-14	72 (67-76)	117 (112-122)	90 (85-101)	109 (50-147)	6	8 (7-10)
PL 955	IVT-IRTS-FB-15	75 (69-80)	120 (115-129)	97 (91-101)	97 (47-127)	6	8 (7-9)
RD3096	IVT-IRTS-FB-17	78 (75-82)	119 (116-123)	102 (96-108)	99 (38-149)	6	9 (8-11)
DWRB 2301	IVT-IRTS-FB-18	72 (67-74)	116 (114-120)	93 (85-100)	94 (41-126)	6	9 (7-10)
*DWRB64	IVT-IRTS-FB-19	71 (68-74)	117 (116-117)	86 (80-92)	89 (53-117)	6	8 (7-9)
RD 3095	IVT-IRTS-FB-20	73 (72-75)	117 (114-121)	94 (92-95)	110 (47-139)	6	9 (8-11)
KB 2212	IVT-IRTS-FB-21	82 (78-85)	121 (117-123)	103 (96-105)	89 (48-134)	6	10 (9-10)
GB2	IVT-IRTS-FB-23	77 (72-82)	117 (115-122)	99 (95-105)	96 (66-126)	6	9 (8-9)
DWRB137 (C)	IVT-IRTS-FB-16	70 (64-75)	115 (109-122)	84 (75-94)	113 (46-144)	6	9 (7-10)
HUB113 (C)	IVT-IRTS-FB-22	77 (70-82)	121 (111-128)	90 (85-97)	113 (55-183)	6	8 (7-10)
RD2899 (C)	IVT-IRTS-FB-24	77 (71-83)	121 (113-128)	93 (91-95)	128 (69-172)	6	8 (8-9)
BH 946 (C)	IVT-IRTS-FB-25	74 (68-78)	117 (111-125)	93 (86-98)	104 (59-156)	6	9 (8-10)

*Filler

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Name of Entry	Entry Code	Grain Characteristics			Disease
		Color (Y,LY,P ,A)	Hulled/ Hulless (H/N)	1000 Gr. Wt. (gm)	Leaf Blight
HUB 291	IVT-IRTS-FB-1	LY	H	38 (35-44)	56
DWRB 2303	IVT-IRTS-FB-2	LY	H	47 (44-50)	46
RD 3093	IVT-IRTS-FB-3	Y	H	41 (33-49)	35
*RD2907	IVT-IRTS-FB-4	LY	H	46 (43-50)	46
PL 954	IVT-IRTS-FB-5	LY	H	41 (39-42)	46
BH1059	IVT-IRTS-FB-6	LY	H	45 (43-46)	56
UPB 1123	IVT-IRTS-FB-7	LY	H	34 (32-38)	46
BH1058	IVT-IRTS-FB-8	LY	H	44 (40-50)	67
HUB 290	IVT-IRTS-FB-9	Y	H	45 (43-48)	46
GB1	IVT-IRTS-FB-10	Y	H	41 (33-45)	45
DWRB 2302	IVT-IRTS-FB-11	LY	H	42 (39-44)	56
PL 956	IVT-IRTS-FB-12	LY	H	46 (42-50)	67
DWRB2319	IVT-IRTS-FB-13	LY	H	39 (33-42)	45
UPB 1122	IVT-IRTS-FB-14	Y	H	38 (34-42)	45
PL 955	IVT-IRTS-FB-15	Y	H	41 (38-44)	46
RD3096	IVT-IRTS-FB-17	LY	H	40 (32-44)	45
DWRB 2301	IVT-IRTS-FB-18	Y	H	40 (38-42)	45
*DWRB64	IVT-IRTS-FB-19	LY	H	44 (42-48)	67
RD 3095	IVT-IRTS-FB-20	LY	H	46 (43-48)	78
KB 2212	IVT-IRTS-FB-21	LY	H	42 (38-44)	35
GB2	IVT-IRTS-FB-23	Y	H	45 (43-46)	57
DWRB137 (C)	IVT-IRTS-FB-16	Y	H	44 (38-48)	56
HUB113 (C)	IVT-IRTS-FB-22	LY	H	41 (39-43)	57
RD2899 (C)	IVT-IRTS-FB-24	Y	H	44 (42-46)	45
BH 946 (C)	IVT-IRTS-FB-25	LY	H	43 (42-46)	45

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INITIAL VARIETAL TRIAL-DUAL PURPOSE (IRRIGATED TIMELY SOWN)
IVT-DP- (NWPZ, NEPZ and CZ)

This trial was conducted at 16 locations across the NWPZ (Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, and Modipuram), NEPZ (Udaipur, Gwalior, Morena, Tikamgarh, Vijapur, and Dholpur), and the Central Zone (Kanpur, Varanasi, Kumarganj, and Ranchi). Data were successfully collected from all 16 locations. The trial included 12 test entries—DWRB2313, DWRB2314, DWRB2315, DWRB2316, DWRB2317, DWRB2318, JHSBD11, JHSBD22, JHSBF21, JHSBF28, JHSBB19, and JHSBE16—alongside two dual-purpose barley checks, RD2715 and RD2552.

In the NWPZ, data were received from all six locations; however, the data from Pantnagar were excluded due to non-compliance with the technical program, specifically the failure to cut all replications at 55 DAS. Additionally, data from Ludhiana, Modipuram, and Dholpur were not included in the zonal pooled analysis despite grain yield station means exceeding 22 q/ha, as the corresponding green fodder yields were below 125 q/ha. The pooled analysis for the zone included data from the remaining three locations—Hisar, Karnal, and Durgapura—where both grain yield and green fodder yield (obtained from the first cut at 55 DAS) were considered. Hisar was included despite its slightly lower green fodder yield.Grain yield ranged from 28.2 q/ha at Hisar to 47.5 q/ha at Durgapura, while green fodder yield ranged from 123.7 q/ha at Hisar to 203.2 q/ha at Karnal. The dual-purpose check variety RD2552 ranked 10th for grain yield (35.3 q/ha), and RD2715 ranked first for green fodder yield (197.7 q/ha). Six test entries—JHSBD22 (46.0 q/ha), JHSBF28 (42.0 q/ha), JHSBE16 (40.9 q/ha), DWRB2313 (40.0 q/ha), DWRB2318 (38.4 q/ha), and JHSBF21 (38.3 q/ha)—demonstrated significantly superior grain yield. However, no test entry was statistically superior to the best check variety RD2715 in terms of green fodder yield.

In the NEPZ, this trial was conducted at four locations, with data received from all sites. However, the data from Ranchi were excluded due to non-compliance with the technical program, specifically the failure to cut all replications at 55 DAS. Additionally, data from Varanasi, due to low site means for both grain and green fodder yields, and Kumarganj, due to a low site mean for green fodder yield, were also rejected. At the Kanpur location, the average grain yield across entries was 31.2 q/ha, and the green fodder yield was 125.7 q/ha. The test entry DWRB2318 achieved the highest grain yield (39.1 q/ha), while the check variety RD2715 recorded the highest green fodder yield (135.0 q/ha). Given that data were available from only one location, no decisions regarding the promotion of entries in this zone can be made.

In the Central Zone, this trial was conducted at five locations, with data provided by all sites. However, data from Morena and Vijapur were excluded due to non-compliance with the technical program, specifically the failure to cut all replications at 55 DAS. The Tikkamgarh location was also excluded from the pooled analysis due to a low site mean observed for green fodder yield. The pooled analysis of the remaining locations revealed that the highest site means for both grain yield (34.6 q/ha) and green fodder yield (283.0 q/ha) were recorded at the Gwalior location. The zonal means for grain yield and green fodder yield were 31.2 q/ha and 247.4 q/ha, respectively. The test entry DWRB2316 stood out, ranking first for both grain yield (43.6 q/ha) and green fodder yield (320.3 q/ha), and was the only entry in the first non-significant group (NSG). The grain and fodder yields recorded by DWRB2316 were significantly superior to those of the best check variety, RD2715. A monitoring team visited the barley trials at Morena, Gwalior, and Tikamgarh in the Central Zone (CZ). All trials were conducted properly and were found to be free from rust.

Table 2.40. IVT-DP-IR-TS-NWPZ- Grain Yield and Green Fodder Yield (q/ha) *Rabi* 2023-24.

Name of Entry	Entry Code	Hisar						Karnal						Durgapura						Zonal Mean					
		GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G
DWRB 2314	IVT-DPB-E1	22.2	13	0	97.5	12	0	37.6	6	1	184.8	12	0	32.7	14	0	193.5	6	0	**30.8**	**12**	**0**	**158.6**	**12**	**0**
JHSBB19	IVT-DPB-E2	28.6	7	0	152.9	2	1	37.3	8	1	210.9	5	0	47.0	10	0	177.5	10	0	**37.6**	**7**	**0**	**180.5**	**4**	**0**
JHSBE16	IVT-DPB-E4	33.5	3	0	131.2	5	0	40.5	3	1	166.6	14	0	48.8	8	0	204.0	2	0	**40.9**	**3**	**0**	**167.2**	**7**	**0**
JHSBD22	IVT-DPB-E5	42.0	1	1	161.6	1	1	41.9	2	1	227.3	2	1	54.0	1	1	195.3	5	0	**46.0**	**1**	**1**	**194.7**	**2**	**1**
DWRB2316	IVT-DPB-E6	22.9	12	0	86.2	14	0	38.4	5	1	221.2	3	0	50.7	5	0	184.8	8	0	**37.3**	**8**	**0**	**164.1**	**9**	**0**
JHSBD11	IVT-DPB-E7	24.3	10	0	128.3	7	0	25.7	12	0	203.7	7	0	50.2	6	0	235.5	1	1	**33.4**	**11**	**0**	**189.1**	**3**	**1**
DWRB2317	IVT-DPB-E9	23.9	11	0	86.6	13	0	33.4	9	0	205.5	6	0	49.1	7	0	171.0	12	0	**35.5**	**9**	**0**	**154.4**	**13**	**0**
DWRB2318	IVT-DPB-E10	32.2	4	0	147.8	3	1	37.4	7	1	199.9	8	0	45.6	12	0	192.0	7	0	**38.4**	**5**	**0**	**179.9**	**5**	**0**
DWRB 2313	IVT-DPB-E11	24.8	9	0	110.9	10	0	42.0	1	1	187.7	11	0	53.3	2	1	181.5	9	0	**40.0**	**4**	**0**	**160.0**	**10**	**0**
JHSBF28	IVT-DPB-E12	40.4	2	1	127.5	8	0	39.6	4	1	167.7	13	0	45.9	11	0	166.3	13	0	**42.0**	**2**	**0**	**153.9**	**14**	**0**
JHSBF21	IVT-DPB-E13	30.3	5	0	125.0	9	0	32.1	10	0	197.2	9	0	52.6	3	1	156.9	14	0	**38.3**	**6**	**0**	**159.7**	**11**	**0**
DWRB 2315	IVT-DPB-E14	26.1	8	0	108.0	11	0	21.5	13	0	214.4	4	0	36.3	13	0	177.0	11	0	**28.0**	**13**	**0**	**166.4**	**8**	**0**
RD 2552 (C)	IVT-DPB-E3	30.0	6	0	139.9	4	1	28.4	11	0	190.7	10	0	47.7	9	0	197.5	3	0	**35.3**	**10**	**0**	**176.0**	**6**	**0**
RD 2715 (C)	IVT-DPB-E8	13.4	14	0	129.0	6	0	18.4	14	0	268.0	1	1	51.8	4	1	196.0	4	0	**27.9**	**14**	**0**	**197.7**	**1**	**1**
	G.M.	28.2			123.7			33.9			203.2			47.5			187.8			**36.5**			**171.6**		
	S.E.(M)	1.4			7.8			2.5			15.0			1.1			5.6			**1.026**			**5.942**		
	C.D. (10%)	4.1			22.3			7.1			42.9			3.3			16.1			**2.4**			**14.0**		
	C.V. (%)	10.1			12.6			14.7			14.8			4.8			6.0								
	DOS	11.11.23						6.11.23						6.11.23											

No. of Trials : Proposed = 7 Conducted = 7

Trial not conducted (00) = Nil

Trial rejected (01): Pantnagar, Technical programme to cut all the replications at 55DAS not followed

Trials Data received but not considered for pooled analysis (03) = Ludhiana, Modipuram and Dholpur (Though the station means for grain yields were > 22 q/ha at these locations, but the corresponding means for green fodder are <125 q/ha)

Table 2.41. IVT-DP-IR-TS –NWPZ- Income from grain yield and forage yield per hectare.

S.N.	Genotype	Grain yield ZM	CD	Check Yield + CD	Forage Yield ZM	CD	Check forage Yield + CD	Grain rates/Qtls MSP	Forage rates/qtls	Income from grain (Rs.)	Income from forage (Rs.)	Total Income
1	DWRB 2314	**30.8**			**158.6**			1850	300	56980	47580	104560
2	JHSBB19*	**37.6**			**180.5**			1850	300	69560	54150	123710
3	JHSBE16*	**40.9**			**167.2**			1850	300	75665	50160	125825
4	JHSBD22*	**46**			**194.7**			1850	300	85100	58410	143510
5	DWRB2316	**37.3**			**164.1**			1850	300	69005	49230	118235
6	JHSBD11	**33.4**			**189.1**			1850	300	61790	56730	118520
7	DWRB2317	**35.5**			**154.4**			1850	300	65675	46320	111995
8	DWRB2318*	**38.4**			**179.9**			1850	300	71040	53970	125010
9	DWRB 2313*	**40**			**160**			1850	300	74000	48000	122000
10	JHSBF28*	**42**			**153.9**			1850	300	77700	46170	123870
11	JHSBF21	**38.3**			**159.7**			1850	300	70855	47910	118765
12	DWRB 2315	**28**			**166.4**			1850	300	51800	49920	101720
13	RD 2552 (C)*	**35.3**			**176**			1850	300	69745	57000	126745
14	RD 2715 (C)	**27.9**	**2.4**	30.3	**197.7**	**14**	211.7	1850	300	56055	63510	119565
	G.M.	**36.5**			**171.6**							
	S.E.(M)	**1.026**			**5.942**							
	C.D. (10%)	**2.4**			**14**							
	C.V. (%)											
	DOS											

* Entries JHSBB19, JHSBB16, JHSBB22, JHSBB28, DWRB 2318 and DWRB 2313 gave significantly higher income per hectare than check RD2715.

Table 2.42. IVT–DP- NWPZ-ancillary and disease data *Rabi* – 2023-24.

Entry Name	Entry Code	Agronomic Characteristics						Grain Characteristics			Disease Reactions
		Days to Heading	Days to Maturity	Plant height (cm)	Tillers/ meter	Two/ Six Row	Spike length (cm)	Color (Y,LY,P, A)	Hulled/ Hulless (H/N)	1000 Gr. Wt. (gm)	LB
DWRB 2314	IVT-DPB-E1	106 (99-111)	142 (135-153)	95 (87-107)	106 (68-161)	6	8 (6-10)	LY	H	27 (20-36)	23
JHSBB19	IVT-DPB-E2	109 (104-113)	146 (138-157)	90 (85-99)	112 (76-174)	6	7 (5-10)	LY	H	29 (25-32)	24
JHSBE16	IVT-DPB-E4	104 (98-113)	145 (139-156)	102 (90-116)	123 (104-160)	6	8 (6-9)	LY	H	36 (34-37)	23
JHSBD22	IVT-DPB-E5	108 (101-114)	145 (138-156)	87 (81-94)	134 (110-167)	6	8 (6-10)	LY	H	34 (32-37)	34
DWRB2316	IVT-DPB-E6	107 (101-112)	147 (141-156)	97 (91-108)	121 (84-180)	6	9 (6-11)	LY	H	34 (31-37)	35
JHSBD11	IVT-DPB-E7	106 (97-115)	144 (136-156)	96 (92-102)	90 (56-143)	6	8 (6-10)	LY	H	35 (32-39)	24
DWRB2317	IVT-DPB-E9	105 (98-114)	145 (135-156)	89 (81-94)	149 (66-268)	2	8 (7-10)	Y	H	44 (37-51)	35
DWRB2318	IVT-DPB-E10	107 (100-113)	142 (135-153)	87 (83-94)	110 (80-154)	6	8 (6-9)	Y	H	37 (34-41)	35
DWRB 2313	IVT-DPB-E11	107 (99-111)	146 (140-156)	96 (87-106)	108 (68-145)	6	9 (8-9)	LY	H	30 (25-37)	13
JHSBF28	IVT-DPB-E12	110 (105-114)	145 (140-153)	102 (95-110)	108 (52-160)	6	8 (6-10)	LY	H	38 (34-42)	46
JHSBF21	IVT-DPB-E13	110 (106-115)	144 (136-153)	102 (92-114)	112 (70-172)	6	9 (7-11)	LY	H	35 (33-38)	45
DWRB 2315	IVT-DPB-E14	110 (106-115)	146 (138-156)	96 (86-102)	118 (90-159)	6	8 (7-9)	Y	H	28 (25-33)	13
RD 2552 (C)	IVT-DPB-E3	106 (100-113)	145 (137-156)	91 (85-94)	140 (104-195)	6	6 (5-7)	Y	H	35 (33-36)	57
RD 2715 (C)	IVT-DPB-E8	106 (100-112)	144 (139-153)	93 (80-104)	82 (50-137)	6	10 (8-12)	LY	H	35 (31-39)	67

Table 2.43. IVT-DP-NEPZ- GY & GFY (q/ha) *Rabi* 2023-24.

Name of Entry	Entry Code	Kanpur					
		GY	Rk	G	GFY	Rk	G
DWRB 2314	IVT-DPB-E1	37.3	4	1	111.2	12	1
JHSBB19	IVT-DPB-E2	34.6	6	1	119.2	11	1
JHSBE16	IVT-DPB-E4	33.7	8	1	135.1	2	1
JHSBD22	IVT-DPB-E5	23.6	11	0	133.5	5	1
DWRB2316	IVT-DPB-E6	34.4	7	1	133.5	5	1
JHSBD11	IVT-DPB-E7	23.6	11	0	110.3	13	1
DWRB2317	IVT-DPB-E9	22.1	13	0	133.8	4	1
DWRB2318	IVT-DPB-E10	39.1	1	1	135.0	3	1
DWRB 2313	IVT-DPB-E11	32.6	9	1	124.3	9	1
JHSBF28	IVT-DPB-E12	38.0	3	1	122.4	10	1
JHSBF21	IVT-DPB-E13	38.4	2	1	109.4	14	1
DWRB 2315	IVT-DPB-E14	26.4	10	0	130.3	7	1
RD 2552 (C))	IVT-DPB-E3	37.0	5	1	126.1	8	1
RD 2715 (C)	IVT-DPB-E8	16.3	14	0	135.3	1	1
	G.M.	31.2			125.7		
	S.E.(M)	2.5			10.2		
	C.D. (10%)	7.2			29.1		
	C.V. (%)	16.1			16.2		
	DOS	14.11.23					

GY : Grain Yield **GFY : Green Fodder Yield**

No. of Trials : Proposed = 4 Conducted = 4
Trial not conducted (00) = Nil
Data rejected (01): Ranchi, Technical programme to cut al the replications at 55DAS not followed
Trials not considered for pooled analysis (02) = Varanasi (LSM both for grain yield and green fodder yield); Kumarganj (LSM for green fodder yield)

Table 2.44. IVT–DP- NEPZ-ancillary and disease data *Rabi* – 2023-24.

Entry Name	Entry Code	Agronomic Characteristics						Grain Characteristics			Dieases
		Days to Heading	Days to Maturity	Plant height (cm)	Tillers/ meter	Two/ Six Row	Spike length (cm)	Color (Y,LY,P, A)	Hulled/ Hulless (H/N)	1000 Gr. Wt. (gm)	LB
DWRB 2314	IVT-DPB-E1	87	126	75	119	6	6	LY	H	26	24
JHSBB19	IVT-DPB-E2	92	129	69	128	6	6	LY	H	26	12
JHSBE16	IVT-DPB-E4	92	129	77	130	6	7	LY	H	27	36
JHSBD22	IVT-DPB-E5	91	129	52	129	6	8	Y	H	27	47
DWRB2316	IVT-DPB-E6	91	130	67	120	6	7	LY	H	33	12
JHSBD11	IVT-DPB-E7	94	131	60	107	6	9	LY	H	28	24
DWRB2317	IVT-DPB-E9	88	129	57	113	2	7	LY	H	37	24
DWRB2318	IVT-DPB-E10	73	131	80	114	6	7	LY	H	29	12
DWRB 2313	IVT-DPB-E11	91	132	67	130	6	8	LY	H	32	24
JHSBF28	IVT-DPB-E12	91	132	65.2	129	6	6	Y	H	27	56
JHSBF21	IVT-DPB-E13	94	131	66.6	128	6	6	LY	H	26	47
DWRB 2315	IVT-DPB-E14	85	126	73	129	6	8	LY	H	27	12
RD 2552 (C))	IVT-DPB-E3	94	132	74	127	6	5	LY	H	29	36
RD 2715 (C)	IVT-DPB-E8	92	132	68	94	6	9	Y	H	29	89

Table 2.45. IVT-DP-CZ- GY & GFY (q/ha) *Rabi* 2023-24.

Name of Entry	Entry Code	Udaipur						Gwalior						Zonal Mean					
		GY	**Rk**	**G**	**GFY**	**Rk**	**G**	**GY**	**Rk**	**G**	**GFY**	**Rk**	**G**	**GY**	**Rk**	**G**	**GFY**	**Rk**	**G**
DWRB 2314	IVT-DPB-E1	31.3	5	0	197.1	11	0	28.8	12	0	350.2	2	0	**30.1**	**8**	**0**	**273.7**	**2**	**0**
JHSBB19	IVT-DPB-E2	24.6	9	0	229.0	5	1	31.2	10	0	199.3	13	0	**27.9**	**11**	**0**	**214.1**	**12**	**0**
JHSBE16	IVT-DPB-E4	20.8	13	0	226.1	7	1	42.8	2	0	223.4	12	0	**31.8**	**5**	**0**	**224.8**	**11**	**0**
JHSBD22	IVT-DPB-E5	20.1	14	0	241.3	1	1	38.8	4	0	259.7	10	0	**29.5**	**9**	**0**	**250.5**	**7**	**0**
DWRB2316	IVT-DPB-E6	34.7	2	0	223.9	8	1	52.5	1	1	416.7	1	1	**43.6**	**1**	**1**	**320.3**	**1**	**1**
JHSBD11	IVT-DPB-E7	29.3	7	0	234.8	2	1	31.9	7	0	308.0	3	0	**30.6**	**7**	**0**	**271.4**	**3**	**0**
DWRB2317	IVT-DPB-E9	23.9	10	0	189.9	12	0	29.6	11	0	187.2	14	0	**26.8**	**12**	**0**	**188.5**	**14**	**0**
DWRB2318	IVT-DPB-E10	31.5	4	0	219.6	9	1	31.4	9	0	259.7	10	0	**31.5**	**6**	**0**	**239.6**	**9**	**0**
DWRB 2313	IVT-DPB-E11	30.3	6	0	232.2	3	1	33.9	6	0	308.0	3	0	**32.1**	**4**	**0**	**270.1**	**4**	**0**
JHSBF28	IVT-DPB-E12	32.7	3	0	111.6	14	0	31.8	8	0	308.0	3	0	**32.3**	**3**	**0**	**209.8**	**13**	**0**
JHSBF21	IVT-DPB-E13	40.2	1	1	187.0	13	0	41.0	3	0	289.9	6	0	**40.6**	**2**	**0**	**238.4**	**10**	**0**
DWRB 2315	IVT-DPB-E14	21.6	12	0	231.2	4	1	28.2	14	0	277.8	9	0	**24.9**	**14**	**0**	**254.5**	**6**	**0**
RD 2552 (C)	IVT-DPB-E3	24.9	8	0	213.8	10	1	28.4	13	0	283.8	8	0	**26.7**	**13**	**0**	**248.8**	**8**	**0**
RD 2715 (C)	IVT-DPB-E8	21.8	11	0	229.0	5	1	34.2	5	0	289.9	6	0	**28.0**	**10**	**0**	**259.4**	**5**	**0**
	G.M.	27.7			211.9			34.6			283.0			**31.2**			**247.4**		
	S.E.(M)	1.7			13.6			0.5			7.0			**0.903**			**7.632**		
	C.D. (10%)	5.0			38.9			1.3			19.9			**2.1**			**17.9**		
	C.V. (%)	12.6			12.8			2.7			4.9								
	DOS	19.11.23						26.11.23											

GY : Grain Yield **GFY : Green Fodder Yield**

No. of Trials : Proposed = 5 Conducted = 5
Trial not conducted (00) = Nil
Data rejected (02): Morena, Vijapur, Technical programme to cut al the replications at 55DAS not followed
Trials not considered for pooled analysis (01) = Tikkamgarh (LSM for green fodder yield)

Table 2.46. IVT -DP-IR-TS-CZ- Income from grain yield and forage yield per hectare.

SN	Entry	Grain yield ZM	CD		Forage Yield ZM	CD		Grain rates/Qtls MSP	Forage rates/qtls	Income from grain (Rs.)	Income from forage (Rs.)	Total Income (Rs.)/ha.
1	DWRB 2314	30.1		30.1	273.7		273.7	1850	300	55685	82110	137795@
2	JHSBB19	27.9		27.9	214.1		214.1	1850	300	51615	64230	115845
3	JHSBE16	31.8		31.8	224.8		224.8	1850	300	58830	67440	126270
4	JHSBD22	29.5		29.5	250.5		250.5	1850	300	54575	75150	129725
5	DWRB2316	43.6		43.6	320.3		320.3	1850	300	80660	96090	176750**
6	JHSBD11	30.6		30.6	271.4		271.4	1850	300	56610	81420	138030@
7	DWRB2317	26.8		26.8	188.5		188.5	1850	300	49580	56550	106130
8	DWRB2318	31.5		31.5	239.6		239.6	1850	300	58275	71880	130155
9	DWRB 2313	32.1		32.1	270.1		270.1	1850	300	59385	81030	140415**
10	JHSBF28	32.3		32.3	209.8		209.8	1850	300	59755	62940	122695
11	JHSBF21	40.6		40.6	238.4		238.4	1850	300	75110	71520	146630**
12	DWRB 2315	24.9		24.9	254.5		254.5	1850	300	46065	76350	122415
13	RD 2552 (C)	26.7		26.7	248.8		248.8	1850	300	49395	74640	124035
14	RD 2715 (C)	28	2.1	30.1	259.4	17.9	276.3	1850	300	55685	82890	138575
	G.M.	31.2			247.4							
	S.E.(M)	0.903			7.632							
	C.D. (10%)	2.1			17.9							
	C.V. (%)											
	DOS											

** Entries DWRB2316, DWRB 2313 and JHSBF21 gave significantly higher income per hectare than check RD2715.

Table 2.47. IVT–DP- CZ-ancillary and disease data *Rabi* – 2023-24.

Entry Name	Entry Code	Agronomic Characteristics						Grain Characteristics			Disease Reactions
		Days to Heading	Days to Maturity	Plant height (cm)	Tillers/ meter	Two/ Six Row	Spike length (cm)	Color (Y,LY,P, A)	Hulled/ Hulless (H/N)	1000 Gr. Wt. (gm)	LB
DWRB 2314	IVT-DPB-E1	55 (1-94)	113 (94-128)	93 (61-128)	107 (75-128)	6	7 (7-7)	LY	H	25 (21-28)	56
JHSBB19	IVT-DPB-E2	58 (2-98)	117 (98-134)	95 (53-134)	109 (87-134)	6	8 (7-8)	LY	H	32 (26-38)	46
JHSBE16	IVT-DPB-E4	57 (4-100)	118 (100-135)	97 (60-135)	121 (89-140)	6	8 (7-8)	LY	H	32 (23-41)	46
JHSBD22	IVT-DPB-E5	56 (5-98)	116 (98-131)	92 (49-131)	108 (71-131)	6	7 (6-7)	LY	H	31 (28-34)	46
DWRB2316	IVT-DPB-E6	61 (6-103)	119 (103-134)	97 (60-134)	118 (88-134)	6	7 (6-7)	LY	H	30 (24-35)	56
JHSBD11	IVT-DPB-E7	60 (7-99)	115 (99-129)	99 (63-129)	124 (96-146)	6	7 (7-7)	LY	H	31 (25-36)	46
DWRB2317	IVT-DPB-E9	60 (9-96)	114 (96-131)	92 (52-131)	104 (75-131)	2	8 (6-8)	Y	H	40 (32-48)	46
DWRB2318	IVT-DPB-E10	60 (10-99)	116 (99-129)	94 (54-129)	109 (80-129)	6	7 (6-7)	Y	H	35 (30-39)	45
DWRB 2313	IVT-DPB-E11	62 (11-102)	119 (102-135)	100 (66-135)	113 (84-135)	6	8 (6-8)	LY	H	27 (23-31)	56
JHSBF28	IVT-DPB-E12	62 (12-97)	116 (97-133)	99 (55-133)	114 (62-147)	6	7 (6-7)	LY	H	32 (23-40)	67
JHSBF21	IVT-DPB-E13	64 (13-101)	117 (101-134)	100 (67-134)	118 (93-134)	6	8 (7-8)	LY	H	34 (26-41)	45
DWRB 2315	IVT-DPB-E14	63 (14-101)	116 (101-132)	94 (52-132)	113 (79-132)	6	7 (7-7)	Y	H	26 (23-29)	45
RD 2552 (C)	IVT-DPB-E3	59 (3-99)	118 (99-135)	97 (61-135)	124 (69-169)	6	6 (6-6)	Y	H	30 (23-37)	35
RD 2715 (C)	IVT-DPB-E8	58 (8-96)	112 (96-125)	95 (66-125)	108 (88-125)	6	8 (7-8)	LY	H	32 (22-41)	67

Trial rejected - IVT-RF-NEPZ

Entry name	Varanasi			Sabour			Ranchi		
	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
IVT-RF-NEPZ-1	7.43	12	0	5.37	12	0	21.74	3	0
IVT-RF-NEPZ-2	10.51	6	0	10.77	8	0	2.50	10	0
IVT-RF-NEPZ-3	9.96	9	0	9.50	9	0	0.62	12	0
IVT-RF-NEPZ-4	9.96	9	0	9.33	10	0	1.92	11	0
IVT-RF-NEPZ-5	0.00	13	0	0.00	13	0	0.00	13	0
IVT-RF-NEPZ-6	11.96	4	0	12.02	7	0	8.70	8	0
IVT-RF-NEPZ-7	9.78	11	0	13.63	6	0	7.97	9	0
IVT-RF-NEPZ-8	10.18	8	0	8.56	11	0	27.54	1	1
IVT-RF-NEPZ-9	15.36	1	1	18.44	3	0	18.84	6	0
IVT-RF-NEPZ-10	14.58	2	0	19.63	2	1	22.10	2	0
IVT-RF-NEPZ-11	12.50	3	0	21.41	1	1	18.84	6	0
IVT-RF-NEPZ-12	10.51	6	0	16.22	4	0	19.57	5	0
IVT-RF-NEPZ-13	11.41	5	0	15.47	5	0	20.29	4	0
G.M.	11.18			13.36			14.22		
S.E.(M)	0.23			0.94			1.35		
C.D.	0.55			2.26			3.24		
C.V.	4.12			14.13			19.03		
DOS	10.11.23			4.11.23			3.11.23		
	LSM			**LSM**			**LSM**		

Trial rejected - IVT/AVT-Sal-Alk

Entry name	Hisar-1		
	Yield	Rk	G
AVT/IVT-SAL-ALK -1	9.65	15	0
AVT/IVT-SAL-ALK -2	13.95	5	1
AVT/IVT-SAL-ALK -3	14.46	3	1
AVT/IVT-SAL-ALK -4	13.37	10	1
AVT/IVT-SAL-ALK -5	13.47	8	1
AVT/IVT-SAL-ALK -6	11.75	11	0
AVT/IVT-SAL-ALK -7	13.46	9	1
AVT/IVT-SAL-ALK -8	13.83	7	1
AVT/IVT-SAL-ALK -9	10.86	13	0
AVT/IVT-SAL-ALK -10	7.24	18	0
AVT/IVT-SAL-ALK -11	7.47	17	0
AVT/IVT-SAL-ALK -12	9.36	16	0
AVT/IVT-SAL-ALK -13	11.06	12	0
AVT/IVT-SAL-ALK -14	20.70	1	1
AVT/IVT-SAL-ALK -15	13.94	6	1
AVT/IVT-SAL-ALK -16	10.45	14	0
AVT/IVT-SAL-ALK -17	14.24	4	1
AVT/IVT-SAL-ALK -18	14.73	2	1
G.M.	12.16		
S.E.(M)	3.14		
C.D.	7.43		
C.V.	51.57	**LSM**	
DOS	20.11.23		

Trials rejected - AVT-Hulless (NWPZ)
Grain Yield Data (q/ha) *Rabi 2023-24*

Entry name	Entry code	Pantnagar		
		Yield	Rk	G
DWRB223	AVT-IR-NB-NWPZ-4	18.92	5	0
DWRB244	AVT-IR-NB-NWPZ-1	20.33	3	0
K-1149 (C)	AVT-IR-NB-NWPZ-3	26.47	1	1
Karan16 (c)	AVT-IR-NB-NWPZ-5	22.20	2	0
PL891 (C)	AVT-IR-NB-NWPZ-2	19.36	4	0
G.M.		**21.46**		
S.E.(M)		0.53		
C.D.		1.31		
C.V.		5.52		
DOS		20.11.2023	**Low Site Mean**	

Pantnagar location was rejected due to low site mean.

Trials Rejected - AVT-Hulless (CZ)
Grain Yield Data (q/ha) *Rabi 2023-24*

Entry name	Entry code	Gwalior			Morena			Vijapur		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
DWRB223	AVT-IR-NB-CZ-5	19.79	2	0	28.92	4	0	13.30	4	0
DWRB244	AVT-IR-NB-CZ-4	22.63	1	1	29.58	3	0	17.05	3	0
K1149 (C)	AVT-IR-NB-CZ-1	18.05	5	0	36.64	1	1	33.55	1	1
Karan16 (C)	AVT-IR-NB-CZ-3	18.26	4	0	27.79	5	0	20.91	2	0
PL891 (C)	AVT-IR-NB-CZ-2	18.41	3	0	36.64	1	1	12.34	5	0
G.M.		**19.43**			**31.91**			**19.43**		
S.E.(M)		0.80			0.83			1.11		
C.D.		1.97			2.04			2.75		
C.V.		9.19			5.78			12.82		
DOS		02.12.2023 **LSM**			16.12.2023 **Late Sowing**			10.11.2023 **LSM**		

Gwalior and Vijapur locations were rejected due to low site mean and Morena location for delayed sowing of the trial.

Trials rejected - IVT-Hulless (NWPZ)
Grain Yield Data (q/ha) *Rabi 2023-24*

Entry name	Entry code	Pantnagar		
		Yield	Rk	G
DWRB2304	IVT-IR-NB-5	20.74	7	0
DWRB2305	IVT-IR-NB-7	8.45	11	0
DWRB2306	IVT-IR-NB-8	16.62	10	0
PL960	IVT-IR-NB-1	25.64	5	0
RD3088	IVT-IR-NB-10	18.12	9	0
RD3089	IVT-IR-NB-13	30.65	1	1
RD3090	IVT-IR-NB-3	25.13	6	0
RD3091	IVT-IR-NB-4	5.87	13	0
RD3092	IVT-IR-NB-2	25.88	3	0
UPB1121	IVT-IR-NB-12	28.09	2	1
K1149 (C)	IVT-IR-NB-6	20.34	8	0
Karan16 (C)	IVT-IR-NB-9	25.66	4	0
PL891 (C)	IVT-IR-NB-11	7.23	12	0
G.M.		**19.88**		
S.E.(M)		1.10		
C.D.		**2.67**		
C.V.		**9.60**		
DOS		20.11.2023		

Trial rejected due low site mean at Pantnagar location.

Trials rejected - IVT Hulless (NEPZ)

Grain Yield Data (q/ha) - LSM Rabi 2023-24

Entry name	Entry code	Varanasi			Ranchi		
		Yield	Rk	G	Yield	Rk	G
DWRB2304	IVT-IR-NB-5	12.80	4	0	9.18	11	0
DWRB2305	IVT-IR-NB-7	9.54	13	0	3.38	13	0
DWRB2306	IVT-IR-NB-8	13.29	2	0	5.80	12	0
PL960	IVT-IR-NB-1	13.04	3	0	16.43	7	0
RD3088	IVT-IR-NB-10	10.27	9	0	32.85	2	1
RD3089	IVT-IR-NB-13	11.23	6	0	30.43	4	0
RD3090	IVT-IR-NB-3	9.66	12	0	12.08	9	0
RD3091	IVT-IR-NB-4	10.99	7	0	31.40	3	0
RD3092	IVT-IR-NB-2	10.02	11	0	21.26	6	0
UPB1121	IVT-IR-NB-12	10.14	10	0	35.27	1	1
K1149 (C)	IVT-IR-NB-6	15.94	1	1	24.64	5	0
Karan16 (C)	IVT-IR-NB-9	12.56	5	0	16.43	7	0
PL891 (C)	IVT-IR-NB-11	10.39	8	0	10.14	10	0
G.M.		**11.53**			**19.18**		
S.E.(M)		0.42			1.51		
C.D.		1.01			3.65		
C.V.		6.26			13.63		
DOS		20.11.2023			10.11.2023		

Trial rejected due to low site mean at Varanasi and Ranchi.

Trials rejected - IVT-Hulless (CZ)

Grain Yield Data (q/ha) Rabi 2023-24

Entry name	Entry code	Morena			Vijapur		
		Yield	Rk	G	Yield	Rk	G
DWRB2304	IVT-IR-NB-5	50.59	2	0	29.97	1	1
DWRB2305	IVT-IR-NB-7	35.19	9	0	3.69	13	0
DWRB2306	IVT-IR-NB-8	48.39	3	0	9.28	11	0
PL960	IVT-IR-NB-1	39.07	6	0	21.06	5	0
RD3088	IVT-IR-NB-10	37.21	8	0	15.83	7	0
RD3089	IVT-IR-NB-13	33.82	10	0	10.00	10	0
RD3090	IVT-IR-NB-3	26.11	11	0	5.81	12	0
RD3091	IVT-IR-NB-4	38.57	7	0	19.64	6	0
RD3092	IVT-IR-NB-2	39.45	5	0	12.17	8	0
UPB1121	IVT-IR-NB-12	25.19	12	0	25.33	2	0
K1149(C)	IVT-IR-NB-6	47.67	4	0	24.94	3	0
Karan16 (C)	IVT-IR-NB-9	57.25	1	1	22.58	4	0
PL891 (C)	IVT-IR-NB-11	21.84	13	0	11.08	9	0
	G.M.	**38.49**			**16.26**		
	S.E.(M)	1.89			1.10		
	C.D.	4.57			2.65		
	C.V.	8.50			11.68		
	DOS	16.12.2023 **Late Sowing**			10.11.2023	**LSM**	

The trial was rejected at the Morena location due to delayed sowing and at the Vijapur centre due to a low site mean**.**

Trials rejected - IVT/AVT-RF-NHZ-Uncut (Normal trial)

Grain Yield Data (q/ha)

Entry name	Entry code	Majhera

		Yield	Rk	G
BHS497	AVT-RF-NHZ-8	13.82	9	1
BHS498	AVT-RF-NHZ-22	11.90	19	0
BHS499	AVT-RF-NHZ-2	14.49	4	1
BHS500	AVT-RF-NHZ-21	11.90	19	0
BHS501	AVT-RF-NHZ-4	13.10	16	0
BHS502	AVT-RF-NHZ-20	14.49	4	1
HBL884	AVT-RF-NHZ-15	10.46	23	0
HBL885	AVT-RF-NHZ-23	13.25	13	1
HBL886	AVT-RF-NHZ-5	12.94	18	0
HBL888	AVT-RF-NHZ-9	15.84	1	1
UPB1118	AVT-RF-NHZ-12	14.70	3	1
UPB1119	AVT-RF-NHZ-11	11.90	19	0
UPB1120	AVT-RF-NHZ-6	14.49	4	1
VLB184	AVT-RF-NHZ-3	13.25	13	1
VLB185	AVT-RF-NHZ-19	13.25	13	1
VLB186	AVT-RF-NHZ-18	11.90	19	0
VLB187	AVT-RF-NHZ-24	13.66	10	1
VLB188	AVT-RF-NHZ-1	13.04	17	0
VLB189	AVT-RF-NHZ-17	13.46	11	1
BHS380 (C)	AVT-RF-NHZ-10	13.46	11	1
BHS400 (C)	AVT-RF-NHZ-7	14.39	7	1
BHS352 (C)	AVT-RF-NHZ-14	15.73	2	1
HBL113 (C)	AVT-RF-NHZ-16	9.21	24	0
VLB118 (C)	AVT-RF-NHZ-13	14.34	8	1
G.M.		**13.29**		
S.E.(M)		1.10		
C.D.		2.66		
C.V.		11.68		
DOS		30.10.2023	**Low Site Mean**	

Majhera location was rejected due to low site mean.

Trials rejected - IVT/AVT-RF-NHZ-Cut (Dual purpose)

Grain Yield Data (q/ha) – Low Site Mean

Entry name	Entry code	Majhera			Almora		
		Yield	Rk	G	Yield	Rk	G
BHS497	AVT-RF-NHZ-8	11.39	16	1	13.39	21	0
BHS498	AVT-RF-NHZ-22	11.39	16	1	22.46	2	0
BHS499	AVT-RF-NHZ-2	13.10	5	1	9.67	24	0
BHS500	AVT-RF-NHZ-21	10.56	20	0	12.95	23	0
BHS501	AVT-RF-NHZ-4	11.49	15	1	15.30	17	0
BHS502	AVT-RF-NHZ-20	7.87	24	0	13.80	20	0
HBL884	AVT-RF-NHZ-15	10.25	22	0	17.98	9	0
HBL885	AVT-RF-NHZ-23	12.01	10	1	18.86	8	0
HBL886	AVT-RF-NHZ-5	11.90	11	1	17.43	12	0
HBL888	AVT-RF-NHZ-9	12.94	8	1	14.50	19	0
UPB1118	AVT-RF-NHZ-12	11.90	11	1	20.04	3	0
UPB1119	AVT-RF-NHZ-11	9.73	23	0	15.66	15	0
UPB1120	AVT-RF-NHZ-6	10.77	19	1	17.43	12	0
VLB184	AVT-RF-NHZ-3	11.90	11	1	17.87	10	0
VLB185	AVT-RF-NHZ-19	13.04	6	1	19.19	6	0
VLB186	AVT-RF-NHZ-18	12.11	9	1	19.21	5	0
VLB187	AVT-RF-NHZ-24	13.25	4	1	20.00	4	0
VLB188	AVT-RF-NHZ-1	13.04	7	1	19.01	7	0
VLB189	AVT-RF-NHZ-17	13.98	1	1	13.04	22	0
BHS380 (C)	AVT-RF-NHZ-10	13.46	3	1	16.76	14	0
BHS400 (C)	AVT-RF-NHZ-7	13.87	2	1	25.63	1	1
BHS352 (C)	AVT-RF-NHZ-14	10.87	18	1	15.64	16	0
HBL113 (C)	AVT-RF-NHZ-16	10.56	20	0	15.11	18	0
VLB118 (C)	AVT-RF-NHZ-13	11.90	11	1	17.67	11	0
	G.M.	**11.80**			**17.03**		
	S.E.(M)	1.39			0.71		
	C.D.	3.36			1.72		
	C.V.	16.62			5.90		
	DOS	30.10.2023			8.11.2023	**LSM**	

Majhera and Almora locations were rejected due to low site mean.

Trials rejected - IVT/AVT-RF-NHZ- Forage (Dual purpose)

Forage Yield Data (q/ha) – Low Site Mean

Entry name	Entry code	Majhera	Almora

		Yield	Rk	G	Yield	Rk	G
BHS497	AVT-RF-NHZ-8	6.99	4	0	29.90	1	1
BHS498	AVT-RF-NHZ-22	5.43	13	0	18.12	14	0
BHS499	AVT-RF-NHZ-2	10.35	1	1	20.74	8	0
BHS500	AVT-RF-NHZ-21	6.94	5	0	25.81	2	0
BHS501	AVT-RF-NHZ-4	5.95	10	0	19.47	11	0
BHS502	AVT-RF-NHZ-20	5.28	15	0	17.04	16	0
HBL884	AVT-RF-NHZ-15	5.18	18	0	17.67	15	0
HBL885	AVT-RF-NHZ-23	5.28	15	0	14.03	20	0
HBL886	AVT-RF-NHZ-5	5.18	18	0	11.78	24	0
HBL888	AVT-RF-NHZ-9	7.51	2	0	11.79	23	0
UPB1118	AVT-RF-NHZ-12	5.69	11	0	12.23	22	0
UPB1119	AVT-RF-NHZ-11	4.19	24	0	13.14	21	0
UPB1120	AVT-RF-NHZ-6	4.66	23	0	22.64	5	0
VLB184	AVT-RF-NHZ-3	6.63	8	0	21.28	7	0
VLB185	AVT-RF-NHZ-19	5.28	15	0	16.75	17	0
VLB186	AVT-RF-NHZ-18	5.64	12	0	19.93	9	0
VLB187	AVT-RF-NHZ-24	6.73	6	0	19.20	12	0
VLB188	AVT-RF-NHZ-1	5.18	18	0	23.56	3	0
VLB189	AVT-RF-NHZ-17	6.73	6	0	22.19	6	0
BHS380 (C)	AVT-RF-NHZ-10	7.51	2	0	19.48	10	0
BHS400 (C)	AVT-RF-NHZ-7	5.07	21	0	16.30	18	0
BHS352 (C)	AVT-RF-NHZ-14	6.21	9	0	18.13	13	0
HBL113 (C)	AVT-RF-NHZ-16	5.33	14	0	23.55	4	0
VLB118 (C)	AVT-RF-NHZ-13	4.92	22	0	14.94	19	0
	G.M.	**5.99**			**18.74**		
	S.E.(M)	0.83			1.17		
	C.D.	2.01			2.83		
	C.V.	19.61			8.80		
	DOS	30.10.2023			8.11.2023		

Majhera and Almora locations were rejected due to low site mean for forage yield.

Trials rejected - Advance Varietal Trial –IRTS-FB-NEPZ Grain Yield (q/ha) - LSM

***Rabi* – 2023-24**

Name of Entry	Entry Code	Varanasi			Sabour		
		Yield	Rk	G	Yield	Rk	G
UPB 1106	AVT-IRTS-FB-1	20.6	2	0	27.6	2	0
BH 946 (C)	AVT-IRTS-FB-2	17.4	3	0	26.2	3	0
HUB113 (C)	AVT-IRTS-FB-3	21.9	1	1	24.9	4	0
DWRB137 (C)	AVT-IRTS-FB-4	12.9	5	0	29.6	1	1
BH393 (Filler)	AVT-IRTS-FB-5	15.8	4	0	21.0	5	0
	G.M.	17.7			25.9		
	S.E.(M)	0.4			0.6		
	C.D. (10%)	1.0			1.5		
	C.V. (%)	5.0	**Low Site Mean**		5.2	**Low Site Mean**	
	DOS	26.11.23			8.11.23		

Trials rejected - Initial Varietal Trial –IRTS-FB-NEPZ

Grain Yield Data (q/ha) – Low Site Mean

Name of Entry	Entry Code	Varanasi			Sabour			Ranchi		
		Yield	RK	G	Yield	RK	G	Yield	RK	G
HUB 291	IVT-IRTS-FB-1	23.9	11	0	8.0	23	0	16.8	20	0
DWRB 2303	IVT-IRTS-FB-2	15.9	24	0	10.4	19	0	13.1	22	0
RD 3093	IVT-IRTS-FB-3	12.3	25	0	0.0	25	0	12.4	23	0
*RD2907	IVT-IRTS-FB-4	22.5	16	0	14.3	12	0	24.9	16	0
PL 954	IVT-IRTS-FB-5	24.6	8	0	8.6	22	0	20.8	17	0
BH1059	IVT-IRTS-FB-6	26.8	4	0	13.9	14	0	32.5	5	0
UPB 1123	IVT-IRTS-FB-7	22.5	16	0	13.4	15	0	26.7	13	0
BH1058	IVT-IRTS-FB-8	27.5	2	0	14.1	13	0	31.8	6	0
HUB 290	IVT-IRTS-FB-9	27.2	3	0	26.2	1	1	30.3	8	0
GB1	IVT-IRTS-FB-10	19.9	20	0	9.4	21	0	10.7	24	0
DWRB 2302	IVT-IRTS-FB-11	23.2	14	0	9.6	20	0	31.2	7	0
PL 956	IVT-IRTS-FB-12	21.7	18	0	15.7	10	0	29.2	11	0
DWRB2319	IVT-IRTS-FB-13	23.9	11	0	16.3	9	0	7.7	25	0
UPB 1122	IVT-IRTS-FB-14	18.8	22	0	16.8	8	0	17.8	19	0
PL 955	IVT-IRTS-FB-15	26.1	5	0	22.5	2	0	40.3	1	1
RD3096	IVT-IRTS-FB-17	18.5	23	0	8.0	24	0	25.7	15	0
DWRB 2301	IVT-IRTS-FB-18	21.7	18	0	14.4	11	0	25.9	14	0
*DWRB64	IVT-IRTS-FB-19	25.4	7	0	18.1	6	0	18.1	18	0
RD 3095	IVT-IRTS-FB-20	24.6	8	0	20.8	3	0	32.8	4	0
KB 2212	IVT-IRTS-FB-21	23.9	11	0	12.5	17	0	29.9	9	0
GB2	IVT-IRTS-FB-23	19.6	21	0	20.5	4	0	39.3	2	1
DWRB137 (C)	IVT-IRTS-FB-16	24.6	8	0	13.3	16	0	29.3	10	0
HUB113 (C)	IVT-IRTS-FB-22	23.2	14	0	18.1	7	0	27.8	12	0
RD2899 (C)	IVT-IRTS-FB-24	30.4	1	1	20.4	5	0	35.7	3	1
BH 946 (C)	IVT-IRTS-FB-25	26.1	5	0	12.1	18	0	15.6	21	0
	G.M.	23.0			14.3			25.1		
	S.E.(M)	0.8			1.1			2.2		
	C.D. (10%)	1.9			2.8			5.4		
	C.V. (%)	4.9			11.2			12.3		
	DOS	26.11.23			10.11.23			10.11.23		

*Filler

Trials rejected - Initial Varietal Trial –IRTS-FB-CZ

Grain Yield Data (q/ha)

Name of Entry	Entry Code	Morena			Vijapur		
		Yield	RK	G	Yield	RK	G
HUB 291	IVT-IRTS-FB-1	47.7	14	0	13.9	21	0
DWRB 2303	IVT-IRTS-FB-2	39.2	21	0	28.7	10	0
RD 3093	IVT-IRTS-FB-3	51.9	12	0	5.9	25	0
*RD2907	IVT-IRTS-FB-4	52.8	8	0	24.2	17	0
PL 954	IVT-IRTS-FB-5	52.2	10	0	26.7	13	0
BH1059	IVT-IRTS-FB-6	49.4	13	0	33.7	3	0
UPB 1123	IVT-IRTS-FB-7	40.5	20	0	25.6	15	0
BH1058	IVT-IRTS-FB-8	53.6	7	0	29.1	9	0
HUB 290	IVT-IRTS-FB-9	45.1	15	0	33.4	4	0
GB1	IVT-IRTS-FB-10	37.6	23	0	10.9	23	0
DWRB 2302	IVT-IRTS-FB-11	45.0	16	0	22.4	19	0
PL 956	IVT-IRTS-FB-12	44.3	18	0	29.3	7	0
DWRB2319	IVT-IRTS-FB-13	28.6	25	0	27.0	12	0
UPB 1122	IVT-IRTS-FB-14	58.6	5	0	31.4	5	0
PL 955	IVT-IRTS-FB-15	66.8	2	1	20.8	20	0
RD3096	IVT-IRTS-FB-17	57.9	6	0	8.1	24	0
DWRB 2301	IVT-IRTS-FB-18	42.0	19	0	25.2	16	0
*DWRB64	IVT-IRTS-FB-19	44.7	17	0	30.6	6	0
RD 3095	IVT-IRTS-FB-20	52.2	10	0	38.0	1	1
KB 2212	IVT-IRTS-FB-21	38.2	22	0	11.2	22	0
GB2	IVT-IRTS-FB-23	33.6	24	0	23.5	18	0
DWRB137 (C)	IVT-IRTS-FB-16	69.8	1	1	29.3	8	0
HUB113 (C)	IVT-IRTS-FB-22	62.9	4	0	27.6	11	0
RD2899 (C)	IVT-IRTS-FB-24	64.3	3	1	36.5	2	1
BH 946 (C)	IVT-IRTS-FB-25	52.7	9	0	26.4	14	0
	G.M.	49.3			24.8		
	S.E.(M)	2.2			1.7		
	C.D. (10%)	5.4			4.2		
	C.V. (%)	6.4			9.6		
	DOS	**16.12.23 (Late Sown)**			10.11.23 **(LSM)**		

*Filler

Trials rejected - (First green fodder cut of all replication at 55DAS-Not Done)- IVT-DP-IR-TS-NWPZ
Grain Yield (GY) and Green Fodder Yield (GFY)

Name of Entry	Entry Code	Replication	Pantnagar		Ranchi		Morena		Vijapur	
			GY (g/plot)	GFY (kg/plot)	GY (g/plot)	GFY (kg/plot)	GY (g/plot)	GFY (kg/plot)	GY (g/plot)	GFY (kg/plot)
DWRB 2314	IVT-DPB-E1	1	780	1.44	1700	3.90	523	13.40	1245	
		2	840	1.57	1700	3.40	597	14.80	0825	
		3	774		1900		1025		0000	8.79
		4	755		1600		1049		0000	9.43
JHSBB19	IVT-DPB-E2	1	1727	2.59	2600	6.10	940	16.20	1800	
		2	1599	2.53	1800	5.70	826	14.60	1665	
		3	1850		2400		2012		0145	10.24
		4	1680		2100		1884		0220	12.51
JHSBE16	IVT-DPB-E4	1	1674	1.70	1700	3.90	680	10.80	1020	
		2	1405	1.90	1800	4.90	768	12.60	1200	
		3	1758		2000		2380		0170	9.71
		4	1506		1800		2034		0215	10.07
JHSBD22	IVT-DPB-E5	1	1388	2.51	2000	5.00	222	16.40	1290	
		2	1290	2.46	2000	4.90	215	17.60	1240	
		3	1134		2500		2300		0060	9.55
		4	1195		2000		2935		0025	7.32
DWRB2316	IVT-DPB-E6	1	2140	2.08	1900	4.10	540	15.60	1065	
		2	1996	2.26	1700	4.20	480	16.80	1120	
		3	1874		2100		1500		20	7.50
		4	1830		2300		1870		195	9.08
JHSBD11	IVT-DPB-E7	1	1285	4.35	1600	4.30	598	16.40	1285	
		2	1530	4.02	1600	3.20	743	15.00	1400	
		3	1364		2000		1400		0	12.59
		4	1656		1900		2176		80	11.15
DWRB2317	IVT-DPB-E9	1	1524	1.86	2000	5.60	240	14.60	685	
		2	1704	2.16	1600	3.40	323	16.40	725	
		3	1887		2200		1956		40	7.36
		4	1534		1600		1936		0	7.94
DWRB2318	IVT-DPB-E10	1	1915	3.15	1800	5.00	870	16.00	1305	
		2	1878	3.38	2700	6.40	1000	14.40	1440	
		3	2198		2400		1270		420	12.64
		4	1850		2700		1800		420	13.70
DWRB 2313	IVT-DPB-E11	1	1410	2.55	2100	5.20	722	15.40	950	
		2	1769	2.50	2400	4.80	742	13.60	1195	
		3	1480		1600		1384		0	12.26
		4	1535		1800		1450		20	10.32
JHSBF28	IVT-DPB-E12	1	1856	2.81	2400	3.20	516	12.60	510	
		2	1775	2.75	1700	3.20	420	14.20	600	
		3	1523		2100		1827		15	11.69
		4	1490		1400		2050		80	11.50

Continue…

JHSBF21	IVT-DPB-E13	1	1965	2.23	2500	4.10	555	16.20	665	
		2	2080	2.69	2400	4.20	490	14.80	795	
		3	1725		1900		2040		515	9.34
		4	1850		2000		2222		605	11.47
DWRB 2315	IVT-DPB-E14	1	1105	2.52	1800	4.70	484	16.60	415	
		2	1495	2.29	1500	3.20	378	15.40	465	
		3	1068		2100		1686		45	7.23
		4	1089		1500		1914		50	7.42
RD 2552 (C)	IVT-DPB-E3	1	2106	2.57	2400	4.90	529	12.40	1150	
		2	1985	2.84	1700	5.40	413	11.20	1300	
		3	2305		2400		1690		0000	8.56
		4	2501		2100		2400		0255	9.89
RD 2715 (C)	IVT-DPB-E8	1	1153	3.35	1000	5.90	665	18.10	350	
		2	1162	2.91	800	5.90	750	19.30	225	
		3	1030		1200		1610		0	11.95
		4	1166		1100		2000		0	8.79
	DOS		20.11.23		21.11.23		17.12.23		10.11.23	
	Plot Size (m^2)		6.9		6.9		4.14		6.0	

Trials rejected - IVT -DPB-IR-TS-NWPZ Grain Yield (GY) and Green Fodder Yield (GFY) Data (q/ha)- LSM

Name of Entry	Entry Code	Ludhiana						Modipura						Dholpur					
		GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G
DWRB 2314	IVT-DPB-E1	19.6	12	0	56.5	12	0	28.9	28.9	28.9	82.9	13	0	22.0	14	0	76.5	10	0
JHSBB19	IVT-DPB-E2	34.6	3	1	70.7	8	0	27.5	27.5	27.5	89.0	8	0	25.1	11	0	124.4	2	1
JHSBE16	IVT-DPB-E4	18.1	14	0	45.5	14	0	30.0	30.0	30.0	87.4	9	0	26.8	7	0	73.5	12	0
JHSBD22	IVT-DPB-E5	37.3	2	1	75.7	7	0	28.0	28.0	28.0	89.5	7	0	23.2	13	0	73.4	13	0
DWRB2316	IVT-DPB-E6	26.2	10	0	69.7	9	0	28.9	28.9	28.9	98.5	4	1	25.1	10	0	79.9	8	0
JHSBD11	IVT-DPB-E7	28.4	9	0	93.5	2	0	25.5	25.5	25.5	84.0	12	0	28.5	4	0	74.9	11	0
DWRB2317	IVT-DPB-E9	30.3	7	0	59.6	11	0	30.5	30.5	30.5	86.6	10	0	26.7	9	0	85.0	7	0
DWRB2318	IVT-DPB-E10	34.4	4	1	116.1	1	1	28.6	28.6	28.6	94.7	5	0	33.5	3	0	99.9	4	0
DWRB 2313	IVT-DPB-E11	23.4	11	0	85.7	3	0	26.7	26.7	26.7	103.8	1	1	23.3	12	0	112.3	3	0
JHSBF28	IVT-DPB-E12	32.7	6	0	67.8	10	0	24.2	24.2	24.2	103.5	2	1	26.7	8	0	71.1	14	0
JHSBF21	IVT-DPB-E13	33.6	5	0	80.3	6	0	32.5	32.5	32.5	93.2	6	0	36.0	2	0	78.6	9	0
DWRB 2315	IVT-DPB-E14	19.6	12	0	46.4	13	0	30.9	30.9	30.9	85.3	11	0	27.3	6	0	129.8	1	1
RD 2552 (C)	IVT-DPB-E3	37.5	1	1	85.7	4	0	26.9	26.9	26.9	78.4	14	0	39.7	1	1	88.4	5	0
RD 2715 (C)	IVT-DPB-E8	28.6	8	0	80.6	5	0	23.9	23.9	23.9	102.7	3	1	28.0	5	0	88.1	6	0
	G.M.	28.9			73.8			28.1	28.1	28.1	91.4			28.0			89.7		
	S.E.(M)	1.1			2.6			0.7	0.7	0.7	2.8			0.9			3.7		
	C.D. (10%)	3.1			7.6			2.1	2.1	2.1	7.9			2.5			10.6		
	C.V. (%)	7.5			7.2			5.2	5.2	5.2	6.1			6.1			8.2		
	DOS	5.11.23 6.11.23						18.11.23						20.11.23					

Trials rejected - IVT -DP-IR-TS-NEPZ-LSM
Grain Yield (GY) and Green Fodder Yield (GFY) Data (q/ha)

Name of Entry	Entry Code	Varanasi						Kumarganj						Tikkamgarh					
		GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G	GY	Rk	G	GFY	Rk	G
DWRB 2314	IVT-DPB-E1	9.1	13	0	41.3	11	0	28.8	5	0	94.0	6	0	52.0	8	0	116.7	1	1
JHSBB19	IVT-DPB-E2	13.4	8	0	39.9	12	0	29.0	4	0	122.7	2	1	58.4	3	0	47.5	14	0
JHSBE16	IVT-DPB-E4	14.9	5	0	66.7	4	0	20.3	11	0	119.7	3	0	51.3	9	0	86.6	9	0
JHSBD22	IVT-DPB-E5	11.1	11	0	51.1	10	0	32.9	1	1	86.0	11	0	55.4	4	0	69.2	12	0
DWRB2316	IVT-DPB-E6	15.6	3	1	69.2	3	0	28.1	8	0	98.6	4	0	54.2	5	0	98.0	7	0
JHSBD11	IVT-DPB-E7	12.3	10	0	62.3	5	0	25.5	10	0	88.4	10	0	41.4	13	0	55.4	13	0
DWRB2317	IVT-DPB-E9	13.0	9	0	61.6	6	0	31.2	3	1	92.8	7	0	46.7	11	0	114.3	2	1
DWRB2318	IVT-DPB-E10	15.8	2	1	59.8	7	0	27.2	9	0	70.0	14	0	49.4	10	0	104.6	5	0
DWRB 2313	IVT-DPB-E11	16.4	1	1	75.4	2	0	13.8	14	0	75.8	13	0	52.4	6	0	95.7	8	0
JHSBF28	IVT-DPB-E12	13.8	6	0	52.5	9	0	16.3	13	0	89.5	9	0	52.1	7	0	102.8	6	0
JHSBF21	IVT-DPB-E13	13.8	6	0	57.6	8	0	28.3	7	0	85.2	12	0	66.8	1	1	105.7	4	0
DWRB 2315	IVT-DPB-E14	10.0	12	0	34.4	14	0	16.9	12	0	130.4	1	1	39.0	14	0	106.1	3	0
RD 2552 (C)	IVT-DPB-E3	15.0	4	0	90.2	1	1	28.4	6	0	90.8	8	0	66.3	2	1	82.8	10	0
RD 2715 (C)	IVT-DPB-E8	7.0	14	0	36.2	13	0	31.5	2	1	94.4	5	0	43.8	12	0	76.7	11	0
	G.M.	12.9			57.0			25.6			95.6			52.1			90.2		
	S.E.(M)	0.4			5.0			1.0			3.5			1.6			1.8		
	C.D. (10%)	1.0			14.2			2.9			10.1			4.7			5.2		
	C.V. (%)	5.7			17.4			7.8			7.4			6.3			4.0		
	DOS	25.11.23						23.11.23						16.11.23					

International Trials and Nurseries

During the Rabi 2023-24 season, two international trials and one international germplasm nursery were received from the International Center for Agricultural Research in the Dry Areas (ICARDA). The trials, IBYT-FFM and IBYT-ASA, each comprised 24 test entries along with 3 control checks, one of which was a designated national check. The nursery, IBON-2024, consisted of 139 test entries, 2 control checks replicated three times each, and one locally replicated Indian check (also repeated three times). In total, 148 genotypes were obtained from ICARDA for testing. The IBYT-ASA trial was conducted across multiple locations: Durgapura, Hisar, Ludhiana, Pantnagar and Karnal. The IBYT-FFM trial was evaluated at Durgapura, Ludhiana, Hisar and Karnal. Meanwhile, the IBON nursery was tested at Durgapura, Pantnagar, Kanpur, and Karnal. A Field Day was organized at Karnal on March 19, 2024, to provide barley breeders from the National Agricultural Research System (NARS) with the opportunity to review and select materials from these nurseries according to the specific needs of their respective regions.

In addition, the EIBGN trial was established with 24 germplasm lines and six released varieties—BH946, HUB113, BHS400, PL891, DWRB123, and DWRB137—used as checks. These 24 promising germplasm lines were selected from various international trials and nurseries based on their performance during the Rabi 2022-23 season. A total of 48 entries, including the six checks, were distributed to twelve locations across the NWPZ (Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Chatha), NEPZ (Kanpur, Varanasi, Kumarganj), and NHZ (Khudwani, Shimla, Bajaura). The nursery trials were successfully conducted at all these locations. Each entry was sown in a 1.5 m^2 plot consisting of two rows, each 2.5 m in length with a spacing of 30 cm. Grain yield data, recorded in grams per plot, were converted to q/ha for analysis. The results were analyzed on both a center-wise and zone-wise basis and are presented in the accompanying tables. Similarly, ancillary character data are summarized below, showing the mean and range for each trait across the 12 testing locations.

Table 2.48. International trials and nurseries evaluated during crop season 2023-24.

SN.	Trials/Nurseries	Genotypes received	National Check	# Sets	Locations
1	2024 International Barley Yield Trial for Feed Forage and Malt in Favourable Environments (IBYT-FFM-24)	24	DWRB137	4	Durgapura, Hisar, Ludhiana Karnal
2	2024 International Barley Yield Trial for Arid and Semi-Arid regions (IBYT-ASA)	24	Lakhan	6	Durgapura, Hisar, Ludhiana Karnal, Pantnagar,Kanpur
3	2024 International Barley Observation Nursery (IBON-24)	147 + 6 checks	DWRB137	5	Hisar, Kanpur, Karnal, Durgapura, Pantnagar

International Barley Yield Trial for Food, Feed, and Malt in Favorable Environments-24 (IBYT-FFM-24)

The International Barley Yield Trial for Food, Feed, and Malt in Favorable Environments (IBYT-FFM) consisted of 24 entries, including one Indian local check variety, DWRB 137 (C1,Entry IBYT-FFM-1), and two ICARDA checks: Entry IBYT-10 (V Morales = C2) and Entry IBYT-FFM-20 (Rihane-03 = C3). The trial was conducted using an Alpha-Lattice design with two replications at four locations—Durgapura, Hisar, Ludhiana, and Karnal—within the Northwestern Plain Zone (NWPZ), under high-input conditions. Data from all trial sites were incorporated into the national pooled analysis. Entry IBYT-FFM-17 achieved the highest yield, recording 63.6 quintals per hectare, followed by IBYT-FFM-22 with 63.10 quintals per hectare, and IBYT-FFM-19 with 61.30 quintals per hectare.

Table 2.49. Grain Yield Evaluation, Ranking, and Clustering of Barley Genotypes in IBYT-FFM24 during Rabi 2023-2024.

Varieties	Pedigree	Karnal			Durgapura			Hisar			Ludhiana			National Mean		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
FFM-1	DWRB 137	60.61	22	0	58.76	16	0	37.83	16	0	30.44	16	0	46.9	22	0
FFM-2	DOÑA JOSEFA/3/CEV 96060/MSEL//CANELA	61.31	21	0	43.17	24	0	30.75	23	0	44.20	6	1	44.9	23	0
FFM-3	DOÑA JOSEFA//CANELA/ICARO	67.58	15	0	50.24	23	0	41.91	8	0	28.99	18	0	47.2	21	0
FFM-4	DATCHA//MSEL/ND21117	61.82	20	0	58.17	17	0	39.42	12	0	39.13	10	1	49.6	18	0
FFM-5	VARBERG//Canela	64.84	16	0	58.95	15	0	44.42	5	1	44.93	3	1	53.3	10	0
FFM-6	DATCHA//MSEL/ND21117	69.89	12	0	56.34	20	0	33.83	20	0	36.23	12	0	49.1	19	0
FFM-7	MSEL//LM 844/QUILMES PAMPA/3/BUCK M8.88/E.ACACIA//MSEL	82.53	4	1	75.13	5	0	56.50	1	1	26.09	21	0	60.1	4	1
FFM-8	CANELA/DEFRA//SHAKIRA	68.98	14	0	52.28	22	0	40.66	11	0	44.57	5	1	51.6	16	0
FFM-9	TRADITION/DWR28	71.42	10	1	72.10	6	0	44.08	6	1	24.64	22	0	53.1	13	0
FFM-10	V Morales	64.72	17	0	67.50	10	0	41.92	7	0	35.51	13	0	52.4	14	0
FFM-11	LEGACY/CHAMICO//ATAH92/GOB/3/RD2552	45.35	24	0	86.20	3	0	37.83	17	0	43.48	8	1	53.2	11	0
FFM-12	Moronera/alanda-01	71.20	11	1	57.74	19	0	41.00	10	0	24.64	23	0	48.6	20	0
FFM-13	TRADITION/RD2552	86.36	2	1	55.16	21	0	54.83	3	1	36.96	11	0	58.3	6	1
FFM-14	Frontier/Alanda	80.57	6	1	71.69	7	0	33.25	22	0	47.10	1	1	58.2	7	1
FFM-15	DWRUB52/RD2552	92.33	1	1	77.55	4	0	41.75	9	0	28.26	19	0	60.0	5	1
FFM-16	ISHI//L94/BCD-TTA/3/ ISHI	69.24	13	0	65.75	12	0	47.25	4	1	23.91	24	0	51.5	17	0
FFM-17	22IBYT7/ / UC 1047/ UC 1108	84.39	3	1	69.91	9	0	55.33	2	1	44.93	3	1	63.6	1	1
FFM18	LOGANBAR/MSEL//AZAF/4/AF9216/3/ZHEDAR# 1/SHYRI//OLMO	64.28	18	0	67.15	11	0	38.33	14	0	45.65	2	1	53.9	9	0
FFM-19	Sebastian/RD2668	77.77	8	1	95.87	1	1	39.08	13	0	32.61	15	0	61.3	3	1
FFM20	Rihane-03	77.11	9	1	57.99	18	0	37.50	18	0	43.48	9	1	54.0	8	0
FFM-21	Tocada/DWRUB52	64.09	19	0	71.52	8	0	37.33	19	0	34.78	14	0	51.9	15	0
FFM-22	ND17268/NDB1173	79.42	7	1	95.41	2	1	33.33	21	0	44.20	7	1	63.1	2	1
FFM-23	MERIT 57/PL 172	81.41	5	1	64.59	13	0	38.00	15	0	28.26	19	0	53.1	12	0
FFM-24	Zeppelin /4/MERIT,B//CLE150/W89.11369/3/CANELA	54.01	23	0	63.81	14	0	27.92	24	0	29.71	17	0	43.9	24	0
	G.M.	70.89			66.37			40.59			35.95			53.4		
	S.E.(M)	9.17			3.56			5.29			3.61			2.93		
	C.D.	22.22			8.62			12.82			8.75			6.9		
	C.V.	18.28			7.58			18.42			14.20					

Checks NC= DWRB 137, (C_1), V Morales (C_2) and Rihane (C_3)

Table 2.50. Mean and Range for Ancillary Traits of IBYT-FFM-24.

Entry	RT	Days to 75% heading	Plant height (cm)	Days to 75% Maturity	1000-grains weight(g)	Spike length(cm)
1	2	91.5(107-72)	78.83(93.64)	130.5(142-119)	44.28(50.5-35.9)	7.33(8.50-6.5)
2	2	86.5(99-66)	85.38(94-75)	127.25(133-118)	47.89(52.4-39.6)	8.06(9.20-7.2)
3	2	88.5(104-68)	90.89(113-73.7)	126.75(135-116)	54.94(60.9-49.6)	8.81(10.40-7.5)
4	2	88.5(98-71)	88.06(101-67.7)	127.75(133-114)	47.02(51.7-38.3)	7.57(8.40-6.7)
5	2	82.75(93-61)	86.55(99-78)	126(134-114)	51.17(58.8-42.7)	7.25(9.30-6.3)
6	2	89.5(98-73)	87.56(107-76.3)	129(135-117)	47.81(51.4-41.9)	7.23(8.33-5.5)
7	2	89(101-74)	85.29(94-75)	129.75(142-118)	44.41(48.3-38.2)	7.68(8.50-6.8)
8	2	95.75(108-77)	99.24(106-94)	131.25(142-120)	44.68(48.5-37.6)	10.03(10.83-9)
9	6	98.5(113-78)	88.84(102-73.7)	135.75(143-123)	34.76(39-27.5)	8.48(9.33-7.8)
10	6	96.5(113-75)	91.08(107-71)	132.25(142-119)	38.24(43.7-35.4)	8.25(10.30-6.5)
11	6	86.5(101-67)	91.54(103-79.3)	130(138-120)	43.77(50.6-31.8)	6.93(7.30-6)
12	6	94.25(104-78)	89.20(103-75.3)	131.75(138-120)	35.60(37.1-33.9)	9.79(11.50-8.5)
13	6	98.5(108-83)	90.31(103.75.3)	135.25(143-122)	31.63(35.7-29.6)	8.66(9.50-7.5)
14	6	94.5(108-76)	100.76(115-85.3)	135.75(143-124)	33.10(37.8-24.9)	8.12(9.37-6.7)
15	6	93.5(107-75)	92.28(105-75)	134.75(142-122)	39.14(46.2-32)	6.70(7.20-6)
16	6	96.25(108-80)	80.88(93-62)	132.5(140-121)	36.57(41.7-32.9)	8.01(8.93-7.3)
17	6	91(101-73)	87.39(94-71.7)	131.5(137-120)	44.22(48-37.6)	7.40(8.30-6.5)
18	2	92.75(103-74)	89.22(101-69.7)	131.5(141-119)	54.54(61.4-46.5)	8.70(9.30-7.8)
19	6	90.5(104-72)	103.24(119-76)	134.5(143-121)	37.88(41.6-35.7)	8.68(10.70-6.8)
20	6	102.25(113-90)	108.42(125-80)	137.25(144-126)	38.91(40.9-37)	6.78(7.70-5.9)
21	2	97.25(113-77)	86.58(115-63)	136(143-123)	40.13(43.8-33.8)	8.66(10.20-7.6)
22	6	90.75(107-68)	93.99(112-63)	130.75(137-119)	35.53(39.9-31.1)	7.64(8.87-6.8)
23	6	95(111-75)	91.76(106-73.3)	134.75(143-125)	33.89(36.7-31)	8.93(9.50-8.1)
24	2	102.25(114-85)	100.97(118-79.7)	136(143-124)	43.53(47.5-38.2)	9.67(11.50-7.5)

International Barley Yield Trial-ASA-2024-(IBYT-ASA-2024)

The IBYT-ASA-2024 trial, consisting of 24 entries, including one Indian local check variety 'Lakhan' (C1, Entry IBYT-FFM-1), and two ICARDA check varieties, Entry IBYT-10 (Rihane-03 = C2) and Entry IBYT-FFM-20 (Furat-03 = C3), was evaluated using an Alpha-Lattice Design with two replications across six locations: Durgapura, Karnal, Kanpur, Hisar, Pantnagar, and Ludhiana. Data from all locations were integrated into a national pooled analysis. Entry IBYT-ASA-7 achieved the highest yield with 46.41 qtls/ha, followed by IBYT-ASA-4 with 45.94 qtls/ha, and IBYT-ASA-12 with 45.69 qtls/ha.

Table 2.51. IBYT-ASA Grain Yield (q/ha). ***Rabi-2023-24***

Entries	Karnal			Durgapura			Hisar			Pantnagar			Ludhiana			Kanpur			National Mean		
	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
IBYT ASA-1	49.09	17	0	66.46	2	1	22.58	20	0	45.80	3	1	29.13	9	0	42.75	6	**0**	42.64	11	0
IBYT ASA-2	36.83	24	0	49.445	18	0	32.67	7	0	47.02	1	1	44.20	8	0	38.41	10	**0**	41.43	14	0
IBYT ASA-3	43.03	22	0	42.5	22	0	20.17	23	0	39.48	6	0	31.16	16	0	48.70	2	**0**	37.51	19	0
IBYT ASA-4	54.63	15	0	59.78	8	0	23.91	19	0	40.96	4	0	48.55	6	1	47.83	3	**1**	45.94	2	1
IBYT ASA-5	55.70	14	0	56.4	12	0	22.00	22	0	30.69	12	0	46.38	13	0	50.72	1	**1**	43.65	6	1
IBYT ASA-6	37.70	23	0	54.67	13	0	17.41	24	0	37.98	7	0	46.38	9	0	44.93	4	**1**	39.85	16	0
IBYT ASA-7	64.27	6	1	65.5	4	1	51.08	1	1	34.54	10	0	23.19	21	0	39.86	8	**0**	46.41	1	1
IBYT ASA-8	59.00	11	0	44.12	21	0	26.75	12	0	36.67	9	0	34.78	2	1	38.41	11	**0**	39.96	15	0
IBYT ASA-9	59.49	10	0	54.11	15	0	22.50	21	0	28.35	17	0	28.99	11	0	30.43	22	**0**	37.31	20	0
IBYT ASA-10	65.11	4	1	58.775	9	0	36.42	5	0	29.31	15	0	28.99	7	1	38.41	12	**0**	42.84	9	0
IBYT ASA-11	75.76	1	1	58.22	10	0	32.50	8	0	30.07	14	0	34.78	2	1	34.06	18	**0**	44.23	5	1
IBYT ASA-12	58.91	12	0	65.845	3	1	24.16	17	0	46.99	2	1	42.03	11	0	36.23	15	**0**	45.69	3	1
IBYT ASA-13	71.02	3	1	60.115	7	0	24.25	16	0	21.90	21	0	38.41	16	0	44.20	5	**1**	43.32	7	1
IBYT ASA-14	59.72	9	0	62.335	5	0	24.08	18	0	37.81	8	0	28.99	24	0	38.41	13	**0**	41.89	13	0
IBYT ASA-15	65.02	5	1	57.5	11	0	37.75	4	0	32.08	11	0	34.78	5	1	29.71	23	**0**	42.81	10	0
IBYT ASA-16	57.96	13	0	51.115	16	0	46.08	2	1	39.61	5	0	28.26	1	1	36.23	16	**0**	43.21	8	1
IBYT ASA-17	48.61	18	0	40.755	23	0	32.33	9	0	30.36	13	0	37.68	14	0	39.13	9	**0**	38.14	18	0
IBYT ASA-18	52.35	16	0	39.73	24	0	26.08	14	0	27.41	18	0	26.81	21	0	41.30	7	**0**	35.61	22	0
IBYT ASA-19	64.07	7	1	60.22	6	0	36.16	6	0	21.21	22	0	37.68	20	0	34.06	19	**0**	42.23	12	0
IBYT ASA-20	63.50	8	1	44.78	20	0	29.33	10	0	20.06	24	0	44.93	23	0	34.49	17	**0**	39.52	17	0
IBYT ASA-21	71.49	2	1	68.78	1	1	38.91	3	0	20.07	23	0	43.48	15	0	28.99	24	**0**	45.29	4	1
IBYT ASA-22	45.08	21	0	49.89	17	0	27.33	11	0	23.14	20	0	28.26	16	0	34.06	20	**0**	34.63	24	0
IBYT ASA-23	45.38	20	0	48.165	19	0	25.50	15	0	24.35	19	0	28.26	16	0	36.96	14	**0**	34.77	23	0
IBYT ASA-24	46.26	19	0	54.61	14	0	26.50	13	0	28.36	16	0	28.99	4	1	34.06	21	**0**	36.46	21	0
G.M.	56.25			54.74			29.44			32.26			35.21			**38.43**			**41.6**		
S.E.(M)	5.34			2.45			2.78			2.19			3.02			**3.04**			**1.49**		
C.D.	12.94			5.94			6.74			5.32			7.33			**6.89**			**3.5**		
C.V.	13.42			6.33			13.35			9.61			12.14			**14.35**					

IBYT-ASA ckecks NC= Lakhan(C_1), Rihane-03 (C_2) and Furat-03 (C_3)

Table 2.52. IBYT-ASA-24 - Pedigree.

Entries	Pedigree
IBYT ASA-1	Lakhan
IBYT ASA-2	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/AC-6629
IBYT ASA-3	Nadawa/Rhn-03//Mtn-01/6/Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml
IBYT ASA-4	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/DWRUB-52
IBYT ASA-5	AwBlack/Aths//Rhn-08/3/Malouh/4/GIZA131
IBYT ASA-6	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/Alanda01
IBYT ASA-7	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/AC-6629
IBYT ASA-8	Arbayan-01//As46/Aths/3/Barjouj/4/DWRUB-52
IBYT ASA-9	Arbayan01//As46/Aths/3/Barjouj/5/GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares
IBYT ASA-10	Rihane-03
IBYT ASA-11	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/Furat-3
IBYT ASA-12	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/HARMAL
IBYT ASA-13	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52
IBYT ASA-14	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52
IBYT ASA-15	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml
IBYT ASA-16	Frontier/VMorales
IBYT ASA-17	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/ATAHUALPA
IBYT ASA-18	Arta/3/Legia/Laurel'S//Aleli/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/6/Arta/WI3167
IBYT ASA-19	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml
IBYT ASA-20	Furat-03
IBYT ASA-21	Fedora/Express//Rhn-03/3/DWRUB-52
IBYT ASA-22	UC1263 X L94/BCD-TTA//UC1231L
IBYT ASA-23	UC 1266 // L94/BCD-TTA/3/UC1264
IBYT ASA-24	UC 1047 / 11HB44
IBYT ASA-16	Frontier/VMorales
IBYT ASA-17	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/ATAHUALPA
IBYT ASA-18	Arta/3/Legia/Laurel'S//Aleli/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/6/Arta/WI3167
IBYT ASA-19	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml
IBYT ASA-20	Furat-03
IBYT ASA-21	Fedora/Express//Rhn-03/3/DWRUB-52
IBYT ASA-22	UC1263 X L94/BCD-TTA//UC1231L
IBYT ASA-23	UC 1266 // L94/BCD-TTA/3/UC1264
IBYT ASA-24	UC 1047 / 11HB44

Table 2.53. Mean and Range for ancillary characters of IBYT-ASA (2024) entries in *Rabi* (2023-24).

Entry	RT	Days to 75% heading	Plant height(cm)	Days to 75% Maturity	1000-grains weight(g)	Spike length(cm)
1	6	90.75(99-75)	97.8(113-81)	131.5(137-120)	43.08(47.5-34.3)	9.18(11.5-7)
2	6	92.25(103-80)	89.2(105-72)	129.25(137-117)	42.63(60.9-30.3)	7.57(9.3-6)
3	6	93.75(107-83)	96.0(110-82)	128.5(138-113)	32.78(55.3-19.2)	8.08(10-6)
4	6	86(98-68)	88.5(107-73)	127.75(135-116)	42.49(53.2-32.2)	8.05(9-6.5)
5	6	89.75(96-84)	91.2(100.33-84.4)	126(132-115)	41.65(54.8-34)	7.25(9-5.5)
6	6	88.25(94-83)	89.9(96-84.5)	125.25(133-117)	41.09(54-27.9)	7.38(8.5-6)
7	6	95(106-84)	84.9(95-77.5)	131.75(137-119)	36.59(51.85-27.8)	8.72(10.3-7.6)
8	6	95.75(103-86)	87.5(93-81.66)	131.25(141-120)	31.36(47.45-22.3)	8.64(10-7.8)
9	6	94.25(103-84)	92.6(101.80)	129.25(142-117)	37.98(45.4-29.4)	7.25(8-6.5)
10	6	96.25(107-86)	98.8(105-93)	133.25(138-124)	41.04(49.9-30.7)	6.63(8.-5.5)
11	6	93.5(10)	93.5(96-87)	130.5(138-121)	36.56(48.15-29.6)	7.88(10.5-7)
12	6	92(99-82)	89.1(99-79)	130.5(139-122)	38.63(42.15-34.2)	8.86(10-8)
13	2	85.75(96-65)	94.4(102-88)	130(137-120)	51.46(56.4-48.5)	8.93(10.5-8)
14	2	84(95-63)	96.5(104.84)	130.5(141-118)	46.63(56.7-39.1)	9.01(10.3-7.7)
15	2	93(107-77)	92.1(104.3-82)	129.25(138-121)	41.08(46.4-36.6)	8.31(10.5-6.7)
16	2	92.75(99-81)	107.5(114-96)	132.75(140-122)	50.26(59.1-40.8)	8.95(0.8-8)
17	2	102(117-88)	100.0(106-93)	136.25(142-124)	45.82(48.65-42.74)	9.12(11.2-7)
18	2	98.5(109-88)	100.7(112.33-89.5)	135.75(141-126)	41.36(45.27-38.35)	7.95(8.8-65)
19	2	96.75(108-85)	98.0(101-95)	134.25(140-122)	44.65(55.6-34.5)	9.79(10.8-9)
20	2	93.75(103-82)	99.0(107-89)	131.25(138-121)	45.06(51.2-38)	8.28(8.5-8)
21	2	91.5(101-75)	88.7()98-77	131.5(143-119)	43.71(49.8-38.7)	8.30(8.5-8)
22	2	100(109-88)	93.8(102-84.2)	134.5(142-127)	43.27(45.37-40.7)	8.55(9.2-8)
23	2	98(110-84)	92.8(95-90)	135.25(142-123)	38.59(42.34)	8.80(9.3-7.9)
24	6	95.75(106-80)	93.4(102-76)	132.25(143-120)	34.07(36.85-32.2)	8.83(9-8.5)

International Barley Observation Nursery-High Input-2024 (IBON-HI-2024)

The IBON-24 trial comprised 139 test entries alongside three check varieties—two ICARDA checks (Rihane-03 and V Morales) and one local check (DWRB137), with each check replicated three times. This nursery was conducted across five locations: Durgapura, Kanpur, Pantnagar, Karnal, and Hisar during the 2023-2024 rabi season. Data were collected from all locations, and grain yield was measured in qtls/ha, calculated from a plot size of 1.5 m^2. The range and mean values for grain yield and ancillary traits are provided in the accompanying table. Entry No. 30 recorded the highest grain yield nationally, followed by entries 26, 25, 32, 22, and 40. Among the check varieties, the local check DWRB137 achieved the highest grain yield, with an average of 42.7 qtls/ha and a range from 15.03 to 43.36 qtls/ha across the locations. This check ranked second overall among all test entries and checks. Detailed data are presented in the corresponding table.

Table 2.54. International Barley Observation Nursery-High Input-2024 (IBON-HI-2024), Yield data qtls/ha.

ENTRY _NO	Pedigree	Karnal	Hisar	Kanpur	Durgapura	Pantnagar	National Average	Rank
30	Frontier/Alanda	69.40	36.67	67.39	43.33	37.33	43.36	1
26	TRADITION/DWR28	63.20	28.67	68.70	46.84	20.20	41.48	2
25	22IBYT7/ / UC 1047/ UC 1108	54.07	30.00	69.57	50.00	21.20	40.73	3
32	DWRUB52/RD2552	78.27	32.00	42.90	49.69	58.07	40.57	4
22	ND17268/NDB1173	60.87	19.67	67.83	49.51	31.93	39.57	5
40	Harrington/Arta//Malt 1/3/RD2552	38.93	21.33	60.25	75.02	32.53	39.11	6
74	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/DWRUB-52	55.87	23.67	65.22	49.56	25.13	38.86	7
27	ISHI//L94/BCD-TTA/3/ ISHI	60.00	23.00	64.00	46.89	27.40	38.78	8
31	TRADITION/RD2552	63.47	28.00	69.57	29.73	24.33	38.15	9
41	BRS195/ND19098-1//DWRUB52	61.33	13.33	65.22	50.18	29.00	38.01	10
2	LOGAN-AR/MSEL//AZAF/4/AF9216/3/ZHEDAR#1/SHYRI//OLMO	60.73	12.00	65.22	50.09	32.67	37.61	11
57	ND17268/RD2660	55.47	30.67	63.25	35.24	39.27	36.93	12
20	UC1280 X L94/BCD-TTA//ISHI	49.27	25.67	60.87	48.09	39.60	36.78	13
13	PFC9215/3/ZHEDAR#1/SHYRI//OLMO/4/Sebastian	59.00	24.33	46.10	52.93	30.53	36.47	14
21	LEGACY/CHAMICO//ATAH92/GOB/3/RD2552	62.80	21.00	26.09	72.44	15.33	36.47	15
29	UC 1116 / 22IBYT7	55.07	25.33	69.57	30.31	22.93	36.06	16
89	Fedora/Express//Rhn-03/3/DWRUB-52	44.40	28.33	61.80	41.96	37.00	35.30	17
11	CANELA/DEFRA//SHAKIRA	56.47	22.33	60.87	34.93	32.73	34.92	18
64	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/GIZA131	55.93	22.00	52.17	43.11	32.27	34.64	19
71	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/GIZA131	53.20	33.67	35.80	50.18	18.60	34.57	20
53	UC1231L //L94/BCD-TTA /3/UC1231L	53.53	15.00	52.17	51.24	16.60	34.39	21
1	BICHY2000//GOB/HUMAI10/3/SHAKIRA	50.93	23.33	34.78	62.09	33.67	34.23	22
119	Ssn/Bda//Arar/3/F2CC33MS/CI07555/4/Avt/Attiki//M-Att-73-337-1/3/Aths/Lignee686/5/DWRUB-52	38.13	15.00	60.87	56.40	31.80	34.08	23
55	Kenia/DWRUB52	52.60	17.33	56.40	43.78	27.27	34.02	24
83	3896/1-3/4/1246/1-3/3/3887/28//3892/1-3/5/Grivita/6/Antares/Ky63-1294//Marageh/7/Tichedrette	55.33	25.67	63.40	25.02	17.80	33.88	25
50	MERIT 57/PL 172	60.33	16.67	47.33	44.89	42.00	33.84	26
28	UC1280//L94/BCD-TTA/3/ISHI	55.00	20.33	69.57	24.27	22.80	33.83	27
120	Fedora/Express//Rhn-03/3/Alanda01	42.27	18.67	52.00	55.73	34.93	33.73	28
121	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	46.60	16.67	56.52	47.73	35.33	33.50	29
17	80.5162/MSEL//GLORIA-BAR/IAR.H.485/6/ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO	63.47	7.33	45.20	51.47	41.07	33.49	30
67	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	45.60	32.67	47.83	40.09	30.87	33.24	31
82	Celebration/Harmal	34.40	19.33	69.57	42.76	20.87	33.21	32
91	Fedora/Express//Rhn-03/3/DWRUB-52	53.13	25.67	52.17	34.89	21.27	33.17	33
77	Frontier/VMorales	42.20	34.00	45.40	44.13	25.80	33.15	34
66	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	31.33	30.00	64.25	39.91	28.40	33.10	355
61	UC1263 X L94/BCD-TTA//UC1231L	39.40	27.00	43.00	56.00	23.67	33.08	36
75	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/Tichedrette	48.60	31.33	52.17	33.24	27.27	33.07	37
60	Piroline/NDB1173	47.93	15.00	30.43	70.84	19.20	32.84	38
80	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/Tichedrette	44.00	10.00	69.57	40.36	28.07	32.78	39
88	Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/6/DWRUB-52	44.87	33.33	47.70	37.07	27.13	32.59	40
16	MSEL//LM 844/QUILMES PAMPA/3/BUCK M8.88/E.ACACIA//MSEL	58.67	10.00	47.83	45.60	32.87	32.42	41
12	UC1322/MP103MQ	53.93	13.67	64.35	28.62	35.07	32.11	42
35	CELEBRATION/DWRUB52	46.93	26.67	49.50	37.42	21.20	32.10	43
45	TRADITION/RD2668	47.93	21.33	42.90	48.36	27.87	32.10	44
36	Harrington/Arta//Malt 1/3/RD2592	55.60	22.33	47.83	34.22	35.00	32.00	45
73	AwBlack/Aths//Rhn-08/3/Malouh/4/Tichedrette	52.53	12.67	60.87	33.91	32.87	32.00	46
10	MSEL//LM 844/QUILMES PAMPA/3/BUCK M8.88/E.ACACIA//MSEL	55.60	25.00	40.66	38.36	22.00	31.92	47
108	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/AC-6629	56.67	34.67	21.74	45.60	20.00	31.73	48
44	UC 1231 // RIHANE / MORALES	57.00	17.67	55.20	28.76	36.47	31.72	49

42	Moronera/alanda-01	51.53	16.33	60.87	29.73	39.33	31.69	50
65	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/7/3896/1-3/4/1246/1-3/3/3887/28//3892/1-3/5/Grivita/6/Antares/Ky63-1294//Marageh	43.00	24.00	47.83	43.02	23.53	31.57	51
97	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/GIZA126	50.87	17.67	48.10	39.78	28.20	31.28	52
34	LWG 5054 / UC 1116	54.67	23.67	58.90	18.93	23.80	31.23	53
19	LOGAN-BAR/MSEL//AZAF/3/MERIT,B/AF9216//CANELA	48.47	28.67	47.83	30.36	35.67	31.06	54
96	Arbayan-01//As46/Aths/3/Barjouj/4/DWRUB-52	45.20	29.00	43.48	35.56	25.07	30.65	55
90	Arta/3/Legia/Laurel'S//Aleli/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/6/Arta/WI3167	40.07	26.67	60.87	24.49	20.20	30.42	56
4	DOÑA JOSEFA//CANELA/ICARO	45.87	14.33	53.00	38.67	49.13	30.37	57
72	GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	50.93	22.33	43.90	33.60	20.53	30.15	58
54	Sebastian/Nawair-01	58.20	26.33	30.43	35.47	21.80	30.09	59
117	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/DWRUB-52	43.53	23.67	46.70	36.36	27.67	30.05	60
15	UMBRELLA//SHAKIRA	53.07	18.00	48.10	30.98	28.53	30.03	61
111	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/AC-6629	46.33	21.00	52.17	30.62	32.20	30.03	62
81	Soufara-02/3/RM1508/Por//WI2269/4/Hml-02 /ArabiAbiad//ER /Apm/5/ ((Galleon x Richard)/5)xTilga/6/DWRUB-52	35.80	24.00	41.80	48.36	29.60	29.99	63
107	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/GIZA126	45.33	25.33	53.40	25.78	38.20	29.97	64
68	Nadawa/Rhn-03//Mtn-01/6/Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml	30.20	26.67	65.22	27.33	20.73	29.88	65
9	L94//Msel/11MQ54	48.60	22.00	44.10	34.62	29.93	29.86	66
127	UC 1047 / 11HB44	40.13	21.33	43.80	44.00	15.93	29.85	67
52	UC 1115 / UC 1047	57.60	20.67	33.04	37.87	25.00	29.84	68
39	Sebastian/RD2668	56.33	19.33	44.75	28.36	32.53	29.75	69
48	UC 1266 // L94/BCD-TTA/3/UC1266	34.47	13.33	73.91	26.36	28.07	29.61	70
43	UC1231L //L94/BCD-TTA/3/UC1280	47.20	11.33	52.17	36.22	27.13	29.39	71
135	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/Schooner/Babunj//Noor68/Kataf	37.53	19.00	52.17	38.13	27.87	29.37	72
92	Tipper/ICB-102854//Alpha/Durra/3/Tichedrette	42.47	27.00	34.78	42.31	26.00	29.31	73
76	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/Tichedrette	45.53	23.00	47.83	29.33	28.00	29.14	74
93	Fedora/Express//Rhn-03/3/DWRUB-52	45.07	26.00	44.50	29.96	35.00	29.10	75
56	Pasadena/RD2668	50.40	19.33	43.48	32.04	16.60	29.05	76
6	DATCHA//MSEL/ND21117	48.73	14.00	41.25	41.11	13.00	29.02	77
8	DOÑA JOSEFA/3/CEV 96060/MSEL//CANELA	48.47	23.33	39.13	34.00	43.53	28.99	78
113	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/Alanda01	34.33	19.67	50.00	40.76	18.47	28.95	79
131	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/BKFMaguelone1604/3/Apro//Sv.02109/Mari/4/Giza119/5/Shyri	40.47	21.67	52.17	30.31	15.07	28.92	80
18	JB_FLAVOUR//CONCHITA	59.60	9.00	52.17	23.42	43.13	28.84	81
47	Sebastian/DWRUB52	47.00	13.67	34.78	48.67	28.93	28.82	82
23	MORALES / UC 933	63.33	12.00	26.09	42.58	40.00	28.80	83
3	VARBERG//Canela	52.33	18.67	34.78	37.78	36.80	28.71	84
112		42.73	23.33	26.09	50.89	14.33	28.61	85
69	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/HARMAL	44.40	22.00	34.78	41.73	23.47	28.58	86
99	Clipper//WI2291*2/WI2269/3/Furat 2/4/Alanda01	42.40	11.67	64.80	23.51	27.00	28.48	87
7	DATCHA//MSEL/ND21117	43.33	21.67	37.83	39.02	30.73	28.37	88
86	Roho/4/Zanbaka/3/ER/Apm//Lignee131/7/3896/1-3/4/1246/1-3/3/3887/28//3892/1-3/5/Grivita/6/Antares/Ky63-1294//Marageh	43.93	22.00	44.70	30.22	29.93	28.17	89
78	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	51.53	14.00	52.80	21.91	18.93	28.05	90
110	Arbayan-01//As46/Aths/3/Barjouj/5/GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares	41.07	29.33	34.78	34.89	25.60	28.01	91
101	Arbayan-01//As46/Aths/3/Barjouj/6/Baishishek/5/Nd10277/Shyri//Nd11231/Shyri/3/Azaf/4/Canela/Gob96Dh	44.07	14.33	26.09	54.76	27.73	27.85	92
14	MAGALY//Sebastian	46.53	12.00	52.17	27.42	22.33	27.63	93
84		51.53	20.33	26.09	39.69	26.13	27.53	94
116	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/GIZA131	25.20	18.67	63.00	29.11	30.40	27.20	95
33	UC 1266 // L94/BCD-TTA/3/UC1263	42.07	22.00	34.78	36.27	31.60	27.02	96
62	MSEL/LOGAN-BAR/CONCHITA	42.93	28.00	40.87	22.13	30.73	26.79	97
95	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	45.47	12.67	50.14	25.42	16.73	26.74	98
51	BISON 216.4/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/7/EXPLORER	47.20	20.00	17.39	48.89	15.40	26.70	99
70	Akrash//WI2291/WI2269/3/Sls/Akrash-02/4/ATAHUALPA	45.87	14.33	46.22	27.02	20.93	26.69	100
118	GK58/3/Kc/MullersHeydla//Sls/4/Wieselbuger//Ahor1303-61//Ste/Antares/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	47.27	16.67	34.78	31.24	24.87	25.99	101
100	AwBlack/Aths//Rhn-08/3/Malouh/4/GIZA131	18.07	14.00	63.40	34.22	17.33	25.94	102
37	BRS195/ND19098-1//RD2668	42.53	24.67	34.78	26.93	28.00	25.78	103

58	PATTI//UC 1116/UC 1047	51.53	24.33	26.09	26.93	34.00	25.78	104
46	UC1231L//L94/BCD-TTA/3/UC1267	48.00	11.67	21.74	45.07	28.00	25.29	105
59	UC 1116 / IBYT // UC 1108	48.60	16.00	26.09	35.29	22.53	25.20	106
24	Tocada/DWRUB52	48.53	16.67	30.43	29.91	31.27	25.11	107
63	Tocada/Manal	46.80	18.67	38.75	20.89	22.67	25.02	108
87	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	45.53	19.67	26.09	33.69	27.60	25.00	109
103	Malouh//Aths/Lignee686/3/DWRUB-52	34.93	13.33	39.90	36.58	34.13	24.95	110
38	Zeppelin /4/MERIT,B//CLE150/W89.11369/3/CANELA	36.40	19.67	43.48	24.04	29.87	24.72	111
79	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/4/AC-6629	51.00	16.00	17.39	37.56	29.33	24.39	112
94	Arbayan-01//As46/Aths/3/Barjouj/4/Malouh//Aths/Lignee686	40.73	23.00	21.74	35.16	23.20	24.13	113
102	Tipper/ICB-102854//Alpha/Durra/3/Rihane03	41.47	9.33	37.80	32.00	15.27	24.12	114
115	Clipper//WI2291*2/WI2269/3/Furat 2/4/Furat-3	30.47	17.33	43.48	26.84	18.33	23.62	115
126	UC 1266 //L94/BCD-TTA/3/UC1280	30.00	13.67	52.17	21.42	29.33	23.45	116
85	Clipper//WI2291*2/WI2269/3/Furat 2/4/Alanda01	38.13	17.67	26.30	33.29	23.13	23.08	117
122	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/DWRUB-52	42.73	18.67	26.09	26.98	23.87	22.89	118
124	UC1231L //L94/BCD-TTA/3/UC1263	34.33	18.67	21.74	38.98	18.53	22.74	119
5	PFC9215/3/ZHEDAR#1/SHYRI//OLMO/4/SHENMAI NO.3/MSEL	42.80	18.33	26.09	25.87	35.27	22.62	120
49	Scarlett/RD2592	35.47	14.00	26.09	35.24	27.27	22.16	121
114	Tipper/ICB-102854//Alpha/Durra/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	48.33	16.33	21.74	23.07	17.60	21.89	122
109	Arbayan-01//As46/Aths/3/Barjouj/4/WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml	41.13	12.67	30.43	24.31	24.40	21.71	123
132	UC 1266 // L94/BCD-TTA/3/UC1289	28.07	11.00	48.00	20.93	31.47	21.60	124
129	ISHI X L94/BCD-TTA//UC1263	28.00	19.67	21.74	36.98	23.47	21.28	125
130	UC 1266 // L94/BCD-TTA/3/UC1268	36.80	14.00	34.78	20.36	26.93	21.19	126
106	Tipper/ICB-102854//Alpha/Durra/3/Tichedrette	37.20	15.00	21.74	28.89	18.00	20.57	127
105	Clipper//WI2291*2/WI2269/3/Furat 2/4/Furat-3	31.87	14.67	26.09	29.87	22.47	20.50	128
98	Clipper//WI2291*2/WI2269/3/Furat 2/4/Furat-3	25.87	12.33	47.10	14.67	16.93	19.99	129
137	Atahualpa/DD-21//DD-21/WI3257	24.40	14.67	36.80	23.69	13.67	19.91	130
104	Uzno-Kazakastan/4/Sonata/3/4679/105//YEA132TH/5/Furat-3	40.53	17.00	17.39	23.78	19.67	19.74	131
138	ISHI X L94/BCD-TTA//UC1280	19.20	15.00	48.75	15.02	21.00	19.59	132
128	UC 1266 // L94/BCD-TTA/3/UC1268	35.73	15.00	23.91	23.20	19.00	19.57	133
134	ISHI X L94/BCD-TTA//UC1263	34.27	16.33	21.74	19.20	18.33	18.31	134
125	UC1263 X L94/BCD-TTA//UC1231L	31.27	11.67	23.50	25.02	16.53	18.29	135
123	UC 1266 // L94/BCD-TTA/3/UC1280	27.60	16.33	22.80	22.62	26.47	17.87	136
136	UC 1266 // L94/BCD-TTA/3/UC1264	21.20	11.33	30.43	16.40	25.93	15.87	137
133	UC 1266 // L94/BCD-TTA/3/UC1264	20.40	13.33	21.74	19.69	28.27	15.03	138
141	DWRB 137	62.20	34.67	60.87	55.78	30.13	42.70	
141	DWRB 137	52.93	30.67	58.00	56.36	31.07	39.59	
141	DWRB 137	59.67	29.33	51.90	57.02	33.47	39.58	
140	V Morales	57.67	26.00	63.75	45.11	24.60	38.51	
139	Rihane-03	57.93	26.33	64.20	40.09	32.80	37.71	
140	V Morales	49.20	24.67	56.52	48.44	22.73	35.77	
140	V Morales	43.33	28.00	40.75	52.67	23.40	32.95	
139	Rihane-03	52.00	20.67	49.20	38.93	30.13	32.16	
139	Rihane-03	42.27	22.00	26.09	39.64	30.20	26.00	

Table 2.55. International Barley Observation Nursery-High Input-2024, ancillary data.

Entry	RT	Days to 75% heading	Plant height(cm)	Days to 75% Maturity	1000-grains weight(g)	Spike length(cm)
1	2	89.4(103-80)	79.3(95-54)	129(138-123)	45.7(52.90-37.60)	9.1(12.3-6.3)
2	2	87.2(98-75)	90.5(98-74.3)	128.4(139-119)	54.7(62.60-42)	8.8(9.2-7.5)
3	2	86(96-72)	94.7(113-71.3)	127.4(138-119)	52.8(62.80-42.44)	9.9(12.4-7.2)
4	2	81.4(90-61)	96.7(105-81.4)	126.4(137-118)	49.3(58-38)	8.1(9.2-7.0)
5	2	85.8(94-76)	96.0(117.7-76)	127.6(140-118)	51.0(58.30-38.20)	8.9(9.8-7.5)
6	2	84.2(93-70)	89.6(108-63.3)	126.4(138-116)	44.3(51.90-39.72)	7.4(8.4-6.0)
7	2	83.8(92-69)	84.4(97.7-65)	127.4(138-120)	46.1(54.10-34.40)	7.1(7.6-6.5)
8	2	81.6(91-64)	91.5(105-79)	127.2(139-121)	50.1(57.30-37.92)	8.7(11.9-7.0)
9	2	82.6(90-6)	91.3(110.7-75)	127.4(138-121)	50.1(58.60-41.40)	8.9(9.8-7.2)
10	2	85.6(94-71)	86.9(101-77)	126.4(137-116)	45.0(51-20-37.80)	8.0(9.2-7.2)
11	2	91.4(102-78)	97.7(106-85)	131.2(141-124)	46.1(52.20-34.80)	9.8(10.9-9.0)
12	2	89.2(98-79)	78.7(89-66)	131.2(140-112)	47.4(54.10-42.64)	9.2(10.9-8.0)
13	2	85.6(94-69)	90.2(106.7-78)	131(104-122)	50.8(58.30-41.20)	8.9(10.2-7.8)
14	2	94.8(114-80)	79.9(92-65.6)	133(141-125)	47.9(58.90-44.40)	10.1(10.5-9.6)
15	2	92.8(109-79)	84.2(92-72.3)	131.8(141-124)	43.7(50.40-38)	10.2(12.0-7.8)
16	2	86.6(98-72)	92.1(103-79.3)	127.2(138-113)	48.5(51.60-46.24)	10.3(12.3-9.4)
17	2	88(99-75)	89.1(97.7-79.4)	128.8(139-120)	51.9(55.70-46.36)	9.2(10.4-8.0)
18	2	93.8(109-83)	78.6(86.7-64.3)	131.6(1414-123)	40.8(45.80-37.44)	9.2(10.5-8.5)
19	2	90(102-78)	102.2(111-91)	129.8(139-123)	43.8(51.80-34.60)	8.4(10.3-5.1)
139	6	94.8(108-80)	105.4(115.3-91.6)	133.4(144-125)	43.6(51.10-40.80)	6.2(9.0-4.1)
20	6	88.8(101-78)	67.7(85-51)	129.8(147-122)	32.4(40-23.80)	6.3(7.7-5)
21	6	81.8(91-65)	92.7(115-78)	130.6(142-124)	44.1(51-36.80)	7.1(7.8-5.5)
22	6	85.4(98-70)	90.79(105-74)	131.6(140-130)	37.2(46.60-20)	8.0(9-6.8)
23	6	99.8(111-83)	95.3(102-89.3)	133.4(145-125)	40.9(53.50-34.80)	8.1(8.7-7.8)
24	2	97.4(109-85)	90.0(104-74.6)	131.8(141-112)	40.5(47.60-34.60)	8.3(9.3-7.5)
25	6	87.2(98-69)	83.4(94-68.3)	130.8(142-123)	42.3(49.80-27.28)	7.6(8.9-6.5)
26	6	98.6(109-85)	84.0(103-63)	133.2(141-123)	34.7(40.40-26.20)	7.6(10-6)
27	6	96.6(109-85)	82.7(94.7-72)	132.8(141-122)	40.4(50.60-32.40)	7.7(9.2-5.9)
28	6	100(109-85)	82.7(94.3-67)	132.6(142-122)	38.8(47-30.20)	6.9(7.5-6)
29	6	93(107-79)	83.8(98-73)	132.2(142-122)	42.2(46.70-37.24)	8.1(9-6.1)
30	6	91.4(108-75)	96.0(109-68.6)	132.8(144-123)	34.3(37.30-28)	9.0(10.5-6.6)
31	6	92.8(103-80)	87.0(104-67)	131.8(145-119)	34.5(40.30-31.60)	7.2(9.3-5.3)
32	6	88.8(98-74)	91.1(105-76.6)	133(145-120)	41.5(46-36.60)	6.8(7.3-6)
33	6	93.4(109-79)	87.4(108-69.3)	133.4(146-121)	35.5(39.90-33.12)	6.8(8-5)
34	6	92.8(110-80)	84.8(91-80.6)	132.8(141-119)	36.7(41.80-34.60)	8.1(10-6.8)
35	6	87.8(97-72)	82.2(92-57.6)	132.8(142-122)	44.4(48.60-41.40)	7.5(8.8-5.8)
36	6	88.2(108-71)	82.8(93.3-66.6)	131.2(141-120)	46.3(49.20-41.84)	9.4(10.3-7.3)
37	6	94(110-81)	96.5(110-71)	132.6(143-120)	35.0(40.40-31.80)	8.0(8.5-7.2)
38	2	99.2(111-82)	97.0(114-86.6)	132.2(142-121)	48.2(52.50-44.44)	9.6(11.5-7.8)
140	6	91.2(108-75)	87.6(101.7-80)	129.2(144-119)	42.4(47.90-39.80)	8.6(10.2-7)
39	6	84.8(95-69)	93.8(107-79)	130.4(143-120)	38.2(40.60-32.40)	8.8(9.5-7.2)
40	2	87.4(102-75)	90.9(103.7-78)	129(139-123)	48.4(57.30-38.60)	9.4(10.6-7)
41	2	90(101-80)	93.7(108-75)	132(142-123)	51.2(56.84-39.40)	8.4(9.2-7.3)
42	6	90.6(100-82)	91.2(104.7-74)	130(141-121)	39.0(52.30-34.40)	9.3(10-7.5)
43	6	94.8(109-83)	93.2(112.5-69.6)	133.8(145-125)	38.3(49.90-30)	7.8(10-6)
44	6	91.8(99-84)	90.8(107-80.5)	132(141-121)	43.0(45.60-38.40)	7.8(8.5-6.5)
45	2	86.4(95-71)	86.7(100-61.3)	131.2(146-122)	48.5(54.80-43.20)	9.5(11-6.2)
46	6	94.4(108-83)	83.6(94-71.6)	135.2(146-124)	38.5(43.20-32.80)	7.6(10.2-6.5)
47	2	91(103-77)	78.7(93-66)	131.8(142-124)	46.7(53.60-34.80)	8.3(10.5-4.8)
48	6	95.6(109-78)	85.3(100-45)	135.6(146-126)	51.7(56.70-42.80)	8.7(9.5-6.4)
49	2	89.4(109-75)	91.1(103-75.6)	132.6(144-123)	46.5(51.70-41.80)	10.2(11-9.3)
50	6	87.2(101-75)	89.3(106.7-62.3)	131.6(141-123)	35.5(38.70-32.98)	9.6(11.2-8.5)
51	2	87.4(99-73)	97.0(111.7-71.3)	128.6(140-120)	51.7(60.60-44.70)	9.1(10-7.8)
52	6	91.2(102-81)	88.9(93.7-78)	130.8(141-115)	40.5(44.70-33)	8.6(10.5-6.7)
53	6	94.2(110-82)	90.5(108-74.6)	133.8(145-122)	45.3(52.20-38.96)	7.5(10-5.8)
54	2	87.8(98-73)	87.7(94-73)	129(138-119)	49.0(57.60-34.76)	9.1(10.5-6.3)
55	2	85.8(101-70)	97.1(106.7-78.3)	128.4(139-120)	55.4(59.77-50.20)	9.7(11.8-7)
56	2	90.2(103-79)	94.5(101-79.3)	130.2(142-120)	52.9(59.50-47.40)	9.1(10-8.5)
57	6	85(98-72)	95.8(114.7-76)	128.8(138-122)	39.6(43.30-34.88)	8.3(9.5-6.5)
141	6	86.4(101-70)	86.4(103-76.5)	128(139-120)	44.2(49.60-36.64)	8.4(10.2-7)
58	6	89.4(102-75)	80.9(85-74)	131(140-121)	41.9(54.90-35.40)	7.5(8.2-7)
59	6	90.2(102-75)	80.7(90-65)	131.6(141-121)	46.8(51.20-41.80)	8.0(10-6)
60	2	91.6(107-73)	100.7(119.3-71)	132.4(143-122)	52.9(62.60-37.20)	10.1(11.5-8)
61	6	93.4(108-80)	91.3(99.3-85)	133.6(145-124)	47.5(53-41)	8.1(9-6.3)
62	2	90.8(102-79)	92.2(108-57)	132.6(143-122)	41.4(48.90-31)	9.2(10.2-6.5)
63	2	93.2(108-80)	97.7(109-77.6)	133.2(144-124)	54.3(59.90-49.90)	9.2(11.5-8)
64	6	85.8(92-78)	92.1(105-75)	130.8(140-123)	45.0(50.20-40.40)	8.3(9.3-6.3)
65	6	83.6(94-73)	87.1(92-83)	128.4(137-120)	37.4(39.20-36)	9.1(10.5-7.2)
66	2	83.8(96-63)	91.3(100-76.6)	129.4(141-119)	48.8(57.80-42.20)	8.6(10-5.9)
67	2	87(103-67)	95.8(108-74.6)	130.4(140-121)	50.8(57.40-41.24)	8.5(9.5-7.5)
68	6	92.8(108-69)	92.2(101-79.6)	129.6(139-119)	32.8(40.40-24.40)	7.4(8-6)
69	6	89.4(99-78)	99.3(114.7-84.7)	130.6(139-122)	40.8(46-32.92)	8.5(9.7-6.5)

70	2	98.4(114-82)	97.7(104.9-82.6)	133.8(143-124)	43.7(49.70-37.24)	8.7(10.4-7.2)
71	6	84.4(95-74)	98.5(113.3-77)	129.6(140-123)	40.2(47.70-37.40)	8.8(10.2-7.3)
72	2	90.4(101-79)	94.0(103-85)	128.2(137-121)	50.4(54.50-45.28)	7.9(9.8-7)
73	6	84.8(95-71)	86.9(93.7-80)	127(136-119)	37.4(47.40-32.80)	8.9(10-7.1)
74	6	86.8(98-67)	92.1(107.3-72.3)	129.6(142-120)	42.6(48.90-32.60)	8.2(10-7.5)
75	6	93.8(109-82)	103.6(113.3-88)	132.8(144-125)	36.3(39.10-31.80)	7.6(8.9-7)
76	6	93.8(108-83)	102.8(109.7-96)	133.8(145-127)	38.0(43.60-29.71)	8.4(9.2-7.8)
139	6	96.2(109-84)	104.0(114.3-91)	134.4(146-127)	41.5(53.80-34.60)	6.9(8-6.3)
77	2	90.4(102-78)	104.1(107.7-84)	133.2(141-124)	52.5(62.40-36.52)	8.7(10.4-5.2)
78	2	92.6(107-76)	96.6(107.7-84)	131.4(143-122)	40.2(53.10-23.20)	9.5(12-8)
79	6	91(103-77)	88.4(97.80.6)	131(141-123)	37.5(47.30-25.80)	7.8(9.5-7)
80	6	88.4(100-75)	97.0(109.7-78.6)	129.8(142-122)	40.3(49.80-28)	7.8(9.5-5.8)
81	2	90.8(102-77)	89.1(96-85.7)	129.8(141-121)	47.5(53.70-40.40)	8.7(11-7)
82	6	90(103-75)	105.7(119.7-80.6)	130.2(141-120)	50.4(54.70-46.29)	7.3(9-5.9)
83	6	90.6(102-78)	100.3(112.7-88)	130.4(140-122)	37.2(45.60-29)	7.0(9.3-5)
84	6	88(99-72)	97.9(104.3-91)	127(137-118)	42.0(47.40-30.60)	7.2(8-6.2)
85	2	90.6(108-75)	102.7(112-92.6)	127.6(140-120)	53.4(57.80-50.56)	8.8(10-7.2)
86	2	85.8(98-74)	92.7(98.6-85)	129.4(136-121)	47.7(53.20-40.68)	8.8(10-7.4)
87	2	90.8(107-75)	89.6(99-74.3)	128.8(141-118)	48.4(52-42)	9.4(12-7)
88	2	83.4(93-63)	96.9(110-81)	128.8(140-117)	51.7(56.10-47.12)	9.8(11.6-8.5)
89	2	90.2(102-74)	93.5(100-84)	129(142-118)	44.6(49.90-40.60)	9.3(9.7-9)
90	2	96(106-83)	94.4(109.7-74)	131(141-120)	44.8(50-36.40)	8.8(10.3-7.5)
91	2	88.2(99-72)	92.3(101-76)	130.4(140-122)	45.1(52.60-33.20)	8.1(9.4-6.3)
92	6	91.8(107-78)	94.3(107.3-65)	128.2(140-118)	37.1(40.8-33.8)	7.6(8.5-6.8)
93	2	91.6(106-75)	92.3(103-78)	127.2(141-120)	44.1(49-39.60)	8.1(9.5-7.2)
94	6	90(103-79)	98.7(115-62.6)	128.2(139-120)	43.1(47.20-37.40)	7.0(8.9-6)
95	2	92(109-76)	88.6(98.6-82.6)	129(141-119)	46.0(48.90.40.80)	8.4(10.4-6.5)
140	6	91.2(108-78)	85.8(93.8-72)	130.4(142-119)	42.3(46.20-36.40)	8.6(9.2-8)
96	6	89(107-76)	89.2(99-70.3)	129.8(139-118)	31.0(33.60-27.67)	8.1(10-6.5)
97	2	87.8(98-74)	96.7(115-69.3)	130.2(141-118)	53.1(60.10-48.50)	8.4(10.1-6.2)
98	2	90.6(107-75)	96.6(111-79)	130(142-116)	50.9(55.20-45)	8.9(10.3-7.5)
99	2	89.4(103-74)	95.9(114-82.3)	129(143-116)	53.7(58.60-44.20)	8.6(10.7-7.0)
100	6	85.4(90-81)	87.7(103-78.3)	126.2(137-114)	40.3(46.40-32.20)	9.2(11-7.5)
101	6	88.6(99-75)	94.7(112-75.3)	127.4(138-120)	43.6(59.80-32.70)	6.6(7.6-5.2)
102	2	98.6(113-82)	92.9(107-77.7)	132.8(144-121)	49.5(53.90-43.60)	6.8(7.5-6.2)
103	2	96(112-78)	103.4(116-87.3)	133.8(147-124)	51.6(62.80-46.20)	9.9(12-7)
104	6	90.2(99-80)	93.2(103-79.7)	130.2(139-122)	34.6(41.20-30.10)	8.7(10-7.4)
105	2	91.2(110-78)	98.8(109.5-78.3)	131.2(141-120)	53.7(57.30-51)	9.2(10.7-7.8)
106	2	95.4(113-81)	98.0(112-75.3)	132.2(142-120)	53.6(57.90-47.80)	8.3(11-7)
107	6	84.2(97-65)	93.0(107-78.3)	129(140-118)	38.8(51.10-34.40)	7.5(8.7-6)
108	6	84.8(97-69)	94.9(107-80.7)	127(140-118)	36.3(41.60-30)	8.1(9.5-7)
109	2	91.8(108-78)	98.1(110-79.7)	130.8(143-120)	53.0(55.90-49.40)	8.3(8.9-7.8)
110	6	90(100-79)	105.3(113-78.6)	129.4(139-121)	42.2(49.10-38.65)	7.8(10-6)
111	6	92.6(108-80)	92.3(100.4-85.3)	129.6(142-119)	36.1(43.40-28.80)	8.8(11-6.2)
112	6	89.4(100-79)	103.8(125-74)	129(141-120)	46.9(50-41.84)	9.4(11-6.5)
113	6	83.6(90-78)	102.3(116-89.3)	128(140-120)	40.5(45.12-28.60)	8.2(9.2-7.1)
114	2	91.2(107-78)	96.8(107-84)	128.6(141-119)	43.1(47-39.90)	8.3(11-5.8)
141	6	85.2(96-71)	88.6(107-74.7)	129.8(144-122)	43.3(47.10-37.80)	8.6(9.7-7)
115	2	92.4(109-78)	100.3(112-84)	130.8(143-122)	54.3(59.30-50.36)	8.2(10.5-6.3)
116	2	94.6(110-83)	103.6(115-72.7)	133.2(145-120)	52.0(59.90-39.28)	8.1(10.2-6.5)
117	6	81.8(91-66)	88.9(97.7-82)	130(140-122)	39.7(43.58-33)	7.5(9.2-6)
118	2	88.2(101-75)	91.1(103-72.7)	129.6(141-120)	50.2(55.30-42.70)	8.2(9.1-6.6)
119	2	86.8(97-69)	92.6(105-65)	130.8(141-122)	59.3(67-51.60)	7.9(12.0-6.2)
120	6	92.4(109-81)	95.5(102-76.3)	131.2(140-122)	42.5(52.80-37.92)	8.7(11-6.5)
121	6	92.6(110-79)	97.5(107.4-85)	133.4(143-124)	40.1(46-37)	7.5(8.2-6.6)
122	6	87.4(98-73)	103.8(115-82.3)	130.6(140-124)	36.5(40.64-31.80)	7.9(9.2-5.6)
123	6	91.8(107-78)	102.1(118.3-81.3)	132(144-123)	39.5(42.90-36.80)	7.6(8.5-6.7)
124	6	94.2(107-84)	92.1(104-84.3)	130.4(140-122)	34.8(38.70-31.86)	8.3(9.5-7.5)
125	2	94.8(109-82)	82.2(98-63.6)	132.2(141-123)	45.4(49.80-39.60)	7.9(8.4-7.5)
126	2	89.2(99-79)	91.3(104-76.6)	129.2(142-121)	47.5(51.53-43.40)	8.5(9.4-7.5)
127	6	89.4(106-78)	98.3(113-83.3)	128.2(140-120)	38.4(44.20-31.50)	7.8(10-5.5)
128	6	90.4(105-78)	92.2(99-84)	131.6(142-122)	34.6(44-29.60)	7.8(9.0-6.2)
129	6	85.8(98-72)	99.7(110-81.7)	130.4(142-122)	35.4(39.60-30.20)	7.5(8.2-7)
130	6	87.8(96-77)	91.7(99-80.3)	130.2(144-122)	37.1(44-33.30)	7.4(8-6.7)
131	2	93.2(107-82)	104.8(123-62.3)	129.6(140-122)	48.6(53.80-43.80)	9.6(11-7.6)
132	6	91.6(107-80)	83.5(99-75)	129.8(138-120)	32.8(43.10-27.90)	8.8(10-7.3)
133	2	94(109-83)	82.5(91-75)	130.2(139-121)	39.7(46.40-32.90)	8.6(11-6.8)
139	6	95.8(110-81)	93.6(110-62.3)	132.2(145-123)	42.1(49.40-36.54)	6.8(9-4.7)
134	2	92(109-78)	93.4(108-86)	131(140-122)	44.0(63.70-30.40)	8.7(10.8-5.8)
135	2	90.6(102-79)	95.8(109-61.7)	130.4(140-121)	46.1(52-39.20)	8.7(9.8-7)
136	2	92.6(104-81)	86.6(96-64)	132.2(142-121)	40.2(45.90-32.40)	8.9(11-7)
137	2	92.6(108-83)	108.7(128-61.3)	128.8(140-122)	37.1(47.90-20)	9.8(13.1-6.7)
138	6	95.6(109-85)	95.4(105-85.5)	131.6(142-119)	35.3(40.40-29.60)	8.1(10.8-6)
140	6	93.4(109-80)	85.5(93.3-78)	129.4(140-120)	43.5(48.90-40.40)	7.5(8.5-6.7)
141	6	87.8(102-73)	85.2(103-72.3)	129.8(142-122)	42.9(47.20-36.40)	7.1(9.1-4.4)

Elite International Barley Germplasm Nursery (EIBGN-2023-24)

The EIBGN trial was established with 24 germplasm lines and six released varieties—BH946, HUB113, BHS400, PL891, DWRB123, and DWRB137—used as checks. These 24 promising germplasm lines were selected from various international trials and nurseries based on their performance during the Rabi 2022-23 season. A total of 48 entries, including the six checks, were distributed to twelve locations across the NWPZ (Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Chatha), NEPZ (Kanpur, Varanasi, Kumarganj), and NHZ (Khudwani, Shimla, Bajaura). The nursery trials were successfully conducted at all these locations. Each entry was sown in a 1.5 m² plot consisting of two rows, each 2.5 m in length with a spacing of 30 cm. Grain yield data, recorded in grams per plot, were converted to q/ha for analysis. The results were analyzed on both a center-wise and zone-wise basis and are presented in the accompanying tables. Similarly, ancillary character data are summarized below, showing the mean and range for each trait across the 12 testing locations.

In the NWPZ, the highest location mean for grain yield was observed at Durgapura (89.4 q/ha), followed by Karnal (31.1 q/ha) and Pantnagar (30.7 q/ha), with an overall zonal mean of 38.8 q/ha. Notably, the grain yields at Durgapura were exceptionally high across different entries. The highest zonal mean for grain yield was recorded by the entry IBYT-FFM-2023-15 (53.4 q/ha), followed by IBON-HI-2023-57 (52.7 q/ha) and IBON-HI-2023-3 (52.4 q/ha). Among the checks, BH946, a variety recommended for NWPZ, recorded the highest grain yield of 47.5 q/ha.

In the NEPZ, grain yields were low at Varanasi (18.5 q/ha) and Kumarganj (12.8 q/ha), whereas the Kanpur location showed appreciable yields with a location mean of 40.8 q/ha. The highest grain yield in this zone was recorded by IBON-HI-2023-55 (37.1 q/ha), followed by IBYT-FFM-2023-6 (32.1 q/ha) and IBON-HI-2023-3 (30.6 q/ha). Among the checks, the two-rowed variety DWRB123 performed the best with a grain yield of 28.4 q/ha.

In the North Hill Zone, the highest location mean for grain yield was observed at Khudwani (32.2 q/ha), followed by Bajaura (28.8 q/ha) and Shimla (24.0 q/ha), resulting in a zonal mean of 28.3 q/ha. The highest yields among the check varieties were recorded by BH946 at Khudwani (41.3 q/ha), BHS400 at Shimla (22.1 q/ha), and PL891 at Bajaura (31.3 q/ha). The entry IBYT-FFM-2023-17 recorded the highest zonal mean grain yield (35.3 q/ha), followed by IBYT-ASA-2023-4 (33.9 q/ha) and IBYT-FFM-2023-22 (32.8 q/ha). BHS400 emerged as the best-performing check variety in this zone, with a grain yield of 29.8 q/ha.Detailed center-wise utilization of this nursery trial is provided in the corresponding tables.

National Barley Genetic Stock Nursery (NBGSN-2023-24)

This nursery, consisting of 12 promising genetic stocks with valuable breeding traits, was distributed to 12 centers for utilization, including Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Chatha, Kanpur, Varanasi, Kumarganj, Khudwani, Shimla, and Bajaura. Detailed information on the genetic stocks supplied and their utilization at each center is provided in the corresponding tables.

Table 2.56. Parentage of Genotypes in EIBGN (2023-24).

Entry Code	Parentage	H/N	RT
IBYT-FFM-2023-17	22IBYT7 // UC 1116 / YUMA	H	6R
IBYT-FFM-2023-15	22IBYT7 // UC 1134 / UC 1047	H	2R
IBYT-FFM-2023-19	Tocada/DWRUB52	H	2R
IBYT-FFM-2023-13	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CIRU/7/P.STO/3/ LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/IBTA80/8/CABUYA	H	6R
IBYT-FFM-2023-6	ZARZA//ATAH92/GOB/7/GLORIA-BAR/COPAL/6/P.STO/3/LBIRAN/ UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	H	6R
IBYT-FFM-2023-9	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BRS180/7/ MSEL//LIMON/BICHY2000	H	2R
IBYT-FFM-2023-21	HB120/DWR28	H	2R
IBYT-FFM-2023-22	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/ 7/MERIT,B/ /CLE150/W89.11369/3/CANELA	H	2R
IBYT-FFM-2023-2	29IBON20// COORS 393 / ND 22202-C	H	2R
IBYT-ASA-2023-23	TAMALPAIS / 11HBSN44	H	6R
IBYT-ASA-2023-16	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/5 Lignee527/NK1272/4/Avt/Attiki //Aths/3/Giza121/Pue	H	6R
IBYT-ASA-2023-6	Hma-02//11012-2/CM67/3/Alanda/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Rhn-03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda	H	6R
IBYT-ASA-2023-20	Furat03 (Check)	H	2R
IBYT-ASA-2023-4	Arig8/Imperial//M7/3/Rt013/4/Alanda-01/5/Lignee527/NK1272//JLB70-063/3/IPA99	H	6R
IBON-HI-2023-21	SHYRI X LAUREL 5 (Both parents BYDV-RMV resistant)	H	2R
IBON-HI-2023-57	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BRS180/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CIRU	H	6R
IBON-HI-2023-15	MSEL / ND 22202	H	6R
IBON-HI-2023-55	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BRS180/7/CIRU/BLLU	H	6R
IBON-HI-2023-14	MP30/UC1323	H	2R
IBON-HI-2023-3	29IBON20// COORS 393 / ND 22202-C	H	2R
IBON-HI-2023-13	MP103R/MP6	H	2R
IBON-HI-2023-8	Frontier/RD2668	H	2R
IBON-HI-2023-35	DWR28/RD2668	H	2R
IBON-HI-2023-27	Z068R05551 /CIMMYT 7862 (BUSCH AG CROSS)	H	6R
BH 946	Check	H	6R
HUB113	Check	H	6R
BHS 400	Check	H	6R
PL891	Check	N	2R
DWRB 123	Check	H	2R
DWRB137	Check	H	6R

Table 2.57. Grain yield (q/ha) of EIBGN entries at different locations of NWPZ in *Rabi* 2023-2024.

Entry Name	Hisar			Karnal			Ludhiana			Durgapura			Pantnagar			Chatha			Zonal mean		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBYT-FFM-2023-17	16.1	21	0	20.8	19	0	11.8	24	0	34.0	24	0	20.9	20	0	7.9	24	0	18.6	24	0
IBYT-FFM-2023-15	45.1	2	1	66.4	1	1	38.5	4	1	104.0	8	0	36.5	8	0	29.6	10	0	53.4	1	1
IBYT-FFM-2023-19	29.1	8	0	26.8	13	0	15.1	23	0	55.7	22	0	10.3	24	0	14.4	22	0	25.2	22	0
IBYT-FFM-2023-13	43.1	3	1	29.3	11	0	45.1	2	1	118.0	4	1	14.6	23	0	44.7	3	1	49.1	5	1
IBYT-FFM-2023-6	19.8	19	0	19.8	21	0	18.5	16	0	84.7	14	0	16.0	22	0	33.5	6	0	32.0	20	0
IBYT-FFM-2023-9	33.1	6	0	25.1	15	0	28.5	12	0	74.0	19	0	18.9	21	0	26.7	12	0	34.4	14	0
IBYT-FFM-2023-21	30.1	7	0	20.8	18	0	33.2	8	1	125.6	3	1	33.5	10	0	37.0	5	0	46.7	7	1
IBYT-FFM-2023-22	28.7	9	0	38.1	7	0	34.9	6	1	77.6	16	0	32.4	12	0	26.7	11	0	39.7	11	0
IBYT-FFM-2023-2	28.4	12	0	14.9	22	0	33.2	8	1	95.9	10	0	42.9	3	1	49.5	1	1	44.1	10	0
IBYT-ASA-2023-23	18.4	20	0	7.7	24	0	33.2	8	1	87.3	12	0	37.0	6	0	23.1	17	0	34.4	13	0
IBYT-ASA-2023-16	21.7	17	0	11.5	23	0	33.2	8	1	109.6	6	0	24.2	19	0	38.1	4	0	39.7	12	0
IBYT-ASA-2023-6	15.7	22	0	20.9	17	0	24.9	14	0	87.9	11	0	31.0	15	0	23.4	16	0	34.0	16	0
IBYT-ASA-2023-20	10.3	23	0	29.3	12	0	17.1	18	0	85.4	13	0	32.3	13	0	24.6	15	0	33.2	18	0
IBYT-ASA-2023-4	24.9	14	0	43.4	6	0	40.4	3	1	136.4	1	1	43.7	2	1	25.7	14	0	52.4	4	1
IBON-HI-2023-21	21.3	18	0	26.0	14	0	25.4	13	0	65.4	21	0	26.5	16	0	16.6	18	0	30.2	21	0
IBON-HI-2023-57	34.6	5	0	50.6	4	0	17.1	18	0	134.4	2	1	32.4	11	0	46.9	2	1	52.7	2	1
IBON-HI-2023-15	10.3	23	0	20.2	20	0	15.4	22	0	37.4	23	0	25.1	18	0	13.4	23	0	20.3	23	0
IBON-HI-2023-55	37.9	4	0	32.3	9	0	48.8	1	1	103.7	9	0	25.3	17	0	26.6	13	0	45.8	8	1
IBON-HI-2023-14	28.2	13	0	55.3	2	1	16.3	20	0	105.3	7	0	37.0	7	0	32.1	9	0	45.7	9	1
IBON-HI-2023-3,	28.6	10	0	55.3	2	1	34.6	7	1	114.3	5	1	49.0	1	1	33.0	7	0	52.4	3	1
IBON-HI-2023-13	21.9	16	0	34.9	8	0	16.3	20	0	73.0	20	0	41.8	4	1	16.2	20	0	34.0	15	0
IBON-HI-2023-8	28.6	10	0	29.9	10	0	17.9	17	0	76.0	17	0	35.3	9	0	15.4	21	0	33.8	17	0
IBON-HI-2023-35	47.2	1	1	46.9	5	0	37.9	5	1	83.7	15	0	32.1	14	0	32.9	8	0	46.8	6	1
IBON-HI-2023-27	24.9	15	0	20.9	16	0	21.3	15	0	75.7	18	0	37.3	5	0	16.4	19	0	32.7	19	0
GM (q/ha)	27.0			31.1			27.4			89.4			30.7			27.3			38.8		
CD at 10%	6.1			13.1			16.6			25.0			11.5			9.5			8.1		
BH 946 (Check)	39.7			19.2			40.4			107.6			40.0			38.2			47.5		
HUB113 (Check)	38.5			12.6			39.2			100.0			33.4			35.4			43.2		
BHS 400 (Check)	28.9			31.4			35.4			89.7			39.6			30.7			42.6		
PL891 (Check)	18.9			21.6			25.4			62.2			20.6			22.0			28.5		
DWRB 123 (Check)	32.2			14.0			34.2			76.8			37.3			31.7			37.7		
DWRB137 (Check)	33.5			12.7			42.9			112.7			41.2			38.5			46.9		

Table 2.58. Grain yield (q/ha) of EIBGN entries at different locations of NEPZ in *Rabi* 2023-2024.

Entry Name	Kanpur			Varanasi			Kumarganj			NEPZ		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBYT-FFM-2023-17	43.2	11	0	16.4	16	0	13.4	8	0	24.3	11	0
IBYT-FFM-2023-15	49.9	5	1	21.0	5	0	12.7	12	0	27.9	7	0
IBYT-FFM-2023-19	46.5	8	0	27.7	1	1	12.7	12	0	29.0	5	0
IBYT-FFM-2023-13	33.2	15	0	19.0	9	0	13.4	8	0	21.9	15	0
IBYT-FFM-2023-6	26.5	21	0	16.8	15	0	14.1	7	0	19.1	20	0
IBYT-FFM-2023-9	66.5	2	1	19.7	7	0	10.1	20	0	32.1	2	1
IBYT-FFM-2023-21	31.5	19	0	25.7	3	0	17.5	2	1	24.9	9	0
IBYT-FFM-2023-22	38.2	12	0	17.4	12	0	11.5	16	0	22.4	13	0
IBYT-FFM-2023-2	24.9	24	0	27.0	2	1	8.8	23	0	20.2	17	0
IBYT-ASA-2023-23	44.9	10	0	17.7	11	0	9.5	21	0	24.0	12	0
IBYT-ASA-2023-16	38.2	12	0	17.0	13	0	10.8	18	0	22.0	14	0
IBYT-ASA-2023-6	31.5	19	0	16.2	17	0	11.5	16	0	19.7	19	0
IBYT-ASA-2023-20	36.0	14	0	14.8	20	0	6.2	24	0	19.0	22	0
IBYT-ASA-2023-4	52.6	3	1	13.8	24	0	9.5	21	0	25.3	8	0
IBON-HI-2023-21	32.6	17	0	14.5	22	0	10.2	19	0	19.1	21	0
IBON-HI-2023-57	52.6	3	1	19.8	6	0	14.8	6	1	29.1	4	0
IBON-HI-2023-15	32.6	17	0	14.5	22	0	12.8	11	0	20.0	18	0
IBON-HI-2023-55	69.3	1	1	19.2	8	0	22.8	1	1	37.1	1	1
IBON-HI-2023-14	46.0	9	0	16.8	14	0	11.6	15	0	24.8	10	0
IBON-HI-2023-3	49.3	6	1	25.4	4	0	16.9	3	1	30.6	3	1
IBON-HI-2023-13	26.0	22	0	15.3	19	0	12.3	14	0	17.9	24	0
IBON-HI-2023-8	26.0	22	0	14.8	21	0	12.9	10	0	17.9	23	0
IBON-HI-2023-35	49.3	6	1	18.1	10	0	16.3	4	1	27.9	6	0
IBON-HI-2023-27	32.6	16	0	15.4	18	0	15.6	5	1	21.2	16	0
GM (q/ha)	40.8			18.5			12.8			24.1		
CD at 10%	21.5			2.0			8.7			7.2		
BH 946 (Check)	50.0			15.2			16.2			27.1		
HUB113 (Check)	45.8			16.1			19.7			27.2		
BHS 400 (Check)	50.0			16.0			18.7			28.2		
PL891 (Check)	49.2			15.5			10.3			25.0		
DWRB 123 (Check)	48.3			17.5			19.3			28.4		
DWRB137 (Check)	49.2			16.0			16.3			27.1		

Table 2.59. Grain yield (q/ha) of EIBGN entries at different locations of NHZ in *Rabi* 2023-2024.

Entry Name	Khudwani			Shimla			Bajaura			NHZ		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBYT-FFM-2023-17	32.3	11	0	28.2	5	1	45.3	1	1	35.3	1	1
IBYT-FFM-2023-15	28.3	18	0	26.1	11	0	35.8	5	0	30.1	10	0
IBYT-FFM-2023-19	25.7	24	0	22.5	15	0	40.7	3	1	29.6	11	0
IBYT-FFM-2023-13	41.0	2	0	25.1	12	0	30.3	11	0	32.1	4	0
IBYT-FFM-2023-6	32.7	9	0	24.9	13	0	23.9	18	0	27.2	15	0
IBYT-FFM-2023-9	33.7	7	0	20.3	17	0	41.6	2	1	31.9	5	0
IBYT-FFM-2023-21	38.4	4	0	17.4	24	0	34.8	6	0	30.2	9	0
IBYT-FFM-2023-22	51.1	1	1	18.5	22	0	28.9	12	0	32.8	3	1
IBYT-FFM-2023-2	26.1	23	0	19.0	21	0	14.2	24	0	19.8	24	0
IBYT-ASA-2023-23	32.4	10	0	19.7	19	0	20.1	21	0	24.1	21	0
IBYT-ASA-2023-16	27.7	21	0	20.2	18	0	24.1	17	0	24.0	22	0
IBYT-ASA-2023-6	30.4	13	0	17.9	23	0	24.6	15	0	24.3	20	0
IBYT-ASA-2023-20	34.1	6	0	27.3	9	1	31.8	8	0	31.1	8	0
IBYT-ASA-2023-4	35.4	5	0	27.1	10	1	39.2	4	0	33.9	2	1
IBON-HI-2023-21	28.4	17	0	28.0	7	1	22.6	19	0	26.3	16	0
IBON-HI-2023-57	28.1	19	0	28.1	6	1	30.5	10	0	28.9	13	0
IBON-HI-2023-15	38.7	3	0	27.5	8	1	27.9	14	0	31.4	6	0
IBON-HI-2023-55	30.1	14	0	28.7	3	1	28.2	13	0	29.0	12	0
IBON-HI-2023-14	31.2	12	0	28.9	1	1	33.2	7	0	31.1	7	0
IBON-HI-2023-3	28.5	16	0	28.7	2	1	19.0	22	0	25.4	18	0
IBON-HI-2023-13	29.9	15	0	20.5	16	0	24.2	16	0	24.8	19	0
IBON-HI-2023-8	33.2	8	0	19.2	20	0	31.2	9	0	27.9	14	0
IBON-HI-2023-35	27.2	22	0	28.2	4	1	21.8	20	0	25.7	17	0
IBON-HI-2023-27	27.9	20	0	24.3	14	0	16.6	23	0	22.9	23	0
GM (q/ha)	32.2			24.0			28.8			28.3		
CD at 10%	8.1			2.5			5.3			2.7		
BH 946 (Check)	41.3			17.8			27.7			28.9		
HUB113 (Check)	38.1			21.0			23.5			27.5		
BHS 400 (Check)	39.3			22.1			27.9			29.8		
PL891 (Check)	39.0			13.6			31.3			28.0		
DWRB 123 (Check)	35.5			20.4			30.9			28.9		
DWRB137 (Check)	40.6			16.2			17.5			24.8		

Table 2.60. Mean and range (in parenthesis) across the 12-locations for ancillary characters of barley entries evaluated under EIBGN (2023-24).

Entry Name	Days to heading (75%)	Days to maturity (75%)	Plant height (cm)	Tiller/meter	Spike Length (cm)	Grain /spike	1000 GW (g)	Yield per plot (1.5 m^2) (g)	Leaf blight
IBYT-FFM-2023-17	107 (84-165)	159 (123-231)	67 (44-86)	91 (41-258)	8 (7-12)	56 (29-72)	36 (15-53)	401 (142-700)	24 (13-36)
IBYT-FFM-2023-15	98 (77-159)	154 (119-226)	82 (56-107)	129 (63-262)	8 (6-11)	27 (18-32)	40 (24-47)	436 (140-750)	24 (13-35)
IBYT-FFM-2023-19	106 (83-160)	160 (123-227)	84 (50-108)	103 (36-230)	8 (5-11)	25 (18-30)	43 (28-51)	406 (140-700)	35 (23-46)
IBYT-FFM-2023-13	99 (76-164)	155 (122-230)	86 (49-114)	92 (31-242)	8 (5-11)	48 (25-66)	36 (29-45)	443 (150-694)	24 (13-46)
IBYT-FFM-2023-6	97 (71-158)	152 (111-225)	74 (44-101)	100 (44-236)	7 (5-8)	46 (27-63)	36 (19-50)	370 (160-526)	25 (14-36)
IBYT-FFM-2023-9	100 (74-160)	154 (119-227)	79 (54-107)	114 (75-248)	8 (5-10)	25 (18-29)	45 (33-56)	469 (100-1000)	24 (13-36)
IBYT-FFM-2023-21	97 (71-158)	154 (118-225)	84 (58-109)	111 (48-256)	8 (6-12)	33 (23-54)	44 (33-58)	443 (240-705)	45 (35-45)
IBYT-FFM-2023-22	106 (84-158)	156 (122-225)	81 (56-109)	101 (44-268)	8 (5-12)	34 (26-54)	42 (23-52)	371 (150-600)	35 (24-47)
IBYT-FFM-2023-2	102 (72-168)	156 (115-232)	89 (67-106)	108 (60-262)	7 (5-11)	31 (21-45)	43 (30-53)	436 (110-726)	34 (23-45)
IBYT-ASA-2023-23	104 (76-165)	157 (123-232)	86 (53-107)	108 (56-282)	7 (6-9)	37 (22-55)	36 (15-47)	389 (120-700)	23 (2-45)
IBYT-ASA-2023-16	100 (75-160)	154 (112-227)	86 (58-119)	114 (55-296)	7 (6-9)	42 (15-66)	43 (25-59)	392 (140-600)	35 (24-45)
IBYT-ASA-2023-6	102 (78-159)	156 (120-226)	72 (51-109)	97 (51-208)	7 (5-10)	50 (29-64)	37 (18-50)	333 (150-585)	34 (12-45)
IBYT-ASA-2023-20	105 (84-161)	158 (122-228)	78 (46-95)	112 (70-222)	8 (7-10)	26 (18-32)	37 (15-49)	370 (100-600)	23 (2-36)
IBYT-ASA-2023-4	105 (81-160)	158 (122-227)	86 (59-115)	105 (36-288)	8 (7-9)	48 (22-68)	38 (15-54)	430 (150-790)	35 (12-57)
IBON-HI-2023-21	106 (78-166)	158 (120-232)	85 (70-108)	95 (38-224)	8 (6-11)	25 (20-33)	45 (23-59)	286 (160-450)	34 (23-35)
IBON-HI-2023-57	102 (76-169)	156 (115-235)	81 (53-116)	108 (46-258)	8 (6-12)	54 (29-73)	35 (20-44)	443 (230-750)	24 (2-37)

Continued in next page……

Entry Name	Days to heading (75%)	Days to maturity (75%)	Plant height (cm)	Tiller/meter	Spike Length (cm)	Grain /spike	1000 GW (g)	Yield per plot (1.5 m^2) (g)	Leaf blight
IBON-HI-2023-15	104 (84-159)	156 (119-226)	87 (60-109)	95 (36-242)	7 (6-9)	55 (21-96)	35 (13-43)	312 (200-450)	34 (2-56)
IBON-HI-2023-55	105 (79-160)	155 (118-227)	82 (69-106)	106 (37-266)	7 (6-9)	48 (30-67)	37 (22-50)	453 (274-1000)	35 (13-37)
IBON-HI-2023-14	105 (84-159)	157 (120-226)	83 (64-105)	120 (60-254)	8 (6-11)	27 (16-34)	41 (21-51)	419 (240-700)	24 (12-45)
IBON-HI-2023-3,	98 (70-158)	152 (114-225)	77 (55-101)	112 (45-228)	7 (5-10)	32 (23-60)	44 (32-50)	434 (206-750)	24 (23-35)
IBON-HI-2023-13	103 (73-166)	157 (118-233)	78 (62-100)	115 (47-277)	7 (5-10)	30 (21-48)	36 (16-48)	352 (204-660)	24 (13-24)
IBON-HI-2023-8	103 (77-158)	156 (119-225)	68 (50-84)	102 (44-245)	8 (6-11)	31 (24-54)	39 (17-50)	334 (192-595)	24 (13-24)
IBON-HI-2023-35	104 (76-158)	155 (120-225)	80 (54-106)	125 (53-261)	8 (6-11)	31 (23-48)	43 (33-51)	428 (270-750)	24 (12-45)
IBON-HI-2023-27	106 (84-162)	156 (120-229)	86 (64-97)	103 (45-217)	8 (7-11)	27 (21-34)	40 (18-48)	359 (206-600)	24 (12-35)
BH 946 (Check)	103 (77-164)	156 (118-231)	80 (57-110)	96 (41-210)	8 (6-10)	48 (26-65)	37.5 (14-48)	426 (205-783)	30 (18-41)
HUB113 (Check)	103 (78-165)	155 (110-231)	80 (55-107)	98 (51-215)	7 (5-9)	44 (25-64)	39 (16-50)	436 (242-692)	29 (10-41)
BHS 400 (Check)	108 (80-164)	158 (121-231)	87 (63-111)	103 (51-227)	7 (6-9)	44 (24-63)	38 (21-50)	430 (237-750)	29 (18-40)
PL891 (Check)	104 (80-163)	156 (121-230)	91 (72-116)	113 (50-247)	9 (7-13)	30 (21-46)	41 (24-53)	382 (142-738)	26 (5-32)
DWRB123 (Check)	101 (75-167)	155 (114-233)	81 (57-107)	110 (50-228)	7 (6-9)	29 (20-42)	44 (24-61)	436 (253-725)	27 (15-35)
DWRB137 (Check)	99 (67-166)	155 (115-232)	73 (45-101)	98 (47-224)	7 (6-8)	48 (24-76)	38 (19-48)	432 (205-755)	29 (12-43)

Table 2.61.Utilization of genotypes of EIBGN-(2023-24) at different locations.

Entry	Hisar	Karnal	Ludhiana	Durgapura	Kanpur	Shimla	Bajaura	Chatha
IBYT-FFM-2023-17	H	-	-	-	-	-	SSB	-
IBYT-FFM-2023-15	H	-	SY	S	-	-		-
IBYT-FFM-2023-19	H	-	-	H	SY		SSB	-
IBYT-FFM-2023-13	-	-	SY	S	SY	-		S
IBYT-FFM-2023-6	-	-	-	-	-	-		-
IBYT-FFM-2023-9	H	-	-	-	S	-	SSB	-
IBYT-FFM-2023-21	-	SY	-	-	-	-	-	-
IBYT-FFM-2023-22	-	-	-	-	-	SY	-	-
IBYT-FFM-2023-2	-	-	-	-	-	-	-	S
IBYT-ASA-2023-23	-	-	-		SY	-	-	-
IBYT-ASA-2023-16	-	-	-	H	SY	SY	-	-
IBYT-ASA-2023-6	-	-	-	-	-	SY	SSB	-
IBYT-ASA-2023-20	H	-	-	-	SY		SSB	-
IBYT-ASA-2023-4	H	SY	-	-	SY	SY	SSB	-
IBON-HI-2023-21	-		-	-	-	-	-	-
IBON-HI-2023-57	-	SY	-	S & H	-	SY	SSB	S
IBON-HI-2023-15	-		-		-	-	SSB	-
IBON-HI-2023-55	-	SY	SY	H	-	-	-	-
IBON-HI-2023-14	-	SY	-		-	-	SSB	-
IBON-HI-2023-3,	-	SY	-	S	SY		-	-
IBON-HI-2023-13	-		-		-	-	-	-
IBON-HI-2023-8	-		-		-	-	SSB	-
IBON-HI-2023-35	-	SY	SY		-	-	-	-
IBON-HI-2023-27	-		-		SY	-	-	-

H=used in hybridization; SY=selection for yield;
SSB =Selected for student and on-going breeding programme.

Table 2.62. Parentage of genotypes of NBGSN -2023-24.

Sr No.	Genotype/ Variety	INGR No.	Parentage	Contributing centre/Institute	Specific trait
1	DWRBG 7	22074	DL456/EIBON17	ICAR- IIWBR, Karnal	High bold grain proportion in six rowed hulless barley as indicated with higher 1000 g weight and bold grains percentage.
2	DWRBG 8	22075	Collection from Leh, Ladakh	ICAR- IIWBR, Karnal	Hulless barley with combination of high grain beta glucan (7%) and protein (16.6%) content.
3	DWRBG 9	22126	IC0118689	ICAR- IIWBR, Karnal	Hulled land race with resistance to Corn Leaf Aphid.
4	DWRBG10	22128	IC0356122	ICAR-IIWBR, Karnal	Hulless six-row land race with High ß- glucan and starch.
5	DWRBG12	22127	INT-15	ICAR- IIWBR, Karnal	Six rowed barley with low grain protein content and high malt diastatic power.
6	DWRB219		Latest identified variety	ICAR- IIWBR, Karnal	Variety identified for Malt purpose
7	BHS 485 (BBM 839)	22129	HBL276/BHS369	ICAR-IARI RS, Shimla	Naked (hulless) barley, resistant to yellow rust and leaf rust at the adult plant stage, promising source of malt with protein and starch content weight).
8	BHS 486 (BBM 845)	22130	HBL276/BHS365	ICAR-IARI, RS, Shimla	Possesses adult plant resistance to yellow rust and leaf rust. Resistant to all the pathotypes of brown rust at seedling stage except H4 race. Resistant to all pathotypes of yellow rust at seedling stage except for M and Q race whereby showing moderate susceptibility.
9	BHS 483 (BBM 833)	22131	BHS 352/ BHS 366	ICAR-IARI, RS, Shimla	Naked (hulless) barley genotypes. Resistant to yellow rust & leaf rust at the adult plant stage, resistant to moderately resistant reaction to all pathotypes of yellow rust at seedling stage (except for 24 and Q race showing MS reaction).
10	BHS 479 (BBM 798)	22280	BBM556/BHS169// BHS369	ICAR-IARI, RS, Shimla	Resistant to all the pathotypes of leaf rust and stripe rust at the seedling stage (except for race 24).
11	BHS 480 (BBM 803)	22279	BLG132/BHS369	ICAR-IARI, RS, Shimla	Resistant to all pathotypes of leaf and stem rust at the seedling stage (except for race 11).
12	IC0138120	2132	Selection from IBON (1991-92)- 138-IC0138120	ICAR- NBPGR, New Delhi	High test weight coupled with early maturity in two- rowed barley.

Table 2.63. Utilization of genotypes of NBGSN-(2023-24) at different locations.

Sr No.	Entry	Shimla	Durgapura	Hisar	Karnal	Pantnagar	Bajaura	Kumarjang	Ludhiana	Khudwani
1	DWRBG 7	H	H	S	-	H	H	H	H	H
2	DWRBG 8	H	H	S	-	H	H	-	H	H
3	DWRBG 9	-	H	-	-	-	-	-	H	
4	DWRBG10	-		-	-	H	H		H	H
5	DWRBG12	-	H	-	-	H	H	H	H	-
6	DWRB219	-	H	H	-	H	-	-	H	-
7	BHS 485	H	H	-	H	H	H	-	H	H
8	BHS 486	-		-	H	H		-	H	
9	BHS 483	-	H	-	H	H	H	-	H	H
10	BHS 479	H		-	H	H	H	-	H	H
11	BHS 480	-	H	H	-	H	H	-	H	-
12	IC0138120	-	H	S	-	H		-	H	-

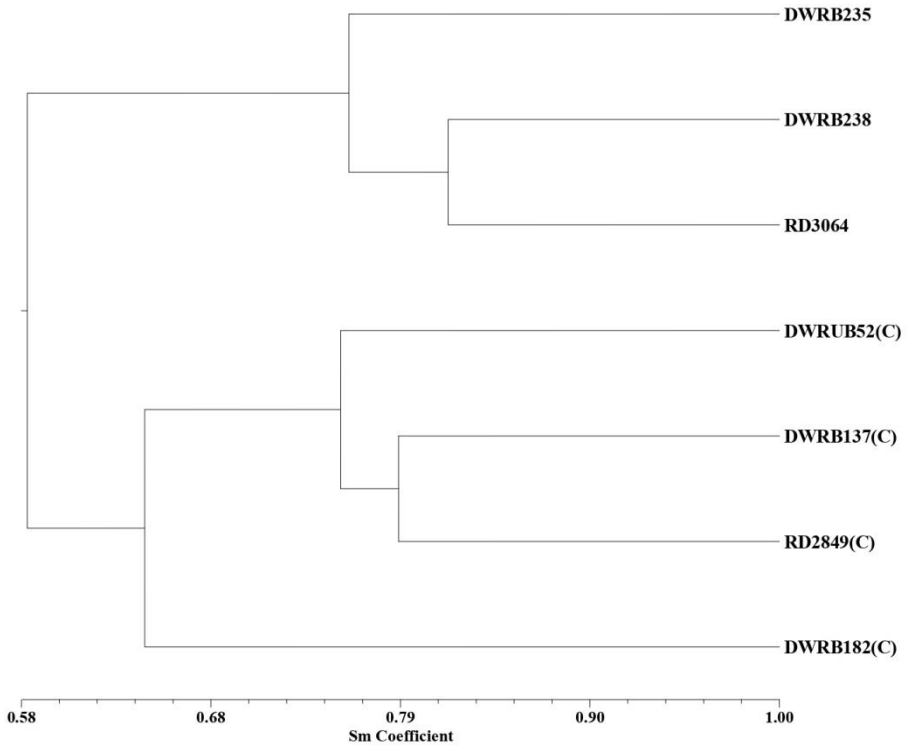
H= Used in hybridization

Molecular Report – AVT Trials (2023-24)

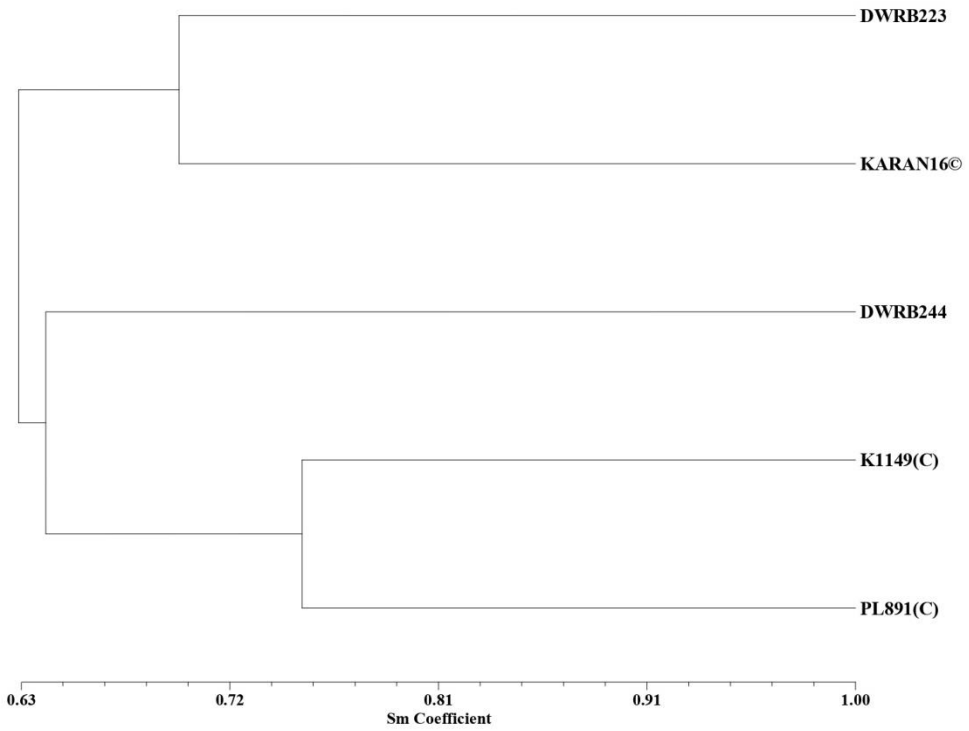
Barley trials entries and checks were characterized at molecular level to analyze genetic variability in all India coordinated barley improvement programme during 2023-24. Total 12 genotypes including entries and their respective checks of AVT-MB-NWPZ and AVT-NB-NWPZ were screened with a set of 46 barley specific SSR/STS markers covering seven chromosomes to develop molecular profiles. Molecular weights for microsatellite products, in base pairs, were estimated and the summary statistics including the number of alleles per locus and polymorphism information content (PIC) were determined. Total 110 alleles were scored for PCR based amplification profiles for screened genotypes. The number of alleles ranged from 1 to 5 with an average of 2.4 alleles per locus. The band fragment size varied from 90 bp to 1500 bp with PIC values ranging from 0.0 to 0.79.

Allele molecular weight data of amplified profiles were converted to develop binary format (allele presence = "1" and allele absence = "0") for genetic diversity analysis with NTSYS-PC version 2.1. AVT trials were scored to develop two binary datasets for malt and naked barley for similarity evaluation. The similarity matrix developed were used to construct dendrogram using Sequential Agglomerative Hierarchical Nesting (SAHN) based Unweighted Pair Group Method of Arithmetic Means (UPGMA) to infer genetic relationships. For estimating the similarity matrix, null alleles were treated as missing data to reduce the biased genetic or similarity measures. For AVT-MB-NWPZ trial, entries and checks grouped within similarity coefficient (Sm) value within 0.63 to 1.0 and showed sufficient genetic variability at molecular level. Entries and checks of AVT-NB-NWPZ trial showed genetic similarity clustering within Sm values of 0.58-1.0 and showed sufficient genetic variability at molecular level. In both the dendrograms, AVT entries are placed at separate node thus distinguishing from their check lines, respectively.

The eventual intend of this effort is to develop molecular markers based amplification profiles for varietal characterization and to assess the level of genetic diversity in Indian barley.



UPGMA based clustering of AVT-MB-NWPZ 2023-24 entries and checks for genetic variability



UPGMA based clustering of AVT-NB-NWPZ 2023-24 entries and checks for genetic variability

Table 2.64. Molecular Markers Used for generating molecular profiles of Barley AVT Trials (2023-24).

Sr No	Marker	Chr	Sequence of PCR Primer (5'-3')	Amplification Conditions
1.	Bmac154	1H	CTGGGTGATGAATAGAGTTTC TATTCTTCAAAAGATGTTCTGC	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @72C
2.	Bmac213	1H	ATGGATGCAAGACCAAAC CTATGAGAGGTAGAGCAGCC	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @72C
3.	Bmag382	1H	TGAAACCCATAGAGAGTGAGA TCAAAAGTTTCGTTCCAAATA	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @72C
4.	Bmag579	1H	CCTAGATAAGGAACATAGCCA CAAAGACCCTAACTCATGTTC	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 1 cycle of 5 mins @ 72C
5.	MGB402	1H	CAAGCAAGCAAGCAGAGAGA AACTTGTGGCTCTGCGACTC	1 cycle of 3 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
6.	ScSSR10477	1H	CATGGGAGGGGACAACAC CGACCAAACACGACTAAAGGA	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 1 cycle of 5 mins @ 72C
7.	HvHVA1	1H	CATGGGAGGGGACAACAC CGACCAAACACGACTAAAGGA	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 1 cycle of 5 mins @ 72C
8.	Bmac175	2H	CTACACCCCTACCATATAAACA CCTCCCCACATACCTTGT	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
9.	EBMAC640	2H	CTCAGTGCGTTACCAGTGC CCTGTCATGCATAACCTATGG	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
10.	Bmag15	2H	TTGAGGGCTGAACACTTCG GCCCACTGTCAAGGACAATT	Touchdown' PCR: 18 cycles of denaturing 1 min @94C and extension 1 min @72C, with Annealing for 30s with temp decreased 1C every second cycle from 69C to 60C. Continue 20 Cycles for 1 min @94C, 1 min @55C, 1 min @72C. End with 5 min @72C.
11.	EBMAC525	2H	TGACAGTGTCTCCAGTAATGA GTTTGTTCTTTTGATTTTGTTG	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
12.	EBmac623	2H	CGAACATTGTCGTGTTAGTAA CTGTCATGCATAACCTATGG'	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
13.	cMWG658	2H	CCAAGAAGGCGAAGAAGGTCC CTCACTGCCCAGAGAAACAGC	STS annealing temperature 62-65oC
14.	Ebmatc39	2H	TAGTCTCTTCATTTATACCATCACC CATGCTGATCCCCCTTCT	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
15.	Bmag6	3H	TTAAACCCCCCCCCTCTAG TGCAGTTACTATCGCTGATTTAGC	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
16.	Bmag603	3H	ATACCATGATACATCACATCG GGGGGTATGTACGACTAACTA	1 cycle of 3 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 55C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
17.	Bmag877	3H	AAAGCTCATGGTAGATCAAGA TAGTTTTCCCAAAAGCTTCTA	1 cycle of 3 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 55C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C

18.	Ebmac541	3H	ACGGATCTACTTTAGCTAGCA AAACAACCCCACACAATC	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
19.	MWG847	3H	GTCTTGGCCAGCTACTCCCG CGCACCTGCACCAGAGGTC	STS annealing temperature 65-67C
20.	Bmag225	3H	AACACACCAAAAATATTACATCA CGAGTAGTTCCCATGTGAC	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
21.	HvLTPPB	3H	TGCTGAGACGCTGAGTACGTTG CAAACTCACGATTCCTCTCAAAG	35 cycles of 1 min at 94 deg C; 1 min at 50 deg C; 2 min at 72 deg C; and a final extension step of 5 min at 72 deg C
22.	Bmag841	3H	GGAAAGTACTTCAAACCTGAA CTTACAAGATGATGAGAACGA	3 min 94C, 45 cycles of 1 min @94C, 1 min @55C, 2 min @72C, final extension of 10 min @72C. 25 microlitre reactions contained 125 nM of each primer.
23.	ABG500	4H	ATTAATCCGACCGTCACTGC ACGAACTCCTCGCTGCC	STS annealing temperature 58-60C
24.	HVM40	4H	CGATTCCCCTTTTCCCAC ATTCTCCGCCGTCCACTC	Annealing (30 s) temperatures were progressively decreased by 1oC every second cycle from 64C to 55C
25.	HVM67	4H	GTCGGGCTCCATTGCTCT CCGGTACCCAGTGACGAC	'Touchdown' PCR of 48 cycles of 94C for 1 min denaturing and 72C for 1 min extension. Annealing (30 s) temperatures were progressively decreased by 1C every second cycle from 64C to 55C. Annealing conditions of 1 min at 55C were maintained during the final 30 cycles. The reaction ended with a 5-min extension at 72C
26.	HvMLOH1A	4H	CCTCCCCTCTGATATGATAA GTACAGACGGTTTAATTGTCC	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 1 cycle of 5 mins @ 72C
27.	Ksug10	4H	GTCCAGCTTCAGCGAGTAC GTGTTGATGTCCTTGAGGCC	STS annealing temperature 60C
28.	MWG634	4H	GTGCTGGGTGGATTAAAAAAGAGGG GAACTAAAGATAGGCGGGAGTACTG	STS annealing temperature 60C
29.	WG622	4H	CTGCCTGTTGATTTTCCATG TTCACCTTGCCATGACGA	STS annealing temperature 60C
30.	Bmag353	4H	ACTAGTACCCACTATGCACGA ACGTTCATTAAAATCACAACTG	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
31.	Bmag337	5H	ACAAAGAGGGAGTAGTACGC GACCCATGATATATGAAGATCA	1 cycle of 3 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 55C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
32.	Bmag751	5H	CACTGCAAATATTAAAATGGA GATCTACTGGTCCATAGTTGC	3 min 94C, 45 cycles of 1 min @94C, 1 min @55C, 2 min @72C, final extension of 10 min @72C.
33.	Bmag812	5H	ATAGTTCTTTCAGGACCAATG GTCATATGGATCTCCAAAGAG	3 min 94C, 45 cycles of 1 min @94C, 1 min @55C, 2 min @72C, final extension of 10 min @72C.
34.	GMS61	5H	CACCTGTTCCGTCCCGTC AACCTCTTTTTTATCCCTCGC	STS annealing temperature 60C
35.	Bmac303	5H	CCTCCAAGATTAGATCTCTCTC CCGTATATTTAAGAAATGGTGA	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C

36.	ABG458	6H	CCGGTCGGTGCAGAAGAG AAATGAAAGCTAAATGGGCGATAT	STS annealing temperature 55-58 C
37.	Bmac40	6H	AGCCCGATCAGATTTACG TTCTCCCTTTGGTCCTTG	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
38.	Bmag500	6H	GGGAACTTGCTAATGAAGAG AATGTAAGGGAGTGTCCATAG	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
39.	GBM1215	6H	ATGACCAGAAAACGCCTGTC GGATTCTGCACACACGAGAA	3 min at 94 deg C; 45 cycles with 30 sec at 94 deg C, 30 sec at 60 deg C (touchdown of 0.5 deg C / cycle for initial 10 cycles - final annealing of 55 deg C for remaining 35 cycles), 30 sec at 72 deg C; and a final extension step of 5 min at 72 deg C
40.	HVM11	6H	CCGGTCGGTGCAGAAGAG AAATGAAAGCTAAATGGGCGATAT	1 cycle of 3 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 55C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C
41.	MWG2029	6H	CCAGTTATCCGAATCCGGAA GTGGTCAGGTACATACGAAT	STS annealing temperature 60C
42.	ABC15864	7H	GCATAAACGGGTGTAAGAGC CATCCAGTTCAGAGGATAGAGC	STS annealing temperature 60C
43.	Bmac64	7H	CTGCAGGTTTCAGGAAGG AGATGCCCGCAAAGAGTT	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
44.	Bmac162		CATGTGTTGAAATCAGTTTTG CCCTCTCTCTCTCTCTCTCTC	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.
45.	Bmac167	7H	CATTTCCACTTCAAAATATCC CCAAAGTTTGAGTGCAGAC	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 1 cycle of 5 mins @ 72C
46.	Bmag110	7H	ACGAGGAGGGACTAGTACAC CCAACTATATTAACAAGGCTCA	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @ 58C, 30 secs @ 72C, 1 cycle of 5 mins @ 72C.

Protocol for developing Molecular profiles of Barley AVT Trials 2023-24

Development of Molecular profiles: An equal number of fresh, young leaves (ten days old) of five plants from each of AVT were bulked for DNA extraction. Total genomic DNA was isolated using the modified CTAB method (Saghai-Maroof *et al*, 1984). A set of 46 SSR/STS molecular markers covering whole genome of barley was used to develop amplification profiles of genotypes. PCR reaction was conducted in reaction volume of 10 ul containing 1X PCR buffer. 200 m M dNTPs, 0.25 uM of primer, 2Mm mgcl2, 1 unit Taq polymerase and 50 ng template DNA . PCR amplification was performed using thermocycler. PCR products were resolved by electrophoresis on 2 % agarose gels at 4v/cm in 0.5 X TBE buffer. Fragment sizes were approximately calculated by interpolation from the migration distance of marker fragments of 100 or 500 bpDNA ladder depending on the amplified fragments size and corroborated with the reported amplified fragment size of respective molecular marker. The occurrence of 'null' alleles was verified by re-amplification using the same primer pair in the same conditions. Gels were visualized with UV light and recorded by imagining system.

Table 2.65. Molecular Profiles of AVT-MB-NWPZ and AVT-NB-NWPZ (2023-24).

SN	Marker	Chr	DWRB244	DWRB223	RD3064	DWRB238	DWRB235	PL891(c)	K1149(c)	KARAN16(c)	RD2849(c)	DWRB182(c)	DWRUB52(c)	DWRB137(c)
1	**Bmac154**	1H	130	110	130	130	130	130	130	130	130, 400	130	130	130
2	**Bmac213**	1H	168	155	150	168	150	180	168	180	180	155	180	168
3	**Bmag382**	1H	109	109	109	109	109	109	109	109	109	109	109	109
4	**Bmag579**	1H	126	110	100	100	100	126	110	126	126	126	126	126
5	**MGB402**	1H	210	240	220	220	215	260,240	260	260	260	260	260	260
6	**ScSSR10477**	1H	NULL	200	150	160	200	200	150	150	150	150	150	140
7	**HvHVA1**	1H	136	136	136	136	136	136	136	136	136	136	136	136
8	**Bmac175**	2H	180	155	155	155	155	180	180	155	180	180	180	180
9	**EBmac640**	2H	176	190	176	176	176	190	190	176	190	190	190	176
10	**Bmag15**	2H	181	181	181	181	181	181	181	181	181	181	181	181
11	**EBmac525**	2H	130	149	130	130	130	149	125	149	149	149	149	149
12	**EBmac623**	2H	NULL	168	168	154	126	168	154	154	154	154	168	154
13	**cMWG658**	2H	600	600	580	580	600	600	600	600	580	580	600	580
14	**Ebmatc39**	2H	139	150	150	150	139	150	150	150	150	170	150	150
15	**Bmag006**	3H	274	274	274	274	274	274	274	274	274	274	274	274
16	**Bmag603**	3H	120	140	120	120	120	122	122	140	122	140	122	122
17	**Bmag877**	3H	NULL	165	165	153	150	165	165	165	165	165	153	165
18	**Ebmac541**	3H	100	140	100	100	100	140	120	140	140	106	120	106
19	**MWG 847**	3H	345	345	345	345	345	345	345	345	345	345	345	345
20	**Bmag225**	3H	140	165	NULL	140	165	185	185	185	185	165	185	185
21	**HvLTPPB**	3H	216	216	216	216	216	216	200	200	216	200	216	216
22	**Bmag841**	3H	115	115	115	NULL	115	115	115	125	125	125	125	125
23	**ABG500**	4H	189	189	189	189	189	189	189	189	189	189	189	189
24	**HVM40**	4H	160	160	160	160	160	160	150	160	160	160	150	160
25	**HVM67**	4H	136	136	136	136	126	136	126	136	136	126	136	136
26	**HvMLOH1A**	4H	175	185	175	175	175	175	175	185	185	175	185	185
27	**Ksug10**	4H	NULL	1500	1300	1500	NULL	1500	1500	1500	1300	1300	1300	1500
28	**MWG634**	4H	800	800	800	800	800	800	800	800	800	800	800	800
29	**WG622**	4H	161	161	161	161	161	161	161	161	161	161	161	161
30	**Bmag353**	4H	90	119	90	90	90	90	119	119	90	90	119	119
31	**Bmag337**	5H	130	165	130	130	95	130	130	130	145	145	165	145
32	**Bmag751**	5H	189	189	189	189	189	189	189	189	189	189	189	189
33	**Bmag812**	5H	NULL	167	NULL	NULL	157	167	147	157	167	157	157	167
34	**GMS61**	5H	145	145	145	145	145	135	135	145	145	135	145	145
35	**Bmac303**	5H	119	138	119	138	119	119	119	138	138	119	119	119
36	**ABG458**	6H	248	248	248	248	248	248	248	248	248	248	248	248
37	**Bmac40**	6H	236	210	NULL	170	190	210	210	236	236	210	210	236
38	**Bmac500**	6H	190	150	190	100	100	110	110	190	190	150	190	190
39	**GBM1215**	6H	240,200	240	200	200	240	240,200	240,200	240	200	200	200	240
40	**HVM11**	6H	175	185	175	175	175	175	175	150	175	175	150	150
41	**MWG2029**	6H	245	245	245	245	245	245	245	245	245	245	245	245
42	**ABC15864**	7H	167	167	167	167	167	167	167	167	167	167	167	167
43	**Bmac64**	7H	155	140	155	155	155	140	155	155	155	140	140	140
44	**Bmac162**	7H	187	187	187, 270	187	187, 270	187	200	187	200	187	200	200
45	**Bmac167**	7H	190	NULL	190	190	190	195	195	184	195	184	195	195
46	**Bmag110**	7H	130	160	145	145	145	145	145	135	145	135	145	184

Molecular weight of amplified fragments measured in base pairs and calibrated with 100 & 500 bp Ladder

Molecular Profiling of Barley AVT 2023-24

Molecular profiles were generated to distinguish entries with their respective checks for barley AVT-MB-NWPZ and AVT-NB-NWPZ trials 2023-24. A set of 46 SSR/STS markers covering all the seven linkage groups of barley was screened with twelve genotypes including entries and checks.

During UPGMA clustering of AVT-MB-NWPZ, three entries under evaluation were grouped in single cluster at similarity coefficient (Sm) value 0.77 and showed sufficient genetic variability at molecular level.

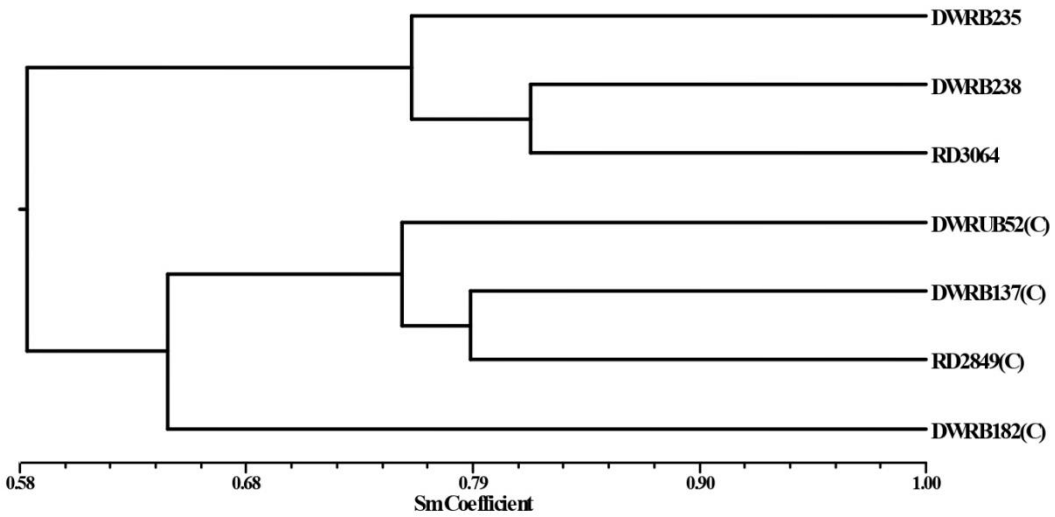


Fig. 2.10. Sm coefficient among entries of AVT – MB-NWPZ .

UPGMA based clustering of AVT-MB-NWPZ 2023-24 entries and checks for genetic variability

Average polymorphic information content (PIC) of AVT entries and checks varied of this trial entries varied from 0.31 to 0.44 across seven linkage groups of barley and chromosome 6H was found most variable.

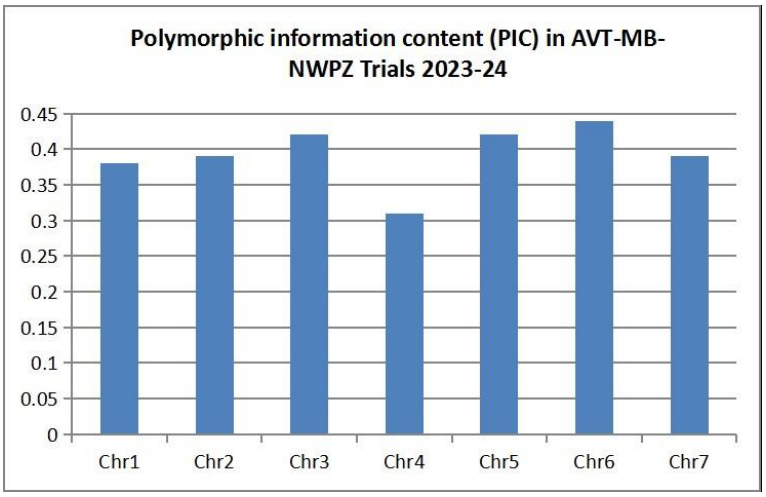


Fig. 2.11. Polymorphic information content (PIC) in AVT-MB-NWPZ (2023-24).

Likewise, for AVT-NB-NWPZ trial, five genotypes including one entry and four checks clustered within Sm range of 0.63 to 1.0.

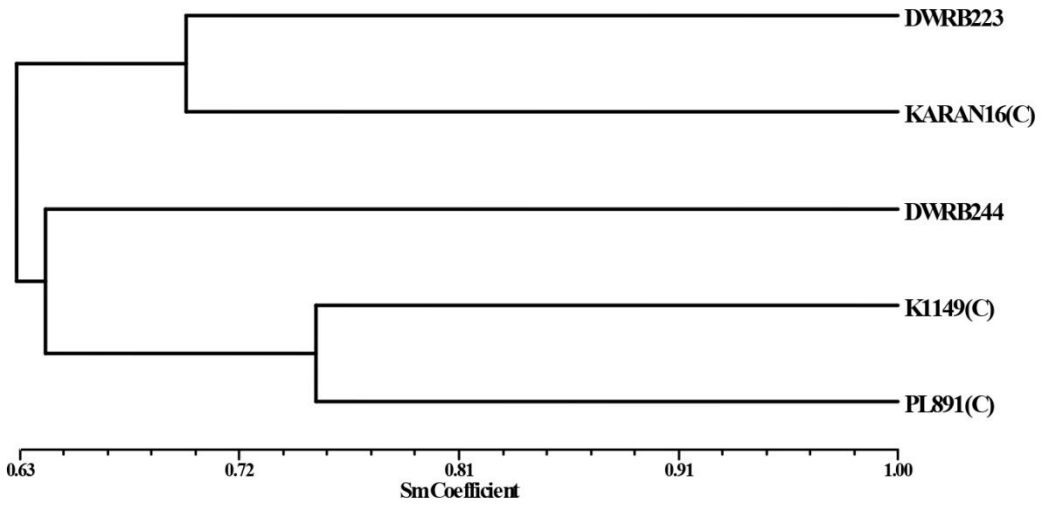


Fig. 2.12. Sm coefficient among entries of AVT – NB-NWPZ.

UPGMA based clustering of AVT-NB-NWPZ 2023-24 entries and checks for genetic variability

Average polymorphic information content (PIC) of AVT entries and checks varied of this trial entries varied from 0.23 to 0.46 across seven linkage groups of barley and chromosome 7H was found most variable.

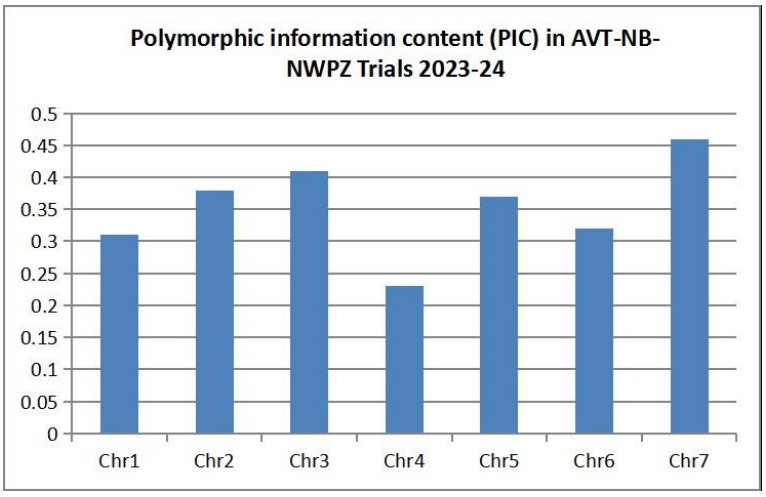


Fig. 2.13. Polymorphic information content (PIC) in AVT-NB-NWPZ (2023-24).

In both dendrograms, each entry is uniquely placed at separate node and is distinct from rest of entries and check lines, respectively. The eventual intend of this effort is to develop molecular markers based amplification profiles for varietal characterization and to assess the level of genetic diversity in Indian barley.

Breeder and Nucleus Seed Production of Barley during 2023-24

Breeder Seed Indent

A consolidated quantity of 571.55q breeder seed indent of 29 varieties was received from Seed Division, DA&FW, New Delhi for its production during 2023-24 and supply during 2024-25. Seven states viz., Rajasthan, Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Madhya Pradesh, and Uttarakhand and five public sector agencies viz., National Seeds Corporation, IFFDC, NDDB & KVSS and National Seed Association of India (NSAI) indented breeder seed. The highest breeder seed indent was placed by Rajasthan 200q (35%) followed by UP 100q (17%), KVSSL (12%) and National Fertilizer Limited. Top five indenting agency contribute almost 85% share in the total breeder seed indent during 2023-24.

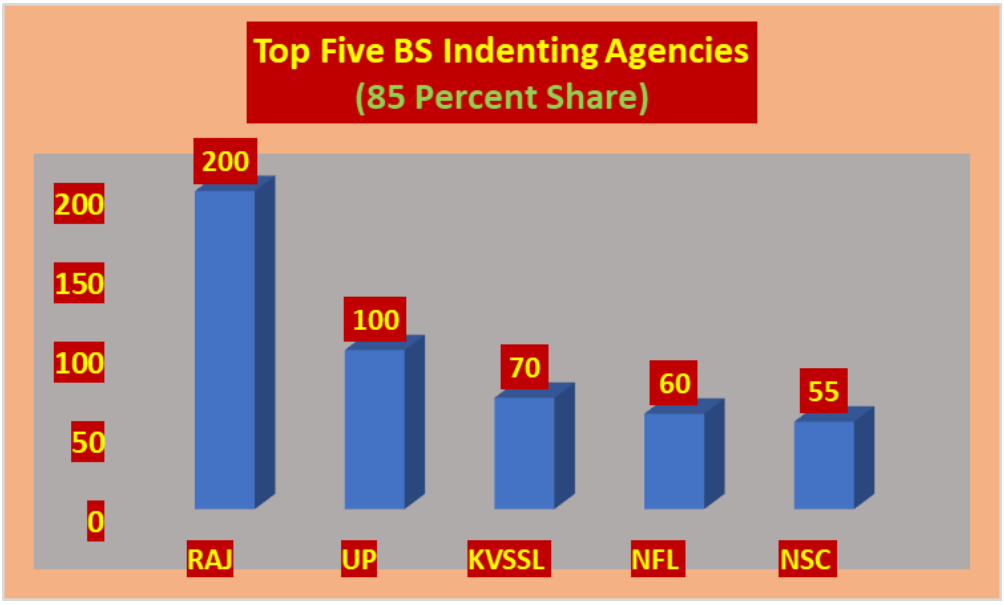


Fig. 2.14. Percent share of different BS indenting agencies.

Breeder Seed Allocation and Production

Total 554.35q breeder seed of 20 varieties was allocated among 9 BSP centres in 6 states. The indent of 17.20q breeder seed of five varieties was not allocated in the BSP-1 due to the <2.0q indent (less quantity) or >10 years old varieties. Among all 20 varieties maximum breeder seed indent was received for the variety DWRB 137 (129.55q) followed by RD 2907 (68.50q) and RD 2899 (60.0q).

A Total 787.50q of breeder seed was produced against 571.55q Indent and 554.35 q allocation with surplus of 215.95q against allocation and 233.15 against indent during 2023-24. Among 9 breeder seed production centres, maximum breeder seed was reported from RARI, Durgapura (405.80q) followed by IIWBR, Karnal (148.00q) and CCSHAU, Hisar (96.00q). Top five breeder seed indented varieties contribute to the tune of 61.28% in total indent during 2023-24. Total 19.04q nucleus seed of 24 varieties was produced against 17.60q allocation in BNS-1 2023-24.

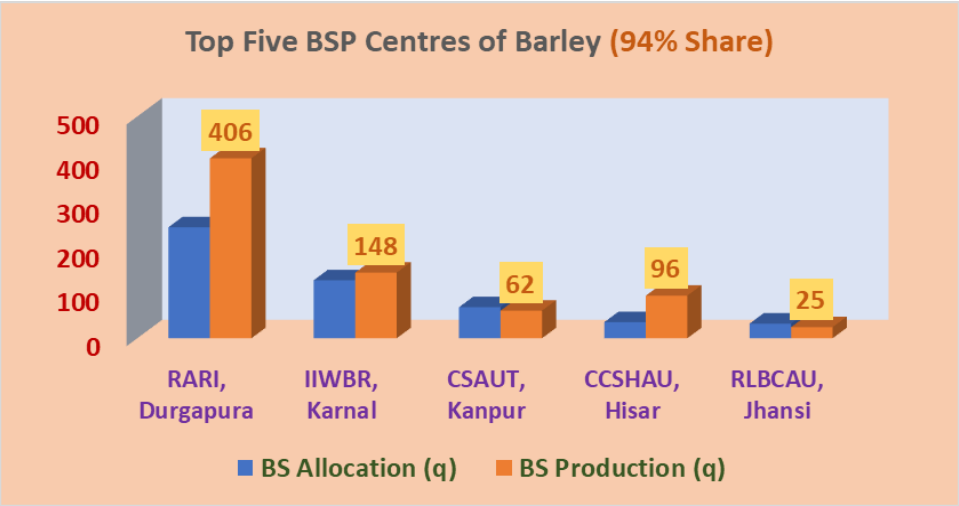


Fig. 2.15. Top Five BSP Centres of Barley.

Table 2.66. Breeder and Nucleus Seed Allocation & Production.

S.No.	BSP Centre	BS Allocation	BSP IV (Production)	Surplus /Deficit ±	NS Allocation	BNS IV (Production)	Surplus /Deficit±
1	RARI, Durgapura	250.25	405.80	155.55	7.00	3.60	-3.40
2	IIWBR, Karnal	130.75	148.00	17.25	4.00	7.50	3.50
3	CSAUT, Kanpur	70.00	62.20	-7.80	2.00	4.80	2.80
4	CCSHAU, Hisar	36.25	96.00	59.75	2.00	3.10	1.10
5	RLBCAU, Jhansi	33.00	25.00	-8.00	1.00	0.00	-1.00
6	PAU, Ludhiana	12.60	40.00	27.40	0.50	0.00	-0.50
7	HPKV, Palampur	10.50	7.00	-3.50	0.50	0.00	-0.50
8	IARI-RS, Karnal	10.00	2.50	-7.50	0.50	0.04	-0.47
9	VPKAS, Almora	1.00	1.00	0.00	0.10	0.00	-0.10
	Total	**554.35**	**787.50**	**233.15**	**17.60**	**19.04**	**1.44**

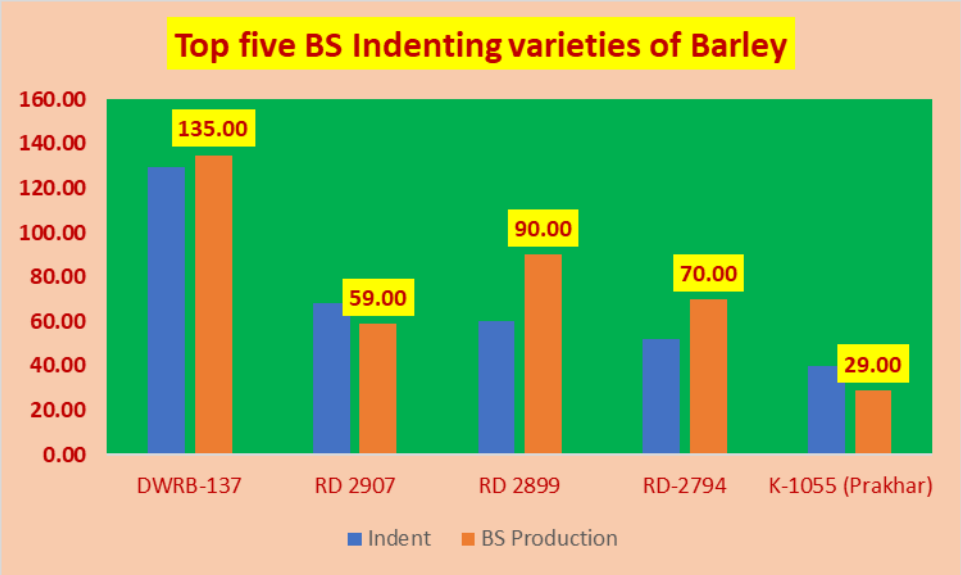


Fig. 2.16. Breeder seed top five Indented varieties of barley.

Table 2.67. Centre wise and variety wise Breeder and Nucleus Seed Production of Barley during 2023-24.

Centre	Variety	Year of Release	DA& FW indent	Breeder seed			Nucleus seed		
				Allocation	Production BSP IV	Surplus/Deficit ±	Allocation	NSP IV	Surplus/Deficit ±
CCSHAU, Hisar	BH 959	2015	12.00	12.00	22.00	10.00	0.50	0.70	0.20
	BH-393	2002	14.25	14.25	49.00	34.75	0.50	0.90	0.40
	BH-946	2014	10.00	10.00	25.00	15.00	1.00	1.50	0.50
	Total			**36.25**	**96.00**	**59.75**	**2.00**	**3.10**	**1.10**
IARI-RS, Karnal	BHS-380	2019	10.00	10.00	2.50	-7.50	0.50	0.04	-0.47
	Total			**10.00**	**2.50**	**-7.50**	**0.50**	**0.04**	**-0.47**
CSAUT, Kanpur	K-1055 (Prakhar)	2018	40.00	40.00	29.00	-11.00	1.00	3.60	2.60
	KB- 1425 (Azad Barley- 33)	2021	30.00	30.00	33.20	3.20	1.00	1.20	0.20
	Total			**70.00**	**62.20**	**-7.80**	**2.00**	**4.80**	**2.80**
IIWBR, Karnal	Central Barley DWRB-137	2018	129.55	96.55	110.00	13.45	2.00	4.00	2.00
	Central Barley DWRB123	2017	12.00	12.00	15.00	3.00	0.50	1.00	0.50
	DWRB 182	2021	13.30	13.30	14.00	0.70	0.50	1.00	0.50
	Karan Maltsona (DWRB 160)	2020	8.90	8.90	9.00	0.10	1.00	1.50	0.50
	Total			**130.75**	**148.00**	**17.25**	**4.00**	**7.50**	**3.50**
RLBCAU, Jhansi	Central Barley DWRB-137	2018	129.66	33.00	25.00	-8.00	1.00	0.00	-1.00
	Total			**33.00**	**25.00**	-8.00	**1.00**	**0.00**	**-1.00**
HPKV, Palampur	HBL 713	2022	10.50	10.50	7.00	-3.50	0.50	1.00	0.50
	Total			**10.50**	**7.00**	**-3.50**	**0.50**	**0.00**	**-0.50**
PAU, Ludhiana	PL-426	1996	12.60	12.60	40.00	27.40	0.50	4.00	3.50
	Total			**12.60**	**40.00**	**27.40**	**0.50**	**0.00**	**-0.50**
RARI, Durgapura	RD 2899	2018	60.00	60.00	90.00	30.00	2.00	1.00	-1.00
	RD 2907	2018	68.50	68.50	59.00	-9.50	1.50	0.50	-1.00
	RD-2035	1994	37.00	37.00	120.00	83.00	1.00	0.70	-0.30
	RD-2552	2000	12.00	12.00	5.80	-6.20	0.50	0.40	-0.10
	RD-2715	2009	10.50	10.50	50.00	39.50	0.50	0.40	-0.10
	RD-2794	2012	52.25	52.25	70.00	17.75	1.50	0.40	-1.10
	RD 2849	2016	10.00	10.00	11.00	1.00	0.50	0.20	-0.30
	Total			**250.25**	**405.80**	**155.55**	**7.00**	**3.60**	**-3.40**
VPKAS, Almora	VLB 130	2019	1.00	1.00	1.00	0.00	0.10	1.00	0.90
	Total			**1.00**	**1.00**	**0.00**	**0.10**	**0.00**	**-0.10**
	Grand Total		**571.55**	**554.35**	**787.50**	**233.15**	**17.60**	**19.04**	**1.44**

BARLEY CROP PROTECTION (2023-24)

Summary

- Total 686 entries consisting 492, 144 and 50 entries in different nurseries *viz*., IBDSN, NBDSN and EBDSN, respectively, were screened for resistance against various diseases, aphid and CCN at different cooperating centers during the crop season 2023-24.
- Out of 492 entries in IBDSN from different breeding centers, 47 entries were found free from yellow rust (ACI = 0) and 291 entries showed resistant reaction having ACI less than 10.
- Total 144 entries evaluated in NBDSN, 16 were entries found free from yellow rust, 119 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 2 entries showed moderate level of resistance with an average score (double digit) 14-35 and HS ≤ 57.
- Among 50 EBDSN entries, 12 found free from yellow rust, whereas 30 shown resistant reaction. 10 entries also showed moderate level of resistance against leaf blight with an average score 14-35 and HS ≤ 57.
- Among eight different fungicidal treatments, two spray of viz., Tebuconazole 50% + Trifloxystrobin 25%, Propiconazole 13.9% + Difenconazole 13.9% and Propiconazole 25% was found most effective in management of foliar blight of barley.

BARLEY PATHOLOGY

Status of barley diseases and insect pests

To know the health status of barley crop, the survey was conducted by the scientists from RARI, Durgapura on the farmers' fields during 21st December, 2023 in the area of district Dausa, Rajasthan overall barley crop was healthy. Extensive surveys were conducted in the month of December by a team of BAU Sabour at Bhagalpur and their adjoining areas by survey team on 16.12.2023 and 17.12.2023 and spot blotch in barley crop with severity ranges from 01 to 12 was noticed at farmer's field in areas viz. Barari, Jagdishpur, Nathnagar, Sabour and Kahalgaon. In another survey conducted by RARI team on 18th January, 2024 in the areas of district Jaipur, and Dausa districts to know the health status of barley crop at farmer's field. The incidence of leaf stripe, loose smut, covered smut and bacterial streak was noted in barley crop in traces at few locations.

Survey was conducted by team of UBKV Coochbehar on 10-12-2024, 17-01-2024, 24-01-2024 and 26-01-2024 at the farmers' fields of different northern districts of West Bengal and their adjoining areas viz. Malda (Manikchak, Harishchandrapur-I and Chanchal block), Dakshin Dinajpur (Raiganj and Balurghat area), Uttar Dinajpur (Islampur sub-division), Darjeeling (Kharbari block), Kalimpong (RRS, Hill Zone), Jalpaiguri (Mahitnagar adjoining area) and Coochbehar district (Dinhata, Tufanganj, Mathabhanga and Pundibari block). The spot blotch incidence was recorded up to 56 in barley crop at Pundibari, Coochbehar. Another survey was conducted on February 15, 16 and 29, 2023 of wheat fields in Dakshin Dinajpur, Malda, Darjeeling and Coochbehar districts by a team of UBKV, Spot blotch incidence was recorded up to 89 in barley crop at Pundibari, and Coochbehar.

Observation of any new barley diseases/ insect pests

To observe the appearance of any quarantine pests on barley crop. The nurseries were observed for any new symptoms during the crop season till the harvest. There was no report from any centre for presence of any of following quarantined pests (disease / insect pest) in their respective areas during the crop season 2023-24.

i. Glume rot - Not reported by any centre
ii. Barley stripe mosaic - Not reported by any centre
iii. Ergot - Not reported by any centre

Status of resistance in breeding lines and advanced entries:
Adult plant resistance (APR)
A total 686 barley breeding lines were screened during the crop season 2023-24 under various nurseries (IBDSN, NBDSN and EBDSN) for resistance against various diseases, aphid and CCN at different cooperating centres. There were 492 entries under IBDSN, 144 were for NBDSN and 50 for EBDSN (Fig. 1). Seedling Resistance Test (SRT) for NBDSN and EBDSN entries was conducted at IIWBR, Regional station, Flowerdale, Shimla. Besides, the screening of barley germplasm for disease resistance, experiments on chemical control of foliar blight were conducted at various locations to evaluate the efficacy of various fungicides. NBDSN entries were also screened for aphid and CCN resistance.

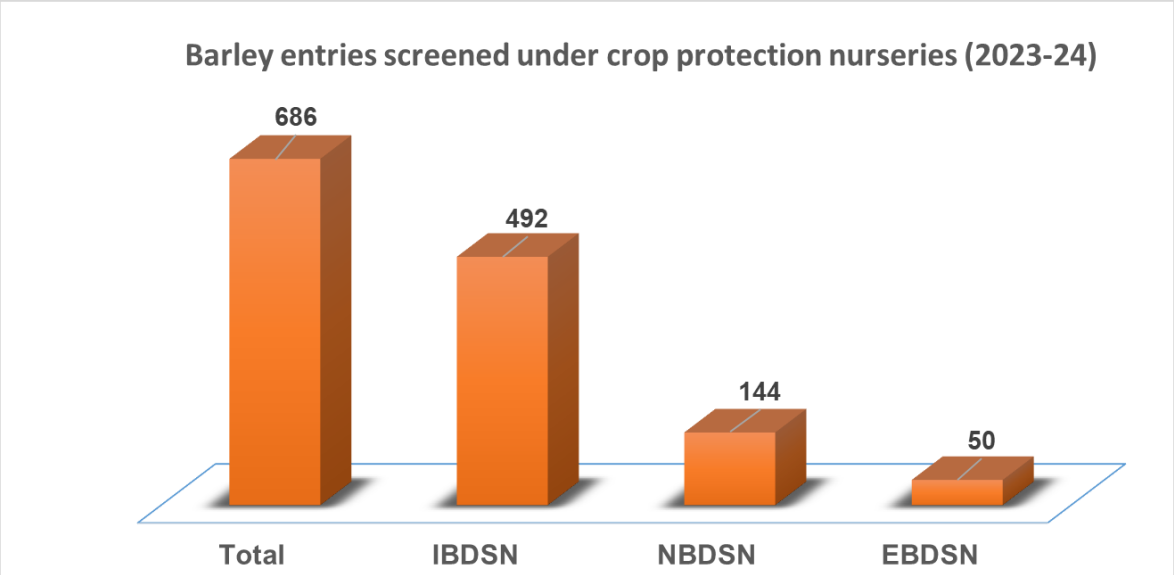


Fig. 3.1: Barley entries screened under crop protection nurseries (2023-24).

Initial Barley Disease Screening Nursery (IBDSN) 2023-24
During the season 2023-24, total 492 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 Bajaura, Ludhiana, Durgapura, Almora, Karnal and Jammu. The screening for leaf blight was done at Ayodhya, Pantnagar, Kanpur and Varanasi. Data of Almora (yellow rust) centres are not considered due to low disease severity in infectors.
To create the epiphytotic condition for yellow rust the inocula were supplied by IIWBR Regional Station, Flowerdale, Shimla and multiplied in respective centres for creating epiphytotics in the main field from tillering to flag leaf stage. The scoring of disease was done based on response and severity. Leaf blight inoculum supplied by IIWBR, Karnal centre and inoculation by centres in the field was done and the scoring of blight disease was done at dough stage in double digit scale on flag leaf (F) and F-1 leaf. For stripe rust, average coefficient of infection (ACI) was calculated along with highest score. The entries showing ACI up to 10.00 for rusts were considered resistant (R). For leaf blight, average disease score in double digit system was calculated along with highest score, the genotypes showed an average score of 00-13 with highest score upto 35 at multilocation were considered resistant and genotypes with average score of 14-35 with HS upto 57 were considered moderately resistant (MR).
Among 492 entries evaluated during 2023-24 (Table 3.1), 47 entries were found free from yellow rust (ACI = 0) and 291 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 3 entries were found resistant against leaf blight with an average score (double

digit) 00-13, and HS ≤ 35, whereas 39 entries were found moderately resistant against leaf blight with an average score (double digit) 14-35 and HS ≤ 57.

Table 3.1. List of 492 entries of IBDSN as per ACI.

Yellow rust, ACI = 0, Entries –47	BK2316, BK2329, BK2330, BK2334, BK2337, BK2353, BK2360, BK2362, BK2364, PKB2332, PKB2353, PKB2358, PKB2362, PKB2365, HB2315, HB2318, HB2319, HB2321, HB2322, VB 2301, BH23-01, BL2210, BL2316, BL2338, BL2361, BBM 972, BBM 976, BBM994, JAUB13, JAUB14, UPBM02, UPBM04, UPBM21, BD2021, BD2025, BD2033, BD2034, BD2036, BD2053, BD2056, BD2057, BD2061, BD2067, BD2068, BD2070, HUBL2307, and ICB-397
Yellow rust, ACI > 0 to 10, Entries – 291	BK2303, BK2305, BK2306, BK2307, BK2308, BK2309, BK2310, BK2311, BK2312, BK2313, BK2314, BK2315, BK2317, BK2319, BK2320, BK2321, BK2324, BK2325, BK2326, BK2327, BK2328, BK2331, BK2332, BK2333, BK2335, BK2336, BK2339, BK2341, BK2343, BK2345, BK2346, BK2347, BK2348, BK2349, BK2352, BK2354, BK2358, BK2359, BK2361, BK2363, BK2365, PKB2301, PKB2304, PKB2306, PKB2307, PKB2313, PKB2314, PKB2315, PKB2321, PKB2323, PKB2325, PKB2333, PKB2334, PKB2335, PKB2341, PKB2342, PKB2343, PKB2346, PKB2348, PKB2349, PKB2354, PKB2355, PKB2356, PKB2359, PKB2360, PKB2363, PKB2364, PKB2366, HB2301, HB2303, HB2304, HB2305, HB2306, HB2307, HB2308, HB2310, HB2311, HB2312, HB2313, HB2314, HB2316, HB2317, HB2320, JHSBB 14, JHSBC 36, JHSBK 40, NDB 1835, NDB 1836, NDB 1837, NDB 1840, NDB 1841, NDB 1842, NDB 1843, NDB 1844, NDB 1845, NDB 1846, NDB 1847, NDB 1850, NDB 1851, NDB 1852, VB 2302, VB 2303, VB 2304, VB 2306, VB 2307, VB 2308, VB 2309, VB 2310, VB 2311, VB 2313, VB 2314, VB 2319, VB 2322, VB 2323, VB 2324, VB 2325, VB 2330, BH23-03, BH23-04, BH23-05, BH23-06, BH23-08, BH23-09, BH23-11, BH23-12, BH23-13, BH23-14, BH23-15, BH23-16, BH23-19, BH23-20, BL2211, BL2216, BL2217, BL2219, BL2238, BL2242, BL2243, BL2244, BL2245, BL2247, BL2248, BL2250, BL2255, BL2260, BL2271, BL2289, BL2292, BL2293, BL2300, BL2302, BL2306, BL2307, BL2311, BL2317, BL2321, BL2322, BL2329, BL2332, BL2334, BL2336, BL2337, BL2340, BL2341, BL2342, BL2343, BL2344, BL2352, BL2353, BL2354, BL2355, BL2358, BL2359, BL2362, BL2363, BL2365, BL2368, BL2373, BL2374, BL2221, BBM 963, BBM 964, BBM 965, BBM 967, BBM 968, BBM 969, BBM 970, BBM 971, BBM 973, BBM 974, BBM 975, BBM 977, BBM 978, BBM 979, BBM 981, BBM 982, BBM 984, BBM 985, BBM 986, BBM 988, BBM 989, BBM 991, BBM 992, BBM 993, BBM 995, BBM 996, BBM 997, BBM 998, JAUB11, JAUB12, JAUB15, JAUB16, JAUB18, UPBM01, UPBM03, UPBM05, UPBM06, UPBM07, UPBM08, UPBM14, UPBM15, UPBM16, UPBM18, UPBM19, UPBM22, UPBM23, UPBM24, UPBM25, UPBM26, UPBM27, UPBM28, BD2011, BD2012, BD2013, BD2014, BD2015, BD2016, BD2017, BD2018, BD2019, BD2020, BD2023, BD2024, BD2027, BD2028, BD2030, BD2031, BD2032, BD2042, BD2043, BD2044, BD2045, BD2046, BD2048, BD2049, BD2050, BD2051, BD2052, BD2054, BD2055, BD2058, BD2059, BD2060, BD2062, BD2063, BD2064, BD2065, BD2066, BD2069, HUBL2303, HUBL2305, HUBL2310, IBYT ASA 22, IBYT ASA 23, IBYT ASA 32, IBYT ASA 38, SELECTION-87, SELECTION-160, IBON-106, IBON-113, IBON-115, AL-109, AL-110, AL-213, AL-219, AL-220, ICB-19, ICB-132, ICB-139, ICB-289, and ICB-295
Leaf blight, Avg. 00-13 with HS ≤ 35, Entries – 3	PKB2325, PKB2332, and PKB2362
Leaf blight, Avg. 14-35 with HS ≤ 57, Entries –39	BK2325, PKB2329, PKB2335, PKB2345, PKB2347, PKB2348, PKB2353, PKB2356, PKB2359, PKB2361, PKB2363, PKB2365, HB2307, HB2311, VB 2303, VB 2304, VB 2313, VB 2316, VB 2320, VB 2322, VB 2323, VB 2325, VB 2327, VB 2330, BL2378, BBM 975, BBM 984, JAUB17, UPBM09, UPBM10, BD2038, BD2040, HUBL2304, IBYT ASA 32, IBON-105, IBON-113, IBON-115, ICB-290, and ICB-295

Table 3.2. Reactions of different entries in Initial Barley Disease Screening Nursery during 2023-24

IBDSN No.	Entry	Yellow Rust		Leaf Blight	
		ACI	HS	Avg.	HS
ICAR-IIWBR, Karnal					
1	BK2301	20.4	40S	35	68
2	BK2302	40.0	80S*	57	99
3	BK2303	1.9	5S	46	99
4	BK2304	14.0	40S	57	99
5	BK2305	6.6	10S	45	99
6	BK2306	6.8	20MS	46	99
7	BK2307	0.5	5MR	56	99
8	BK2308	8.4	20S	46	68
9	BK2309	3.2	10S	46	99
10	BK2310	2.9	10S	34	68
11	BK2311	1.6	5MS	34	68
12	BK2312	2.1	10S	35	79

13	BK2313	2.0	5S	34	99
14	BK2314	4.2	10MS	46	78
15	BK2315	1.8	10MS	57	99
16	BK2316	0.0	0	57	99
17	BK2317	1.1	5MS	56	99
18	BK2318	22.5	40S	45	99
19	BK2319	7.6	10S	46	99
20	BK2320	3.0	10S	46	99
20A	Infector	72.0	100S	78	79
21	BK2321	5.6	20MS	46	99
22	BK2322	22.4	60S*	57	99
23	BK2323	10.8	20S	46	99
24	BK2324	5.3	10S	57	99
25	BK2325	2.2	5S	35	57
26	BK2326	3.8	10S	46	99
27	BK2327	7.2	20S	46	99
28	BK2328	3.9	10MS	34	78
29	BK2329	0.0	0	34	99
30	BK2330	0.0	0	46	99
31	BK2331	9.8	20S	57	99
32	BK2332	8.0	20S	57	99
33	BK2333	3.8	10S	45	99
34	BK2334	0.0	0	45	99
35	BK2335	4.0	10S	45	99
36	BK2336	0.04	TR	34	99
37	BK2337	0.0	0	45	99
38	BK2338	13.6	20S	34	99
39	BK2339	1.0	5MS	47	79
40	BK2340	12.0	40S	57	99
40A	Infector	76.0	100S	79	89
41	BK2341	3.2	10S	57	99
42	BK2342	27.6	60S*	45	99
43	BK2343	4.3	20S	56	99
44	BK2344	17.0	40S	46	68
45	BK2345	10.0	20S	46	79
46	BK2346	0.8	5MS	46	99
47	BK2347	9.6	20S	45	99
48	BK2348	2.1	10S	34	99
49	BK2349	8.0	20S	45	99
50	BK2350	19.8	40S	46	99
51	BK2351	27.4	60S	57	99
52	BK2352	2.6	10MS	57	99
53	BK2353	0.0	0	57	99
54	BK2354	7.2	20S	46	99
55	BK2355	14.5	20S	57	99
56	BK2356	19.4	40S	68	99
57	BK2357	21.6	40S	78	99
58	BK2358	0.2	TMS	67	99
59	BK2359	0.4	TS	57	99
60	BK2360	0.0	0	57	99
60A	Infector	80.0	100S	79	79
61	BK2361	5.1	10S	57	99
62	BK2362	0.0	0	56	99
63	BK2363	2.1	10S	46	99
64	BK2364	0.0	0	46	99
65	BK2365	4.0	10S	45	99
CSAUA&T, Kanpur					
66	PKB2301	5.4	10S	35	68

67	PKB2302	36.0	80S	36	57
68	PKB2303	40.0	80S	46	79
69	PKB2304	2.4	5MS	57	89
70	PKB2305	44.2	80S	46	68
71	PKB2306	2.3	5S	35	68
72	PKB2307	4.0	10S	57	99
73	PKB2308	21.0	60S*	46	57
74	PKB2309	13.0	40S	36	47
75	PKB2310	48.1	80S	45	99
76	PKB2311	36.8	80S	46	99
77	PKB2312	40.0	60S	45	99
78	PKB2313	6.3	10MS	57	89
79	PKB2314	1.0	5MS	46	78
80	PKB2315	4.0	10S	45	99
80A	Infector	80.0	100S	89	89
81	PKB2316	25.2	60S*	57	99
82	PKB2317	32.0	80S*	34	99
83	PKB2318	48.4	100S	46	99
84	PKB2319	13.3	40S	36	47
85	PKB2320	40.8	80S	57	99
86	PKB2321	5.8	20MS	45	99
87	PKB2322	40.8	80S	45	99
88	PKB2323	1.2	5S	35	68
89	PKB2324	15.0	40S	57	79
90	PKB2325	3.3	10S	12	13
91	PKB2326	13.4	40S	36	68
92	PKB2327	12.0	20S	45	99
93	PKB2328	19.0	40S	56	99
94	PKB2329	27.2	60S*	24	46
95	PKB2330	44.2	80S	57	99
96	PKB2331	40.2	80S	45	99
97	PKB2332	0.0	0	13	35
98	PKB2333	9.2	20S	46	99
99	PKB2334	0.8	10MR	46	78
100	PKB2335	3.6	10S	35	57
100A	Infector	72.0	100S	79	89
101	PKB2336	11.0	20S	68	89
102	PKB2337	52.2	100S	44	99
103	PKB2338	40.8	80S	56	99
104	PKB2339	14.4	40S	44	99
105	PKB2340	40.0	80S	56	99
106	PKB2341	1.6	10MS	56	99
107	PKB2342	3.2	10MS	67	99
108	PKB2343	2.8	5S	45	99
109	PKB2344	16.0	40S	45	99
110	PKB2345	20.2	40S	34	46
111	PKB2346	1.0	5MS	46	57
112	PKB2347	36.0	80S	24	46
113	PKB2348	8.2	20S	23	46
114	PKB2349	9.2	20S	45	99
115	PKB2350	32.0	80S*	46	99
116	PKB2351	36.8	80S*	56	99
117	PKB2352	11.0	20S	47	79
118	PKB2353	0.0	0	24	56
119	PKB2354	0.2	TMS	46	47
120	PKB2355	0.2	TMS	34	68
120A	Infector	76.0	100S	89	89
121	PKB2356	5.5	20S	24	47

122	PKB2357	28.0	60S*	46	69
123	PKB2358	0.0	0	34	68
124	PKB2359	1.7	5S	24	24
125	PKB2360	3.3	10MS	46	57
126	PKB2361	40.0	80S	35	57
127	PKB2362	0.0	0	12	24
128	PKB2363	2.0	5MR	25	36
129	PKB2364	1.8	5MS	46	57
130	PKB2365	0.0	0	34	57
131	PKB2366	2.8	10S	46	99
CSK HPKV, Bajaura					
132	HB2301	1.0	5MS	34	99
133	HB2302	11.0	20S	56	99
134	HB2303	8.8	20S	46	99
135	HB2304	3.4	10MS	45	99
136	HB2305	2.0	5MS	44	99
137	HB2306	8.8	20S	45	99
138	HB2307	4.1	20S	35	47
139	HB2308	1.6	10MS	57	99
140	HB2309	10.2	20S	44	99
140A	Infector	76.0	100S	79	89
141	HB2310	1.0	5S	34	99
142	HB2311	5.2	10S	35	36
143	HB2312	1.2	5MR	45	99
144	HB2313	4.4	20MR	46	99
145	HB2314	3.6	10S	46	99
146	HB2315	0.0	0	45	99
147	HB2316	0.8	10MR	67	99
148	HB2317	8.6	20S	68	99
149	HB2318	0.0	0	45	99
150	HB2319	0.0	0	45	99
151	HB2320	4.8	20S	56	99
152	HB2321	0.0	0	57	99
153	HB2322	0.0	0	46	99
ICAR-IGFRI, Jhansi					
154	JHSBA 5	24.4	60S*	56	99
155	JHSBA22	30.6	80S	57	99
156	JHSBB 14	5.6	20S	56	99
157	JHSBC 5	26.2	60S*	68	99
158	JHSBC 29	32.8	80S*	57	99
159	JHSBC 36	8.8	20MS	57	99
160	JHSBF 15	40.0	80S	57	99
160A	Infector	76.0	100S	89	99
161	JHSBF 18	44.0	80S	56	99
162	JHSBH 39	13.0	60S*	46	99
163	JHSBI 1	26.2	60S	44	99
164	JHSBI 18	36.0	80S	46	99
165	JHSBI 22	31.6	60S*	57	99
166	JHSBK 1	13.0	40S	47	89
167	JHSBK 40	4.2	10MS	57	99
ANDUAT, Ayodhya					
168	NDB 1835	0.9	5MS	57	99
169	NDB 1836	0.4	TS	57	99
170	NDB 1837	3.3	10MS	57	99
171	NDB 1838	24.8	60S*	57	89
172	NDB 1839	18.2	40S	57	99
173	NDB 1840	0.2	TMS	57	89
174	NDB 1841	0.8	5MS	34	89

175	NDB 1842	1.2	5S	46	99
176	NDB 1843	0.1	TMR	34	99
177	NDB 1844	2.0	10S	34	89
178	NDB 1845	0.2	TMS	46	99
179	NDB 1846	0.2	TMS	46	99
180	NDB 1847	3.8	10MS	45	99
180A	Infector	72.0	100S	79	89
181	NDB 1848	28.0	60S	46	99
182	NDB 1849	32.6	60S	56	99
183	NDB 1850	1.2	5S	45	99
184	NDB 1851	2.1	10MS	45	99
185	NDB 1852	8.0	20S	46	99
ICAR-VPKAS, Almora					
186	VB 2301	0.0	0	34	99
187	VB 2302	1.8	20MR	57	99
188	VB 2303	0.2	TMS	34	57
189	VB 2304	7.2	20S	24	57
190	VB 2305	14.4	40S	67	99
191	VB 2306	2.4	5MS	45	99
192	VB 2307	6.6	10S	46	99
193	VB 2308	5.0	10S	46	68
194	VB 2309	8.8	20S	57	99
195	VB 2310	1.2	5MS	56	99
196	VB 2311	4.8	10S	58	99
197	VB 2312	22.2	60S*	56	99
198	VB 2313	2.8	10S	35	57
199	VB 2314	8.0	20S	35	68
200	VB 2315	14.4	40S	45	99
200A	Infector	72.0	100S	79	89
201	VB 2316	13.0	40S	35	57
202	VB 2317	18.2	40S	47	78
203	VB 2318	16.2	40S	47	58
204	VB 2319	3.1	10S	35	68
205	VB 2320	14.8	40S	34	57
206	VB 2321	12.0	20S	36	57
207	VB 2322	5.8	20S	34	57
208	VB 2323	2.4	10MS	35	57
209	VB 2324	4.0	20S	44	99
210	VB 2325	8.0	20S	34	57
211	VB 2326	26.8	60S*	45	99
212	VB 2327	26.8	60S*	34	57
213	VB 2328	17.0	40S	46	99
214	VB 2329	13.7	40S	45	99
215	VB 2330	9.5	20S	34	46
CCS HAU, Hisar					
216	BH23-01	0.0	0	57	99
217	BH23-02	23.2	60S*	57	99
218	BH23-03	7.8	20MS	34	79
219	BH23-04	2.6	10MS	57	89
220	BH23-05	1.6	5MS	34	99
220A	Infector	76.0	100S	79	89
221	BH23-06	2.4	20MR	56	99
222	BH23-07	16.0	40S	46	99
223	BH23-08	4.4	10S	45	99
224	BH23-09	0.8	5MS	57	99
225	BH23-10	20.0	40S	45	99
226	BH23-11	8.8	20S	44	99
227	BH23-12	3.2	10MS	45	99

228	BH23-13	2.7	10MS	56	99
229	BH23-14	0.5	5MR	57	99
230	BH23-15	3.4	10S	46	99
231	BH23-16	1.0	5MS	58	99
232	BH23-17	30.0	80S	56	99
233	BH23-18	13.1	40S	57	99
234	BH23-19	2.8	10MS	57	99
235	BH23-20	4.4	10S	57	99
PAU, Ludhiana					
236	BL2207	22.8	60S*	47	99
237	BL2210	0.0	0	46	99
238	BL2211	4.6	10S	34	99
239	BL2216	8.8	20S	34	78
240	BL2217	2.6	10MS	46	99
240A	Infector	72.0	100S	79	79
241	BL2219	7.0	20S	46	57
242	BL2238	0.2	TMS	56	99
243	BL2239	15.6	40S	45	99
244	BL2241	14.0	40S	45	99
245	BL2242	0.4	TS	47	78
246	BL2243	0.1	TMR	57	99
247	BL2244	2.8	10S	45	99
248	BL2245	3.6	10MS	34	99
249	BL2247	3.0	10S	45	99
250	BL2248	4.2	20MS	45	99
251	BL2250	3.6	10S	47	99
252	BL2255	0.4	5MR	46	78
253	BL2259	28.0	60S	45	99
254	BL2260	3.0	10S	57	99
255	BL2271	0.8	5MS	35	78
256	BL2277	15.0	40S	45	99
257	BL2289	9.0	20S	35	78
258	BL2290	10.6	20S	46	99
259	BL2292	8.1	20S	57	99
260	BL2293	0.2	TMR	46	68
260A	Infector	80.0	100S	89	99
261	BL2295	17.0	40S	46	99
262	BL2299	30.0	80S	45	99
263	BL2300	7.6	20S	57	99
264	BL2301	11.4	20S	56	99
265	BL2302	0.4	5MR	46	99
266	BL2303	26.0	80S*	46	99
267	BL2306	2.6	5S	57	99
268	BL2307	3.0	10S	44	99
269	BL2310	14.4	40S	56	99
270	BL2311	2.0	10S	47	79
271	BL2316	0.0	0	46	68
272	BL2317	2.8	10MS	35	78
273	BL2321	1.2	5S	46	78
274	BL2322	1.4	5MS	34	89
275	BL2329	0.2	TMS	44	99
276	BL2332	1.1	5S	45	99
277	BL2334	0.4	TS	46	99
278	BL2336	1.6	10MS	57	99
279	BL2337	0.2	TS	56	99
280	BL2338	0.0	0	45	99
280A	Infector	76.0	100S	89	99
281	BL2340	3.6	10S	57	99

282	BL2341	2.7	10MS	46	68
283	BL2342	2.4	10S	46	99
284	BL2343	0.4	5MR	46	99
285	BL2344	0.8	5MS	46	99
286	BL2352	6.0	10S	45	99
287	BL2353	1.4	5S	45	99
288	BL2354	3.4	10S	45	99
289	BL2355	1.0	5S	57	99
290	BL2357	16.0	40S	57	99
291	BL2358	9.2	20S	56	99
292	BL2359	4.6	10S	45	99
293	BL2361	0.0	0	45	99
294	BL2362	0.4	5MR	46	99
295	BL2363	1.2	5MS	57	99
296	BL2365	1.2	5MS	57	99
297	BL2368	4.0	10MS	57	99
298	BL2373	0.4	TS	56	99
299	BL2374	4.6	20S	45	99
300	BL2221	5.8	20MS	46	99
300A	Infector	76.0	100S	89	99
301	BL2377	44.0	60S	56	99
302	BL2378	53.6	80S	35	57
303	BL2379	40.8	80S	35	68
304	BL2380	25.6	60S*	36	58
305	BL2381	16.0	40S	47	68
306	BL2383	36.2	80S*	45	99
307	BL2389	40.0	80S	57	99
308	BL2391	32.2	80S*	57	99
309	BL2393	40.0	80S	46	99
310	BL2394	28.0	80S*	46	68
311	BL2399	16.0	40S	35	68
IARI, Shimla					
312	BBM 963	0.5	5MR	78	99
313	BBM 964	1.2	5MS	78	99
314	BBM 965	3.6	10S	57	99
315	BBM 966	21.2	60S*	45	78
316	BBM 967	3.2	10S	57	99
317	BBM 968	2.6	10MS	56	99
318	BBM 969	0.2	TMS	56	99
319	BBM 970	3.0	10S	46	68
320	BBM 971	4.0	10S	45	78
320A	Infector	72.0	100S	89	99
321	BBM 972	0.0	0	68	99
322	BBM 973	7.0	20S	46	78
323	BBM 974	6.0	20S	35	78
324	BBM 975	1.6	5MS	24	36
325	BBM 976	0.0	0	57	99
326	BBM 977	7.2	20MS	45	99
327	BBM 978	2.6	10MS	57	99
328	BBM 979	4.2	10MS	34	68
329	BBM 980	29.6	80S	45	99
330	BBM 981	3.0	10S	36	57
331	BBM 982	7.7	20S	46	99
332	BBM 983	10.2	20S	45	99
333	BBM 984	0.2	TMS	24	46
334	BBM 985	1.7	5S	56	99
335	BBM 986	1.0	5S	56	99
336	BBM 987	18.0	40S	46	99

337	BBM 988	9.0	20S	36	58
338	BBM 989	5.8	10S	46	99
339	BBM 990	14.0	40S	57	99
340	BBM 991	0.2	TMS	45	99
340A	Infector	72.0	100S	89	99
341	BBM 992	1.0	5S	68	99
342	BBM 993	6.0	20S	56	99
343	BBM 994	0.0	0	68	99
344	BBM 995	0.2	TMS	78	99
345	BBM 996	3.0	10MS	78	99
346	BBM 997	0.8	5MS	56	99
347	BBM 998	5.4	20MS	45	99
SKUAST-Jammu					
348	JAUB11	3.2	10MS	45	99
349	JAUB12	2.0	10MS	45	68
350	JAUB13	0.0	0	45	99
351	JAUB14	0.0	0	46	79
352	JAUB15	5.0	20S	46	99
353	JAUB16	8.2	20S	35	78
354	JAUB17	24.4	60S*	34	57
355	JAUB18	2.6	10MS	57	99
GBPUA&T, Pantnagar					
356	UPBM01	3.4	10S	44	99
357	UPBM02	0.0	0	56	99
358	UPBM03	1.8	10MS	57	99
359	UPBM04	0.0	0	55	99
360	UPBM05	0.1	TMR	46	99
360A	Infector	72.0	100S	89	99
361	UPBM06	0.8	5MS	57	99
362	UPBM07	2.2	20MR	46	99
363	UPBM08	0.2	TMS	45	99
364	UPBM09	14.8	40S	34	57
365	UPBM10	13.2	40S	24	57
366	UPBM11	28.0	60S*	35	68
367	UPBM12	44.8	80S	46	99
368	UPBM13	45.6	80S	46	99
369	UPBM14	0.8	5MS	34	99
370	UPBM15	2.5	10S	45	99
371	UPBM16	2.0	10S	35	68
372	UPBM17	17.0	40S	46	99
373	UPBM18	0.2	TMS	56	99
374	UPBM19	3.0	10S	35	78
375	UPBM20	10.1	20S	46	99
376	UPBM21	0.0	0	36	58
377	UPBM22	7.0	20S	46	99
378	UPBM23	3.0	10S	46	99
379	UPBM24	7.8	20S	45	99
380	UPBM25	0.1	TMR	35	68
380A	Infector	72.0	100S	79	89
381	UPBM26	0.8	5MS	45	99
382	UPBM27	8.0	20S	56	99
383	UPBM28	6.2	20S	35	68
384	UPBM29	17.0	40S	56	99
RARI, Durgapura					
385	BD2011	0.2	TMS	68	99
386	BD2012	9.2	20S	56	78
387	BD2013	0.8	5MS	45	68
388	BD2014	1.6	10MS	47	68

389	BD2015	0.2	TS	55	99
390	BD2016	3.4	10MS	56	99
391	BD2017	3.6	10MS	46	99
392	BD2018	6.4	20S	68	99
393	BD2019	4.0	10S	56	99
394	BD2020	6.1	20S	67	99
395	BD2021	0.0	0	68	99
396	BD2022	28.0	60S	55	99
397	BD2023	8.4	20MS	46	99
398	BD2024	3.6	10MS	46	99
399	BD2025	0.0	0	56	99
400	BD2026	32.4	80S	56	78
400A	Infector	72.0	100S	89	99
401	BD2027	0.6	5MR	57	99
402	BD2028	6.0	20S	67	99
403	BD2029	32.0	80S	56	99
404	BD2030	6.4	20S	46	68
405	BD2031	0.4	5MR	55	99
406	BD2032	2.6	10MS	56	89
407	BD2033	0.0	0	68	99
408	BD2034	0.0	0	56	99
409	BD2035	15.0	40S	67	99
410	BD2036	0.0	0	68	99
411	BD2037	28.0	60S*	55	99
412	BD2038	25.2	60S*	35	57
413	BD2039	24.0	60S*	46	57
414	BD2040	38.8	80S	35	57
415	BD2041	29.0	80S*	46	99
416	BD2042	8.1	20S	57	79
417	BD2043	0.4	TS	56	99
418	BD2044	1.1	5MS	68	99
419	BD2045	0.8	5MR	78	99
420	BD2046	2.0	10S	58	99
420A	Infector	76.0	100S	89	99
421	BD2047	44.8	100S	68	99
422	BD2048	4.0	20S	56	99
423	BD2049	3.2	10S	56	99
424	BD2050	2.8	10S	46	99
425	BD2051	0.2	5R	57	99
426	BD2052	2.8	10MS	46	99
427	BD2053	0.0	0	68	99
428	BD2054	1.0	5S	56	99
429	BD2055	2.5	10S	57	99
430	BD2056	0.0	0	46	99
431	BD2057	0.0	0	46	99
432	BD2058	0.4	TS	56	99
433	BD2059	0.2	TMS	57	99
434	BD2060	2.0	5S	67	99
435	BD2061	0.0	0	46	99
436	BD2062	0.4	5MR	56	99
437	BD2063	3.7	10S	68	99
438	BD2064	1.0	5S	56	99
439	BD2065	8.2	20S	46	99
440	BD2066	0.2	TMS	57	99
440A	Infector	72.0	100S	89	99
441	BD2067	0.0	0	57	99
442	BD2068	0.0	0	58	99
443	BD2069	4.0	20S	56	99

444	BD2070	0.0	0	67	99
BARMALT					
445	BM-201	14.2	40S	57	99
B.H.U., Varanasi					
446	HUBL2301	15.8	40S	35	68
447	HUBL2302	28.0	60S*	45	99
448	HUBL2303	7.1	20S	44	99
449	HUBL2304	10.6	40MS	35	57
450	HUBL2305	3.0	10MS	45	99
451	HUBL2306	13.0	40S	35	68
452	HUBL2307	0.0	0	45	99
453	HUBL2308	32.0	80S	36	99
454	HUBL2309	17.6	40S	45	68
455	HUBL2310	8.8	20S	56	99
Dr. Om Vir Singh, Karnal					
456	IBYT ASA 22	1.8	10MS	57	78
457	IBYT ASA 23	6.0	20S	45	99
458	IBYT ASA 24	32.0	80S	34	68
459	IBYT ASA 32	2.6	10MS	34	56
460	IBYT ASA 38	8.0	20S	35	68
460A	Infector	72.0	100S	79	89
461	IBYT ASA 44	32.8	80S	46	68
462	SELECTION-83	13.0	40S	57	99
463	SELECTION-84	21.0	60S*	57	99
464	SELECTION-85	21.0	60S*	34	78
465	SELECTION-86	36.8	80S	35	68
466	SELECTION-87	6.0	20S	45	99
467	SELECTION-160	4.0	10S	67	99
468	IBON-105	11.6	20S	24	57
469	IBON-106	0.6	5MR	45	99
470	IBON-111	18.0	40S	34	99
471	IBON-113	3.4	10MS	34	57
472	IBON-115	1.8	10MS	34	57
473	IBON-119	12.2	40MS	56	99
474	AL-102	30.8	80S	45	99
475	AL-104	12.9	40S	46	99
476	AL-105	30.0	80S	35	99
477	AL-109	1.8	5S	56	99
478	AL-110	6.8	20S	45	99
479	AL-213	7.0	20S	46	57
480	AL-218	12.1	60S*	57	99
480A	Infector	72.0	100S	89	99
481	AL-219	1.8	20MR	44	99
482	AL-220	2.4	10MS	45	99
483	AL-222	32.0	80S	45	99
484	AL-223	25.4	80S*	45	99
485	ICB-19	8.0	20S	45	99
486	ICB-132	0.9	10MR	35	58
487	ICB-139	6.0	20S	45	99
488	ICB-289	4.0	20MS	36	68
489	ICB-290	23.1	60S*	35	57
490	ICB-291	32.0	80S	35	68
491	ICB-295	1.8	5S	34	57
492	ICB-397	0.0	0	35	68

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, *Indicates high rust score (more than 40S) at one location only.

National Barley Disease Screening Nursery (NBDSN) 2023-24

The NBDSN entries were screened for stripe rust resistance at hot spot centres that include Bajaura, Hisar, Ludhiana, Durgapura, Almora, Karnal, and Jammu. Leaf rust screening was done at Ludhiana, Jammu and Wellington, so HS is reflected in table. The leaf blight screening was done at Ayodhya, Pantnagar, Dharwad, Kanpur, Varanasi, Coochbehar and Kalyani. CCN screening was done at Durgapura and Hisar centres. Stripe rust data of Almora centre is not considered due to low disease development in the infectors. Leaf rust data was not received from Wellington, hence not included. For CCN, the number of nematode cysts / plants was counted and entries having 0-4 cysts/ plant in pot were considered as resistant (R) whereas those with cysts/plant 4.1- 9.0 were Moderately Resistant (MR). The entries with galls between 9.1 and 20.0 were treated as susceptible (S) and the entries with more than 20.0 galls per plant were treated as highly susceptible (HS).

Out of 144 entries evaluated during 2023-24 (Table 3.3), 16 entries were found free from stripe rust, 119 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 2 entries were found moderately resistant against leaf blight with an average score (double digit) 14-35 and HS ≤ 57. The centre wise responses are presented in Table 3.4. The resistant entries identified against yellow rust and blight are given below:

Table 3.3. List of 144 entries of NBDSN as per ACI.

Yellow rust, ACI = 0, Entries – 16	RD3093, UPB 1123, PL 955, DWRB137 ©, DWRB 2301, RD2899 ©, JHSBB19, DWRB2318, UPB-1120, UPB-1118, HBL-113©, DWRBU-52 ©, DWRB-238, DWRB-2309, RD-3110, and RD-2794 ©
Yellow rust, ACI > 0 to 10, Entries – 119	HUB 291, DWRB2303, RD2907 (Filler), PL 954, BH1059, BH1058, HUB 290, GB1, DWRB 2302, PL 956, DWRB2319, UPB 1122, RD3096, DWRUB64 (Filler), RD 3095, KB 2212, HUB113 ©, GB2, BH 946 ©, DWRB 2314, RD 2552 ©, JHSBE16, JHSBD22, DWRB2316, JHSBD11, RD 2715 ©, DWRB2317, DWRB 2313, JHSBF28, JHSBF21, DWRB 2315, UPB 1106, BH 946, HUB113, DWRB137, BH393 (Filler), VLB-188, BHS-499, VLB-184, BHS-501, HBL-886, BHS-400©, BHS-497, HBL-888, BHS-380©, UPB-1119, VLB-118©, BHS-352©, HBL-884, VLB-189, VLB-186, VLB-185, BHS-502, BHS-500, BHS-498, HBL-885, VLB-187, RD-3092, RD-3090, RD-3091, DWRB-2304, DWRB-2305, DWRB-2306, RD-3088, PL-891©, UPB-1121, RD-3089, DWRB-244, DWRB-223, DWRB-2849 ©, DWRB-182 ©, RD-3064 ©, DWRB-235, DWRB-137 ©, PL-959, RD-3105, RD-3087, DWRUB-52 ©, DWRB-2311, PL-957, RD-3085, DWRB-2308, BH-1056, BH-1057, BH-1055, DWRB-2310, RD-3106, DWRB-2312, RD-3107, PL-958, RD-2849 ©, RD-3084, RD-3086, DWRB-2307, UPB-1124, UPB-1125, RD-3100, RD-3099, RD-3094, RD-3108, KB-2231, KB-2201, RD-3097, HUB-287, NDB-1821, NDB-1173©, BH-1061, RD-2907©, RD-3103, RD-3109, NDB-1829, RD-3104, RD-3102, RD-3111, RD-3101, RD-3080, HUB-293, KB-2031, and BH-1062
Leaf blight, Avg. 14-35 with HS ≤ 57,Entries – 2	DWRB2316, and BHS-380©,

Table 3.4. Reactions of different entries in NBDSN 2023-24

S. No.	Entry	Yellow Rust		Leaf Rust	Leaf Blight		CCN
		ACI	HS	HS	Avg.	HS	HS
1	HUB 291	2.1	10MS	0	46	99	HS
2	DWRB2303	0.1	TMS	10MS	46	99	S
3	RD3093	0.0	0	TMS	56	99	HS
4	RD2907 (Filler)	0.2	5R	0	46	99	S
5	PL 954	3.3	10S	0	46	99	S
6	BH1059	1.5	5MS	TMS	46	99	HS
7	UPB 1123	0.0	0	TMS	56	99	HS
8	BH1058	0.0	TR	0	46	79	HS
9	HUB 290	0.4	5MR	0	46	79	S
10	GB1	0.1	TMR	0	68	99	S
11	DWRB 2302	2.5	10MS	0	47	79	HS
12	PL 956	1.7	5MS	5MS	56	99	HS
13	DWRB2319	1.3	5S	0	46	99	HS
14	UPB 1122	0.7	5MS	0	46	99	S
15	PL 955	0.0	0	0	46	79	HS
16	DWRB137 ©	0.0	0	TMS	46	99	HS
17	RD3096	0.3	TS	0	68	99	HS

18	DWRB 2301	0.0	0	TMS	56	99	HS
19	DWRUB64 (Filler)	1.7	10S	0	57	99	HS
20	RD 3095	3.0	10S	0	46	99	S
21	KB 2212	0.3	TMS	0	35	68	HS
22	HUB113 ©	0.1	TMR	0	45	79	HS
23	GB2	5.1	20S	5MS	46	79	HS
24	RD2899 ©	0.0	0	0	46	89	HS
25	BH 946 ©	0.8	5MS	20MS	46	89	S
26	DWRB 2314	0.8	5MR	0	56	99	S
27	JHSBB19	0.0	0	TMS	45	89	S
28	RD 2552 ©	1.3	10MS	10MS	46	89	S
29	JHSBE16	5.9	20S	0	46	99	HS
30	JHSBD22	0.03	TR	0	45	99	HS
31	DWRB2316	1.3	5S	5S	35	57	HS
32	JHSBD11	0.1	TMS	TMS	57	99	HS
33	RD 2715 ©	0.7	5MS	0	78	99	HS
34	DWRB2317	1.7	10S	10MS	46	99	S
35	DWRB2318	0.0	0	0	45	99	S
36	DWRB 2313	3.2	10S	0	24	68	S
37	JHSBF28	0.8	5MS	0	46	89	HS
38	JHSBF21	0.8	5S	0	46	89	HS
39	DWRB 2315	8.5	20S	0	57	99	HS
40	UPB 1106	7.0	20S	TMS	46	89	HS
41	BH 946	1.8	5S	0	57	99	HS
42	HUB113	2.7	20MS	5MS	67	99	HS
43	DWRB137	2.8	10S	0	67	99	S
44	BH393 (Filler)	2.3	10MS	0	57	99	HS
45	VLB-188	3.2	10S	TMS	35	68	HS
46	BHS-499	8.3	20S	20MS	45	99	HS
47	VLB-184	0.7	5MR	10S	67	99	HS
48	BHS-501	3.5	10S	TMS	46	78	HS
49	HBL-886	1.8	5S	0	46	99	HS
50	UPB-1120	0.0	0	0	46	99	HS
51	BHS-400©	5.3	10S	TMS	45	99	HS
52	BHS-497	2.7	10S	0	56	99	HS
53	HBL-888	1.7	5S	5MS	68	99	HS
54	BHS-380©	0.1	TMR	0	34	57	HS
55	UPB-1119	0.1	TMS	5MS	56	99	HS
56	UPB-1118	0.0	0	TMS	56	99	HS
57	VLB-118©	1.6	5S	0	35	68	HS
58	BHS-352©	6.7	20S	0	46	99	HS
59	HBL-884	5.7	20S	0	45	99	S
60	HBL-113©	0.0	0	0	57	99	S
61	VLB-189	7.5	20S	TMS	45	89	HS
62	VLB-186	8.3	20S	0	45	78	MR
63	VLB-185	5.3	10S	TMS	46	99	HS
64	BHS-502	2.7	10S	5S	46	99	S
65	BHS-500	1.7	10S	TMS	57	99	S
66	BHS-498	2.6	15S	0	78	99	HS
67	HBL-885	4.3	20MS	TMS	68	99	HS
68	VLB-187	4.2	10S	0	46	99	HS
69	PL-960	16.7	40S	0	46	99	S
70	RD-3092	0.1	TMR	TMR	35	99	S
71	RD-3090	0.2	5R	20MS	68	99	S
72	RD-3091	0.3	5MR	0	46	79	S
73	DWRB-2304	0.1	TMS	5MS	35	68	HS
74	K-1149©	32.3	80S	0	46	99	HS
75	DWRB-2305	3.2	10S	20S	57	99	HS
76	DWRB-2306	8.4	20S	0	35	68	S
77	KARAN-16©	12.3	40S	5S	35	78	S
78	RD-3088	2.3	10S	10S	67	99	HS
79	PL-891©	2.6	10S	TMS	35	58	HS
80	UPB-1121	3.7	20S	0	34	67	HS
81	RD-3089	2.3	10MS	0	67	99	S

82	DWRB-244	7.7	20S	5S	35	89	HS
83	DWRB-223	5.0	20S	0	35	99	HS
84	DWRB-2849 ©	0.1	TMS	20MS	36	79	HS
85	DWRB-182 ©	3.5	20S	0	35	79	HS
86	DWRBU-52 ©	0.0	0	0	45	99	HS
87	RD-3064 ©	2.8	10S	TMS	46	79	HS
88	DWRB-238	0.0	0	0	46	99	HS
89	DWRB-235	0.8	5MS	0	56	99	S
90	DWRB-137 ©	1.7	10MS	0	57	99	HS
91	PL-959	3.3	10S	10MS	56	99	HS
92	RD-3105	5.8	20MS	0	56	99	0
93	DWRB-2309	0.0	0	TMS	47	79	HS
94	RD-3087	3.3	10S	0	56	99	HS
95	DWRUB-52 ©	0.1	TMS	5MS	46	89	HS
96	DWRB-2311	2.7	10S	0	45	89	S
97	PL-957	4.3	10S	TMS	45	99	S
98	RD-3085	0.1	TMR	0	46	99	S
99	DWRB-2308	0.2	TS	5MS	46	99	HS
100	BH-1056	3.0	10S	TMS	35	68	HS
101	BH-1057	2.5	10S	0	46	89	HS
102	BH-1055	8.2	20S	0	45	78	HS
103	DWRB-2310	1.7	10S	5MS	45	99	HS
104	RD-3106	1.4	10MS	5S	56	99	HS
105	DWRB-2312	0.03	TR	5S	57	99	HS
106	RD-3107	1.4	10MS	TMR	56	99	HS
107	PL-958	0.1	TMS	0	46	99	HS
108	RD-2849 ©	0.1	TMR	TMS	45	79	S
109	RD-3084	4.2	10S	10S	56	99	HS
110	RD-3086	0.1	TMS	10S	46	99	HS
111	DWRB-2307	0.7	5MS	0	45	79	0
112	UPB-1124	4.8	10S	0	46	99	HS
113	UPB-1125	3.3	20S	0	46	99	HS
114	RD-3100	1.5	5MS	TMS	78	99	HS
115	RD-3099	0.4	TS	TMS	68	99	S
116	RD-3094	0.2	TS	0	57	99	HS
117	RD-3108	0.7	5MS	0	78	99	HS
118	KB-2231	3.5	10S	0	45	99	HS
119	NDB-1833	21.3	60S*	10S	46	89	S
120	KB-2201	0.6	5MR	0	57	79	HS
121	RD-3097	1.3	10MS	0	67	99	HS
122	HUB-287	8.5	20S	0	46	68	HS
123	HUB-288	14.5	60S*	5MS	46	78	HS
124	K-603©	14.8	40S	0	46	99	S
125	NDB-1821	1.7	10S	TMR	57	99	S
126	RD-3098	11.0	20S	0	45	99	HS
127	RD-3110	0.0	0	0	35	99	HS
128	RD-2794 ©	0.0	0	5R	46	99	S
129	NDB-1173©	0.8	5MS	0	46	99	HS
130	BH-1061	3.3	20S	5MS	46	68	HS
131	RD-2907©	1.3	10MS	5S	57	99	0
132	RD-3103	1.3	20MR	TR	88	99	HS
133	RD-3109	3.2	10S	TMR	79	99	HS
134	NDB-1829	3.7	10S	0	46	99	HS
135	RD-3104	2.5	10S	5MS	56	99	HS
136	RD-3102	1.7	10S	0	68	99	HS
137	HUB-294	22.7	60S	TMS	45	99	HS
138	RD-3111	0.3	5MR	0	67	99	HS
139	KB-2203	16.7	40S	5R	56	99	S
140	RD-3101	0.1	TMS	5R	57	99	S
141	RD-3080	2.2	10MS	0	57	99	HS
142	HUB-293	6.8	20S	TMS	56	99	HS
143	KB-2031	6.7	20S	0	36	57	S
144	BH-1062	2.2	10MS	10MS	46	79	HS
	Infector	76.7	100S	60S	89	99	-

Out of 154 entries, few check varieties and entries were found place in many trials and only one check is retained in NBDSN thus resulting 144 entries under NBDSN.

Abbreviations: ACI- Average Coefficient of Infection; HS- Highest score, Avg. - Mean, CCN- Cereal Cyst Nematode, (C) - Released Checks, NG – Not germinated. *Indicates high rust score (more than 40S) at one location only. For CCN, HS- Highly susceptible, S- Susceptible, MR- Moderately Resistant, R- Resistant.

Area Under Disease Progress Curve (AUDPC) of leaf blight for NBDSN entries

The disease progress may account for different resistance components like latent period, size of spots, number of spores per unit area etc. which are under the influence of prevailing weather conditions. A convenient option of identifying lines that allow slow disease development is the estimation of the Area Under Disease Progress Curve (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 categorised as resistant and from 101 to 500 are categorised as moderately resistant. The AUDPC score-based categorization of NBDSN entries is as follows:

AUDPC	Entries
Up to 100	Nil
101 - 500	KB 2212, DWRB2316, DWRB 2313, VLB-188, BHS-380©, VLB-118©, RD-3092, DWRB-2304, DWRB-2306, PL-891©, UPB-1121, DWRB-244, DWRB-223, DWRB-182©, DWRBU-52 ©, BH-1056, KB-2231, RD-3110, and RD-2794©

Elite Barley Disease Screening Nursery (EBDSN, 2023-24)

The nursery was constituted with entries showing resistance to different disease in previous years in NBDSN and EBDSN. During the crop season 2023-24, total 50 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, Jammu and Wellington. The leaf blight screening was done at Ayodhya, Pantnagar, Kanpur and Varanasi. Stripe rust data of Almora centre is not considered due to low disease development in the infectors. Leaf rust data was not received from Wellington, hence not included. CCN screening was done at Durgapura and Hisar centres.

Confirmed sources of resistance:

Out of 50 entries screened in EBDSN (Table 3.5), the following entries were confirmed for resistance against the particular disease under AICW&BIP. Twelve entries were found free from yellow rust, whereas 30 exhibited resistant reaction. Out of 50 entries screened for leaf blight, 10 entries also showed moderate level of resistance against leaf blight with an average score (double digit) 14-35 and HS ≤ 57. The centre wise data are presented in Table 3.7. The resistant entries identified against yellow rust and blight are given below:

Table 3.5. Entries screened in EBDSN with ACI

Yellow rust, ACI = 0, Entries – 12	HLR 115, HLR 137, HLR 271, DWRB127, DWRB137, DWRB143, DWRB206, BHS478, BHS479, KB2160, RD2907, and VLB183
Yellow rust, ACI > 0 to 10, Entries – 30	HLR 75, HLR 103, HLR 134, HLR 272, HLR 273, DWRB6, DWRB128, DWRB207, BHS474, BHS480, BHS481, BHS483, BHS485, BHS486, HVS-9, HVS-27, HVS-40, HVS-43, HVS-44, HVS-45, DWR47-IC443614, RD2794, RD3065, RD3077, RD3078, VLB175, DWRUB52, DWRB182, DWRB239, and DWRB240
Leaf blight, Avg. 14-35 with HS ≤ 57, Entries – 10	DWRB206, HVS-7, HVS-14, HVS-28, HVS-40, HVS-42, HVS-43, HVS-44, HVS-45, and DWRB190

Table 3.6. Reactions of different entries in Elite Barley Disease Screening Nursery during 2023-24.

S. N.	Entry	Yellow Rust		Leaf Rust	Leaf Blight		CCN
		ACI	HS	HS	Avg.	HS	HS
1	HLR 75	1.3	10MS	20S	57	68	S
2	HLR 103	2.2	5S	TMS	34	68	S
3	HLR 115	0.0	0	0	57	99	S
4	HLR 134	0.1	TMR	5MS	57	99	S
5	HLR 137	0.0	0	0	57	67	S
6	HLR 271	0.0	0	5S	56	99	S
7	HLR 272	0.2	TMS	TMS	68	99	HS
8	HLR 273	0.2	5R	0	68	99	HS
9	DWRB6	0.1	TMR	5MS	56	99	S
10	DWRB127	0.0	0	0	45	79	S
11	DWRB128	0.4	5MR	0	46	89	S
12	DWRB137	0.0	0	TS	46	99	S
13	DWRB143	0.0	0	0	56	99	HS
14	DWRB206	0.0	0	TMS	35	46	HS
15	DWRB207	0.7	5MS	5MS	45	99	S
16	BHS474	0.03	TR	0	68	99	HS
17	BHS478	0.0	0	0	68	99	HS
18	BHS479	0.0	0	0	79	99	HS
19	BHS480	4.8	20MS	5MS	56	99	HS
20	BHS481	1.7	10S	5S	57	99	S
21	BHS483	1.5	5S	0	46	68	S
22	BHS485	3.3	20S	10S	46	68	HS
23	BHS486	3.5	20MS	0	57	99	HS
24	HVS-7	24.0	40S	0	24	35	HS
25	HVS-9	4.3	10S	TR	34	78	HS
26	HVS-14	33.3	80S	0	24	36	HS
27	HVS-27	0.03	TR	0	56	99	S
28	HVS-28	22.5	60S	0	35	57	HS
29	HVS-32	24.7	60S	20S	36	57	HS
30	HVS-33	28.3	80S	0	46	68	HS
31	HVS-40	5.5	20S	10MS	35	46	S
32	HVS-42	29.3	60S	0	24	45	HS
33	HVS-43	2.5	10S	5S	35	56	HS
34	HVS-44	4.3	10S	5S	24	35	HS
35	HVS-45	7.5	20S	0	35	57	HS
36	DWRB190	12.5	40S	0	35	46	HS
37	DWR47-IC443614	8.8	20S	0	35	68	S
38	BH462-IC335830	33.3	80S	10MS	56	99	S
39	KB2160	0.0	0	0	46	89	S
40	RD2794	0.7	10MR	TMS	45	89	HS
41	RD2907	0.0	0	5S	57	99	HS
42	RD3065	0.8	5MS	0	45	99	HS
43	RD3077	0.8	5S	0	79	99	S
44	RD3078	2.7	20MS	TMS	89	99	HS
45	VLB175	0.03	TR	0	35	68	HS
46	VLB183	0.0	0	0	45	99	HS
47	DWRUB52	0.7	5MS	5S	45	89	HS
48	DWRB182	0.1	TMS	TMS	45	89	HS
49	DWRB239	1.3	10MS	TMS	35	89	HS
50	DWRB240	0.03	TR	0	46	99	HS
	Infector	73.3	100S	60S	89	99	-

Abbreviations: ACI- Average Coefficient of Infection; HS- Highest score, Avg. - Mean, CCN- Cereal Cyst Nematode, (C) - Released Checks, NG – Not germinated. For CCN, HS- Highly susceptible, S- Susceptible, MR-Moderately Resistant, R-Resistant.

Table 3.7. Centre wise reactions of different entries of barley in National Barley Disease Screening Nursery (NBDSN) during 2023-24.

S. No.	Entry	Yellow Rust						Leaf Rust		Leaf Blight							CCN	
		Bajaura	Hisar	Ludhiana	Durgapura	Karnal	Jammu	Ludhiana	Jammu	Ayodhya	Pantnagar	Dharwad	Kanpur	Varanasi	Coochbehar	Kalyani	Durgapura	Hisar
1	HUB 291	10MS	0	0	0	5MS	TMR	0	0	35	35	34	36	99	34	57	HS	S
2	DWRB2303	0	0	TMS	0	0	0	0	10MS	36	37	56	00	99	35	57	S	S
3	RD3093	0	0	0	0	0	0	0	TMS	57	25	56	00	99	89	79	S	HS
4	RD2907 (Filler)	0	0	TR	0	0	5R	0	0	35	36	67	12	99	23	79	S	S
5	PL 954	0	5S	5MS	10S	TS	0	0	0	35	25	67	02	99	34	79	S	R
6	BH1059	0	TS	0	0	5MS	5MS	0	TMS	34	37	56	12	99	34	79	HS	S
7	UPB 1123	0	0	0	0	0	0	0	TMS	46	36	46	36	99	23	79	HS	S
8	BH1058	0	0	TR	0	0	0	0	0	35	46	46	00	68	46	79	HS	S
9	HUB 290	0	0	0	TMR	5MR	TR	0	0	34	37	56	12	68	24	79	S	S
10	GB1	0	0	0	0	0	TMR	0	0	78	25	78	47	99	78	79	S	S
11	DWRB 2302	0	TS	5MR	10MS	5MS	0	0	0	35	26	67	36	68	45	79	S	HS
12	PL 956	0	TS	TS	0	5MS	5MS	0	5MS	35	24	89	24	99	34	79	S	HS
13	DWRB2319	0	TS	TS	5S	TS	0	0	0	34	36	46	00	99	25	79	S	HS
14	UPB 1122	0	0	0	0	0	5MS	0	0	35	37	67	00	99	23	79	S	MR
15	PL 955	0	0	0	0	0	0	0	0	46	47	34	02	68	34	79	HS	S
16	DWRB137 ©	0	0	0	0	0	0	0	TMS	34	36	34	12	99	35	79	HS	MR
17	RD3096	0	0	TS	0	0	5R	0	0	57	25	89	57	99	89	79	HS	HS
18	DWRB 2301	0	0	0	0	0	0	0	TMS	36	13	78	00	99	67	79	S	HS
19	DWRUB64 (Filler)	0	10S	0	0	0	0	0	0	57	48	67	12	99	56	79	HS	R
20	RD 3095	0	10S	0	0	0	10MS	0	0	46	26	56	00	99	35	79	S	NG
20A	Infector	60S	80S	80S	100S	60S	60S	60S	60S	78	89	67	79	79	68	99	-	-
21	KB 2212	0	0	TR	TMS	TMS	0	0	0	35	26	67	00	68	23	35	S	HS
22	HUB113 ©	0	0	0	TMR	0	TMR	0	0	34	47	56	12	79	35	35	S	HS
23	GB2	0	0	20S	TMR	10S	0	0	5MS	47	36	67	02	79	24	35	HS	MR
24	RD2899 ©	0	0	0	0	0	0	0	0	35	37	78	12	89	25	35	HS	HS
25	BH 946 ©	0	0	0	5MS	TMS	0	0	20MS	57	35	67	00	89	56	35	S	S
26	DWRB 2314	0	0	TS	TMS	TMS	5MR	0	0	35	47	56	00	99	56	79	S	S
27	JHSBB19	0	0	0	0	0	0	0	TMS	45	36	78	00	89	34	13	S	S
28	RD 2552 ©	0	0	0	0	0	10MS	0	10MS	46	48	78	12	89	35	13	S	S
29	JHSBE16	0	0	5S	20S	10S	TMR	0	0	35	36	46	36	99	46	35	S	HS
30	JHSBD22	0	0	0	0	0	TR	0	0	35	24	78	24	99	23	35	S	HS
31	DWRB2316	0	TS	TS	5S	TS	0	0	5S	45	36	46	00	57	23	35	MR	HS
32	JHSBD11	0	0	0	0	0	TMS	0	TMS	57	48	89	47	99	56	35	S	HS
33	RD 2715 ©	0	0	0	0	0	5MS	0	0	46	47	89	57	99	89	99	S	HS

34	DWRB2317	0	0	0	0	0	10S	0	10MS	35	36	56	24	99	34	57	S	S
35	DWRB2318	0	0	0	0	0	0	0	0	34	35	56	00	99	35	57	S	R
36	DWRB 2313	0	0	5MS	10S	5S	0	0	0	36	13	46	02	68	23	13	S	S
37	JHSBF28	0	TS	0	0	0	5MS	0	0	46	26	56	00	89	68	57	HS	S
38	JHSBF21	0	5S	0	0	0	0	0	0	57	24	89	00	89	34	57	HS	HS
39	DWRB 2315	0	10S	10S	20S	10S	TMS	0	0	36	14	89	24	99	78	79	HS	R
40	UPB 1106	0	0	10S	20S	10S	5MR	0	TMS	35	24	78	24	89	45	58	HS	S
40A	Infector	80S	80S	80S	100S	60S	60S	60S	60S	78	89	67	79	89	89	79	-	-
41	BH 946	5S	0	TS	5MS	TMS	0	0	0	46	25	67	36	99	34	99	HS	HS
42	HUB113	0	0	0	0	0	20MS	0	5MS	35	37	78	36	99	67	89	S	HS
43	DWRB137	0	0	5MR	10S	5S	0	0	0	56	46	89	36	99	45	78	S	S
44	BH393 (Filler)	0	TS	5MS	10MS	TMS	0	0	0	35	25	89	24	99	46	78	HS	S
45	VLB-188	0	10S	TS	5MS	0	10MR	0	TMS	35	24	67	00	68	23	35	S	HS
46	BHS-499	0	10S	10S	20S	10S	0	0	20MS	45	26	56	00	99	45	57	S	HS
47	VLB-184	0	0	0	0	5MR	5MR	10S	0	46	25	78	24	99	89	79	HS	HS
48	BHS-501	0	0	5S	10S	5S	TMS	0	TMS	45	45	78	02	68	34	57	S	HS
49	HBL-886	0	0	5S	5S	TS	0	0	0	35	36	67	00	99	35	57	HS	S
50	UPB-1120	0	0	0	0	0	0	0	0	68	27	89	00	99	26	35	S	HS
51	BHS-400©	10MS	0	5S	10S	5S	5MS	0	TMS	35	24	78	00	99	23	79	S	HS
52	BHS-497	0	0	5S	10S	TS	TR	0	0	46	36	78	12	99	45	57	HS	S
53	HBL-888	0	0	5S	5S	TMR	0	0	5MS	57	47	67	47	99	89	99	HS	S
54	BHS-380©	0	0	0	TMR	0	TR	0	0	35	25	34	00	57	23	35	HS	HS
55	UPB-1119	0	0	0	0	0	TMS	0	5MS	46	37	89	00	99	35	78	HS	S
56	UPB-1118	0	0	0	0	0	0	0	TMS	36	36	78	12	99	34	78	HS	S
57	VLB-118©	0	0	5S	5MS	TMS	0	0	0	34	26	56	00	68	23	35	S	HS
58	BHS-352©	0	0	10S	20S	10S	0	0	0	35	36	46	24	99	45	57	HS	S
59	HBL-884	0	0	10S	20S	5MR	5MR	0	0	46	25	56	00	99	34	57	S	MR
60	HBL-113©	0	0	0	0	0	0	0	0	58	14	67	36	99	36	79	S	S
60A	**Infector**	**60S**	**80S**	**80S**	**100S**	**60S**	**80S**	**60S**	**60S**	**78**	**79**	**89**	**79**	**79**	**89**	**99**	-	-
61	VLB-189	0	10S	10S	20S	5S	0	0	TMS	46	36	89	00	79	23	35	MR	HS
62	VLB-186	0	10S	10S	20S	10S	0	0	0	57	37	78	00	78	24	13	MR	R
63	VLB-185	0	10S	5S	10S	5S	5MR	0	TMS	68	26	56	36	99	23	35	S	HS
64	BHS-502	0	10S	TS	5S	0	0	5S	0	57	37	56	02	99	23	57	S	S
65	BHS-500	0	10S	0	TMR	0	0	0	TMS	46	35	46	47	99	24	79	S	MR
66	BHS-498	0	15S	0	0	0	TMS	0	0	67	46	78	58	99	78	99	S	HS
67	HBL-885	0	10S	0	0	0	20MS	0	TMS	68	35	56	57	99	89	99	S	HS
68	VLB-187	0	5S	5S	10S	5S	0	0	0	57	36	46	36	99	23	35	MR	HS
69	PL-960	0	20S	20S	40S	20S	0	0	0	57	27	67	00	99	23	46	S	S
70	RD-3092	0	0	0	0	0	TMR	0	TMR	58	36	46	00	99	23	13	S	NG
71	RD-3090	0	0	0	0	0	5R	0	20MS	57	26	89	47	99	89	99	S	MR
72	RD-3091	0	0	0	0	5MR	0	0	0	67	48	67	12	79	23	13	S	MR

73	DWRB-2304	0	0	0	TMS	0	0	0	TMS	68	37	34	36	35	24	13	HS	HS
74	K-1149©	0	10S	60S	80S	40S	5MS	0	0	56	48	56	36	99	23	13	S	HS
75	DWRB-2305	0	10S	5S	5MS	0	0	20S	5MS	78	26	67	12	99	45	79	S	HS
76	DWRB-2306	0	0	10S	20S	20S	TMR	0	0	68	36	46	00	NG	24	13	S	S
77	KARAN-16©	0	10S	20S	40S	5MS	0	5S	TMS	78	37	46	12	46	23	35	S	NG
78	RD-3088	0	TS	TS	10S	0	5MR	10S	0	67	58	67	00	99	78	99	HS	MR
79	PL-891©	0	10S	TS	TMR	5MS	0	0	TMS	58	26	34	00	57	24	35	HS	S
80	UPB-1121	0	20S	0	5MR	0	0	0	0	67	35	24	00	57	23	13	HS	S
80A	Infector	60S	80S	80S	100S	60S	60S	60S	60S	89	89	78	79	79	78	99	-	-
81	RD-3089	0	TS	5MS	10MS	TMS	0	0	0	57	24	78	12	99	67	99	S	R
82	DWRB-244	0	20S	TS	5S	0	20S	0	5S	35	13	89	24	46	23	35	S	HS
83	DWRB-223	0	10S	0	0	0	20S	0	0	68	36	34	02	99	23	13	HS	HS
84	DWRB-2849 ©	0	0	0	0	0	TMS	0	20MS	46	48	46	02	79	23	35	HS	S
85	DWRB-182 ©	0	20S	TS	0	0	0	0	0	47	36	34	00	79	24	35	S	HS
86	DWRBU-52 ©	0	0	0	0	0	0	0	0	36	58	34	00	99	23	35	S	HS
87	RD-3064 ©	0	0	5S	10S	5MR	0	0	TMS	47	25	56	36	79	25	35	HS	S
88	DWRB-238	0	0	0	0	0	0	0	0	45	37	67	00	99	25	79	HS	HS
89	DWRB-235	0	TS	0	0	0	5MS	0	0	45	48	46	00	99	45	79	S	MR
90	DWRB-137 ©	0	0	TMR	0	5MR	10MS	0	0	36	37	89	36	99	23	79	HS	R
91	PL-959	0	10S	0	0	0	10S	0	10MS	45	27	89	02	99	23	79	S	HS
92	RD-3105	0	0	5S	10S	5MS	20MS	0	0	68	24	67	00	99	35	79	S	HS
93	DWRB-2309	0	0	0	0	0	0	0	TMS	68	48	56	24	79	25	59	S	HS
94	RD-3087	0	0	5S	5S	10S	0	0	0	57	34	89	00	99	35	59	S	HS
95	DWRUB-52 ©	0	0	0	0	0	TMS	0	5MS	68	48	46	00	89	23	59	S	S
96	DWRB-2311	0	10S	0	0	5MS	5MR	0	0	45	26	56	24	89	23	35	S	S
97	PL-957	0	10S	5MS	5MS	0	10MS	0	TMS	58	37	67	00	99	23	13	S	S
98	RD-3085	0	0	0	TMR	0	0	0	0	46	47	67	00	99	35	35	S	HS
99	DWRB-2308	0	TS	0	0	0	0	0	5MS	45	36	56	12	99	23	79	HS	HS
100	BH-1056	0	0	5MR	5MR	10S	5MS	0	TMS	57	26	46	00	68	23	57	HS	HS
100A	Infector	60S	80S	80S	100S	60S	60S	60S	60S	89	79	67	79	89	78	89	-	-
101	BH-1057	0	TS	0	0	10S	5MS	0	0	68	24	46	36	89	23	35	MR	HS
102	BH-1055	5MS	10S	5S	10S	20S	0	0	0	78	15	67	00	68	24	35	S	HS
103	DWRB-2310	0	0	0	0	10S	0	0	5MS	57	36	46	00	99	23	35	S	HS
104	RD-3106	0	0	0	TMR	0	10MS	5S	0	46	26	89	00	99	25	79	S	HS
105	DWRB-2312	0	0	TR	0	0	0	5S	0	58	34	67	36	99	25	57	S	HS
106	RD-3107	0	0	0	TMR	10MS	0	0	TMR	67	37	78	02	99	23	58	S	HS
107	PL-958	0	0	0	0	0	TMS	0	0	58	25	56	00	99	23	79	S	HS
108	RD-2849 ©	0	0	TMR	0	0	0	0	TMS	57	36	34	00	79	23	57	S	S
109	RD-3084	0	0	5S	10S	10MS	5MR	10S	5MS	67	13	34	24	99	45	79	S	HS
110	RD-3086	0	0	0	TMS	0	0	10S	10MS	57	26	34	36	99	25	35	S	HS
111	DWRB-2307	0	0	0	0	0	5MS	0	0	46	38	67	00	79	23	35	S	HS

112	UPB-1124	0	10S	5S	5MS	10S	0	0	0	47	27	34	24	99	23	57	HS	HS
113	UPB-1125	0	20S	0	0	0	0	0	0	45	36	56	24	99	35	57	HS	HS
114	RD-3100	0	0	10MR	5MS	TMS	0	0	TMS	58	47	78	57	99	89	99	S	MR
115	RD-3099	0	TS	0	TMS	0	TMS	0	TMS	46	68	89	58	99	35	79	HS	S
116	RD-3094	0	TS	0	0	0	0	0	0	58	36	56	36	99	34	79	HS	S
117	RD-3108	0	0	0	0	0	5MS	0	0	46	69	78	57	99	78	99	HS	S
118	KB-2231	NG	10S	0	0	NG	5MS	0	0	35	24	56	00	NG	23	99	S	NG
119	NDB-1833	0	20S	60S	40S	10MS	0	NG	10S	47	15	46	24	89	23	57	S	HS
120	KB-2201	0	0	TR	5MR	TMR	TMS	0	0	58	26	67	57	79	23	57	HS	HS
120A	Infector	60S	80S	80S	100S	60S	60S	60S	60S	78	89	78	79	89	78	89	-	-
121	RD-3097	0	0	0	0	0	10MS	0	0	68	48	67	00	99	78	99	S	HS
122	HUB-287	0	TS	10S	20S	20S	0	0	0	58	37	67	00	68	23	57	S	HS
123	HUB-288	0	60S	10S	10MS	5MS	5S	0	5MS	57	26	56	36	78	23	58	S	HS
124	K-603©	10MS	0	20S	40S	20S	TMS	0	0	35	47	67	24	99	23	57	S	S
125	NDB-1821	0	0	0	0	0	10S	0	TMR	46	37	78	02	99	67	79	S	NG
126	RD-3098	0	0	20S	20S	10S	20MS	0	0	57	36	67	00	99	34	35	S	HS
127	RD-3110	0	0	0	0	0	0	0	0	46	27	46	00	99	23	35	HS	R
128	RD-2794 ©	0	0	0	0	0	0	0	5R	46	46	56	02	99	23	57	S	S
129	NDB-1173©	0	0	0	0	5MS	TMS	0	0	57	25	67	12	99	23	57	S	HS
130	BH-1061	0	0	0	0	20S	0	0	5MS	56	47	56	58	68	25	13	S	HS
131	RD-2907©	0	0	0	0	0	10MS	5S	0	47	36	89	47	99	23	35	S	HS
132	RD-3103	0	0	0	0	0	20MR	0	TR	67	89	89	57	99	89	99	S	HS
133	RD-3109	0	0	TS	5MS	5MS	10S	0	TMR	58	58	89	68	99	89	79	S	HS
134	NDB-1829	0	5S	5S	10S	5MR	0	0	0	57	37	56	36	99	25	35	S	HS
135	RD-3104	0	10S	5MS	0	0	TMS	0	5MS	68	47	67	00	99	23	99	S	HS
136	RD-3102	0	10S	0	0	0	0	0	0	58	26	67	79	99	89	57	HS	-
137	HUB-294	0	0	60S	60S	20MS	0	0	TMS	46	36	67	00	99	23	57	HS	-
138	RD-3111	0	0	0	0	5MR	0	0	0	46	68	89	24	99	23	99	S	-
139	KB-2203	10S	0	40S	40S	10S	0	0	5R	35	37	34	24	99	89	57	S	-
140	RD-3101	0	0	0	0	0	TMS	0	5R	47	48	34	24	99	25	99	HS	-
140A	Infector	60S	80S	80S	100S	60S	60S	60S	60S	89	78	67	79	99	89	89	-	-
141	RD-3080	0	0	5S	0	0	10MS	5S	0	68	47	78	24	99	23	57	HS	-
142	HUB-293	20S	0	TS	0	20S	0	0	TMS	68	36	56	00	99	89	35	HS	-
143	KB-2031	0	0	10S	20S	10S	0	0	0	45	26	46	57	NG	24	35	S	-
144	BH-1062	0	0	TS	10MS	5MS	0	0	10MS	57	36	46	NG	57	23	79	HS	-

Table 3.8. Centre wise reactions of different entries of barley in Elite Barley Disease Screening Nursery (EBDSN) during 2023-24

S. N.	Entry	Stripe rust						Leaf Rust		Leaf Blight				CCN	
		Bajaura	Hisar	Ludhiana	Durgapura	Karnal	Jammu	Ludhiana	Jammu	Ayodhya	Pantnagar	Kanpur	Varanasi	Durgapura	Hisar
1	HLR 75	0	0	0	0	0	10MS	0	20S	57	57	47	68	S	NG
2	HLR 103	0	0	5S	5MS	5MS	0	0	TMS	24	24	00	68	S	S
3	HLR 115	0	0	0	0	0	0	0	0	35	27	NG	99	S	S
4	HLR 134	0	0	0	0	0	TMR	0	5MS	68	36	36	99	S	MR
5	HLR 137	0	0	0	0	0	0	0	0	67	47	57	57	S	S
6	HLR 271	0	0	0	0	0	0	5S	0	78	57	00	99	S	NG
7	HLR 272	0	0	0	TMS	0	TR	0	TMS	89	37	58	99	S	HS
8	HLR 273	0	0	0	0	0	5R	0	0	89	48	36	99	S	HS
9	DWRB6	0	0	TR	0	TMR	0	0	5MS	46	36	24	99	S	S
10	DWRB127	0	0	0	0	0	0	0	0	35	47	00	79	S	MR
11	DWRB128	0	0	TR	5MR	0	TMR	0	0	45	35	24	89	S	NG
12	DWRB137	0	0	0	0	0	0	TS	TR	46	36	12	99	S	MR
13	DWRB143	0	0	0	0	0	0	0	0	57	57	12	99	S	HS
14	DWRB206	0	0	0	0	0	0	0	TMS	46	36	12	35	S	HS
15	DWRB207	0	0	0	0	5MS	TR	0	5MS	35	37	00	99	S	S
16	BHS474	0	0	TR	0	0	0	0	0	57	57	68	99	S	HS
17	BHS478	0	0	0	0	0	0	0	0	67	48	57	99	S	HS
18	BHS479	0	0	0	0	0	0	0	0	68	79	79	99	HS	NG
19	BHS480	0	0	5MS	10MS	TMS	20MS	0	5MS	35	24	57	99	HS	S
20	BHS481	0	0	0	0	0	10S	0	5S	57	36	47	99	S	S
20A	**Infector**	60S	80S	80S	100S	60S	60S	60S	60S	89	89	79	99	-	-
21	BHS483	0	0	0	0	5MS	5S	0	0	46	36	24	68	S	S
22	BHS485	0	20S	0	0	0	0	10S	10MR	57	37	02	68	HS	S
23	BHS486	0	5S	0	0	0	20MS	0	0	46	47	36	99	HS	S
24	HVS-7	40S	40S	20S	40S	5MS	0	0	0	35	25	02	13	HS	HS
25	HVS-9	0	TS	5S	10MS	5MR	10S	0	TR	78	26	00	13	HS	MR
26	HVS-14	20S	0	60S	80S	40S	0	0	0	35	36	02	24	HS	S
27	HVS-27	0	0	0	0	0	TR	0	0	68	36	00	99	S	MR
28	HVS-28	5MS	0	60S	60S	10S	5R	0	0	57	46	00	35	S	HS
29	HVS-32	10MS	0	60S	60S	20S	0	20S	5MS	46	57	36	13	HS	HS
30	HVS-33	10S	0	60S	80S	20S	0	0	0	68	47	12	35	S	HS

31	HVS-40	0	0	20S	10MS	5MS	TMS	0	10MS	46	36	12	35	S	S
32	HVS-42	20MS	0	60S	60S	40S	0	0	0	45	37	00	13	HS	S
33	HVS-43	5MS	0	10S	0	0	5R	5S	0	46	36	00	56	HS	HS
34	HVS-44	0	10S	5S	10S	0	TMS	0	5S	35	26	00	13	S	HS
35	HVS-45	5S	0	20S	20S	0	0	0	0	57	16	00	56	S	HS
36	DWRB190	0	5S	20S	40S	10S	0	0	0	35	37	00	46	S	HS
37	DWR47-IC443614	0	20S	10S	10S	5S	10MS	0	0	57	24	00	68	S	R
38	BH462-IC335830	20S	20S	60S	80S	20S	0	5S	10MS	68	36	00	99	S	R
39	KB2160	0	0	0	0	0	0	0	0	46	47	02	89	S	NC
40	RD2794	0	0	0	0	0	10MR	0	TMS	46	26	00	89	S	HS
40A	**Infector**	60S	80S	80S	100S	60S	60S	60S	60S	89	89	79	99	-	-
41	RD2907	0	0	0	0	0	0	0	5S	35	37	36	99	HS	HS
42	RD3065	0	0	TS	0	0	5MS	0	0	45	36	00	99	S	HS
43	RD3077	0	0	0	0	0	5S	0	0	58	69	79	99	S	MR
44	RD3078	0	0	0	0	0	20MS	0	TMS	89	89	79	99	HS	S
45	VLB175	0	0	TR	0	0	0	0	0	35	36	00	68	HS	S
46	VLB183	0	0	0	0	0	0	0	0	34	25	00	99	HS	S
47	DWRUB52	0	0	0	0	0	5MS	TMS	5S	35	37	00	89	HS	S
48	DWRB182	0	0	TMS	0	0	0	0	TMS	35	36	00	89	HS	NG
49	DWRB239	0	0	0	0	0	10MS	0	TMS	34	25	00	89	HS	S
50	DWRB240	0	0	TR	0	0	0	0	0	45	47	02	99	-	HS

Management of foliar blight of barley through chemicals

The experiment was conducted in RBD with three replications at Ayodhya, Pantnagar, Kanpur, Varanasi and Vijapur. The fungicides were sprayed after first appearance of disease and observations were taken at various intervals. Field efficacy of eight fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25%, Propiconazole 13.9% + Difenconazole 13.9%, Azoxystrobin 12.5% + Tebuconazole 12.5%, Picoxystrobin 7.05% + Propiconazole 11.7%, Kresoxim Methyl 44.3% SC, Propiconazole 25%, Tebuconazole 25.9% and Mancozeb 75%. was tested against leaf blight of barley in randomized block design with three replications (Table 3.9). The maximum disease was created in the plots at tested locations with no fungicidal spray. The data from Varanasi was not considered due to non-availability of one fungicide (Kresoxim Methyl 44.3% SC). At Ayodhya centre application of Tebuconazole 50% + Trifloxystrobin 25% was found best for management of foliar blight with maximum disease control of barley leaf blight with average disease score of 34, whereas three fungicides *viz.*, Propiconazole 13.9% + Difenconazole 13.9%, and Picoxystrobin 7.05% + Propiconazole 11.7% and Propiconazole 25% resulted in average disease score of 35. Similar trend was observed at Pantnagar, Kanpur and Vijapur. At Pantnagar, Tebuconazole 50% + Trifloxystrobin 25%, Propiconazole 13.9% + Difenconazole 13.9% and Propiconazole 25% resulted in maximum disease control of barley leaf blight with average disease score of 25, 35 and 36, respectively. At Kanpur, Tebuconazole 50% + Trifloxystrobin 25%, Azoxystrobin 12.5% + Tebuconazole 12.5% and Picoxystrobin 7.05% + Propiconazole 11.7% were most effective in managing the disease resulting in maximum disease control of barley leaf blight with average disease score of 35, 36 and 36, respectively. Whereas at Vijapur, Trifloxystrobin 25%, Propiconazole 13.9% + Difenconazole 13.9% and Propiconazole 25% resulted in maximum disease control of barley leaf blight with average disease score of 13, 16 and 24, respectively. Whereas, at Overall, at all four centres Tebuconazole 50% + Trifloxystrobin 25% was found best fungicide for management of the disease with average disease severity 24 and maximum average yield 39.40 q/ha.

Table 3.9. Chemical management of foliar blight of barley during 2023-24

Treatments	Dose	Ayodhya		Pantnagar		Kanpur		Vijapur	
		DS	Yield (q/ha)	DS	Yield (q/ha)	DS	Yield (q/ha)	DS	Yield (q/ha)
Tebuconazole 50% + Trifloxystrobin 25%,	0.10%	34	37.59	25	47.24	35	42.5	13	30.4
Propiconazole 13.9% + Difenconazole 13.9%	0.10%	35	36.25	35	43.95	57	29.2	16	28.9
Azoxystrobin 12.5% + Tebuconazole 12.5%	0.10%	57	33.14	56	40.51	36	39.2	35	23.6
Picoxystrobin 7.05% + Propiconazole 11.7%	0.10%	35	35.54	47	42.13	36	33.3	25	27.5
Kresoxim Methyl 44.3% SC	0.10%	78	31.27	79	32.10	47	30.3	37	22.8
Propiconazole 25%	0.10%	35	35.81	36	43.27	56	29.2	24	26.1
Tebuconazole 25.9%	0.10%	56	34.38	58	40.68	47	35.5	26	25.7
Mancozeb 75%	0.20%	68	31.98	68	36.67	46	33.3	48	21.9
Control	-	89	29.03	89	28.62	68	27.3	57	20.8
CD at 5%	-	9.11	2.47	12.58	1.68	13.37	5.13	12.28	2.64
SE(m)	-	3.01	0.82	4.16	0.55	4.42	1.70	4.06	0.87

*DS = Disease severity

Pathotype distribution and rust resistance in NBDSN and EBDSN

1. **Rust situation and physiologic variation in barley rust pathogens**

During 2023-24, there was no report of stem and leaf rusts of barley from the farmer's fields. Pathotype 57 (0S0) of *Puccinia striiformis* f. sp. *hordei* was confirmed in only barley yellow rust sample that was collected from village Dangar, Bilaspur (H.P.).

Rust resistance in barley NBDSN and EBDSN lines during 2023-24

All the NBDSN and EBDSN lines were screened against different pathotypes of three rust pathogens of barley under precise conditions of temperature and light. Wherever needed, confirmatory and selected testing was also undertaken. These lines were evaluated against seven pathotypes of *Puccinia striiformis* f. sp. *hordei* (M, 57, 24, G, Q, 6S0 and 7S0), five pathotypes of *P. graminis* f. sp. *tritici* (11, 21A-2, 40A, 117-6 and 122), and 11 isolates (pathotypes) of *P. hordei* (H1, H2, H3, H4, H5, H6, H7, H8, H9, H10 and H11). None of the NBDSN and EBDSN entries was resistant to all the tested pathotypes of *Pst, Pt* and *Pgt*. The detailed report is presented below.

NBDSN

A total 139 entries of NBDSN were evaluated against the different pathotypes of *Puccinia* spp. on barley. None of the lines was resistant to all three rusts of barley. Eight lines BHS498, GB1, RD2715(C), RD3096, RD3097, RD3100, RD3104, and RD3108 were resistant to all tested pathotypes of both leaf and stripe rust pathogens. DWRB182 (C) was resistant against all the pathotypes of black and yellow rust pathogens. Moreover, 33 lines were resistant to stripe rust and 15 lines to leaf rust. Resistance to all the pathotypes of *P. graminis* f. sp. *tritici* was observed only in two lines DWRB2319 and UPB1124 (Table 3.10).

Table 3.10. Seedling rust resistance in NBDSN during 2023-24.

Resistant to rusts	No. of lines	Lines
Stripe and stem	01	DWRB-182 (C)
Stripe and leaf	08	BHS498, GB1, RD2715 (C), RD3096, RD3097, RD3100, RD3104, RD3108
Stripe	33	BH1058, BH1059, DWRB2301, DWRB2314, DWRB137 (C), DWRB2303, GB2, HBL888, HUB290, HUB291, HUB113, JHSBB19, JHSBD11, JHSBD22, JHSBF21, JHSBF28, PL 955, PL 956, RD 2552 (C), RD3095, RD-2794 (C), RD2899 (C), RD2907(C), RD3088, RD3089, RD3090, RD3102, RD3103, RD3111, UPB1122, UPB1123, UPB1119, UPB1120
Stem	02	DWRB2319, UPB-1124
Leaf	15	BHS-380(C), BHS-400(C), BHS501, DWRB2315, DWRB2312, DWRB238, HBL113(C), HBL885, NDB1821, NDB1829, RD3080, RD3093, RD3107, UPB1121, VLB186

EBDSN

Fifty EBDSN lines were evaluated for resistance to three rusts of barley. Resistance to all three rusts was not recorded in any EBDSN line. However, DWRB182 was resistant to stem and stripe rusts. Resistance to all the pathotypes of *Puccinia striiformis* f. sp. *hordei* and *P. hordei* each was observed in 4 lines (BHS474, BHS478, BHS479, BHS481) (Table 2). Twelve lines were resistant to stripe rust and 4 lines to leaf rust. Resistance to all the pathotypes of *P. graminis* f. sp. *tritici* was observed only in HVS-9 (Table 3.11).

Table 3.11 Seedling rust resistance in EBDSN during 2023-24.

Resistant to rusts	No. of lines	Lines
Stripe and stem	01	DWRB182
Stripe and leaf	04	BHS474, BHS478, BHS479, BHS481
Stripe	12	DWRB127, DWRB137, DWRB143, HLR134, HLR271, HLR272, HLR273, HVS27, RD2794, RD2907, RD3077, RD3078
Stem	01	HVS9
Leaf	04	BHS486, DWRB190, VLB175, DWRB240

Detailed response of the NBDSN and EBDSN entries to the pathotypes of three *Puccinia* spp on barley are presented in Table 3.12 and 3.13.

Table 3.12. Seedling resistance test results of NBDSN against Yellow, Black & Brown rusts during 2023-24 at ICAR-IIWBR, RS, Shimla.

S. No.	Line/ Variety	Pathotypes																					
		Yellow Rust							Black rust					Brown rust*									
		M	24	57	Q	G	6S0	7S0	11	21A-2	40A	117-6	122	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11
1	BH 946	S	S	S	S	S	R	S	S	S	R	MS	MR	S	S	S	S	S	S	S	S	S	S	S
2	BH1055	S	S	S	S	S	S	S	S	MS	MS	MR	R	S	S	S	MS	MS	S	S	S	S	S	S
3	BH1056	S	MS	S	S	S	S	S	S	MR	MR	R	MR	S	S	S	S	S	S	S	S	S	S	S
4	BH1057	S	R	S	S	S	S	R	R	MR	R	R	R	S	S	S	R	S	S	S	S	S	S	S
5	BH1058	R	R	R	R	R	R	R	MR	R	R	R	MR	MS	S	S	MS	S	S	S	S	MS	S	S
6	BH1059	R	R	R	R	R	R	R	R	MR	R	R	MR	S	MS	S	MS	MS	MS	S	S	S	S	S
7	BH-1061	S	R	MS	MS	R	S	MS	R	MR	R	R	MR	R	S	S	R	S	R	MS	R	R	S	R
8	BH1062	R	R	MS	S	R	R	R	MR	MS	S	S	MS	S	S	MS	MS	R	S	S	MR	MR	S	S
9	BH393	S	S	S	S	S	S	S	MS	MR	R	S	MS	S	MS	S	MS	S	MS	S	S	R	S	S
10	BHS352(C)	MS	MS	MS	MS	MR	R	R	R	MS	MR	R	R	MS	NG	S	MS	NG	S	NG	S	S	MS	MR
11	BHS380(C)	MS	MS	MS	R	R	R	MS	S	MS	MR	S	MR	R	R	R	R	R	R	R	R	R	R	R
12	BHS400(C)	MS	MR	MS	MS	MS	MS	MS	MR	R	MR	S	R	R	R	R	R	R	R	R	R	R	R	R
13	BHS497	S	MS	S	R	MS	MS	MR	MR	MS	MR	S	R	S	NG	S	S	S	S	S	S	S	S	S
14	BHS498	R	R	R	R	R	R	R	MR	MR	MR	MR	R	R	R	R	R	R	R	R	R	R	R	R
15	BHS499	S	S	S	MS	S	R	R	MR	R	MR	MS	R	S	S	S	S	S	S	S	S	S	S	S
16	BHS500	MS	Mix	S	MS	S	R	R	MR	MS	MR	R	S	S	S	S	S	S	S	S	S	S	S	S
17	BHS501	R	MR	S	S	MS	R	MR	R	MS	MR	S	MR	R	R	R	R	R	R	R	R	R	R	R
18	BHS502	S	S	S	S	S	S	S	MS	S	R	MR	R	R	R	MS	R	R	R	R	R	R	R	R
19	DWRB2301	R	R	R	R	R	R	R	MS	R	MR	R	MR	S	R	MS	R	MS	R	S	S	R	S	S
20	DWRB2302	S	MS	S	R	R	R	MR	S	MS	R	R	MR	S	S	S	S	S	S	S	S	S	S	S
21	DWRB2313	MS	S	S	S	MS	R	MS	R	MR	MR	MR	R	S	Mix	MS	R	R	MS	S	R	R	R	MS
22	DWRB2314	R	R	R	R	R	R	R	MR	R	R	R	R	MR	MS	S	R	R	MS	MR	R	MR	R	MS
23	DWRB2315	S	S	S	S	S	MS	S	R	MS	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R
24	DWRB137 (C)	R	R	R	R	R	R	R	MS	MS	MS	MS	MR	S	S	S	S	MS	S	S	S	S	S	S
25	DWRB182 (C)	R	R	R	R	R	R	R	R	R	R	R	R	S	S	S	MS	MS	S	S	MS	S	S	MS
26	DWRB223	MS	R	MS	S	S	S	R	R	MS	R	R	NG	NG	R	NG	R	R	NG	R	R	R	R	R
27	DWRB2303	R	R	R	R	R	R	R	R	R	MR	R	R	MR	R	MS	R	R	MS	R	S	R	S	R
28	DWRB2304	MS	MS	MR	MR	NG	NG	R	NG	NG	NG	NG	R	NG	NG	NG	R	NG	NG	R	NG	NG	NG	NG
29	DWRB2305	NG	NG	NG	NG	MS	NG	NG	NG	NG	NG	NG	R	MS	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
30	DWRB2306	NG	NG	NG	NG	R	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
31	DWRB2307	MS	S	S	S	MS	S	R	S	MR	MR	MS	R	MS	S	S	R	MR	MR	S	S	MS	MS	S
32	DWRB2308	S	R	MR	S	R	R	R	MS	R	R	MR	R	S	S	S	R	MS	S	S	S	S	S	S
33	DWRB2309	R	S	S	S	R	R	R	R	R	S	R	R	S	S	S	S	S	S	S	S	S	S	S
34	DWRB2310	S	S	S	S	MS	R	R	MR	MR	R	MR	MR	S	S	S	MS	MS	S	S	S	S	S	S
35	DWRB2311	S	R	S	S	R	R	R	MR	R	MS	R	R	S	S	S	S	S	S	S	S	S	S	S
36	DWRB2312	S	MR	MS	S	R	MS	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	R
37	DWRB2316	S	S	R	MS	R	S	MS	R	R	MR	R	R	S	S	R	R	R	R	S	R	MR	R	R
38	DWRB2317	R	MS	S	R	MR	R	R	MS	R	MR	R	R	S	S	S	MS	MS	S	S	R	S	MS	S
39	DWRB2318	S	S	S	S	MS	S	MS	MS	MS	MS	MR	MR	MS	S	S	R	MS	MS	S	R	R	MS	MS
40	DWRB2319	MS	MR	S	MS	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R
41	DWRB235	R	R	S	R	R	MS	R	R	MR	MS	MR	R	S	S	S	S	S	S	S	S	S	S	S
42	DWRB238	S	R	R	S	R	S	R	R	R	MR	MR	R	R	R	R	R	R	R	R	S	R	R	R
43	DWRB244	NG	NG	S	NG	NG	R	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
44	DWRB2849 (C	S	R	MS	MS	R	MS	R	MR	MR	MR	R	R	MS	S	S	MR	MS	S	S	S	S	MIX	S
45	DWRBU52 (C)	S	R	S	MR	R	R	R	R	MR	R	R	MR	S	S	S	S	S	S	S	S	S	S	S
46	DWRUB52 (C)	S	S	S	R	R	S	R	R	MR	MS	R	R	S	S	S	S	S	S	S	S	S	S	S
47	DWRUB64	R	R	MR	R	R	R	R	S	MS	MS	MR	MS	MR	S	S	S	MS	MS	S	S	S	S	MS
48	GB1	R	R	R	R	R	R	R	S	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R
49	GB2	R	R	R	R	R	R	R	MS	MR	MS	MS	S	MS	MS	S	S	S	S	S	S	S	S	S
50	HBL113(C)	R	R	MS	R	MS	R	MR	MR	MS	MR	MS	MR	R	R	R	R	R	R	R	R	R	R	R
51	HBL884	R	S	S	MS	MS	R	R	MS	MS	R	MR	MS	MR	R	S	R	S	S	MR	R	R	R	MS
52	HBL885	R	R	R	MR	R	R	R	MR	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R
53	HBL886	MS	S	S	R	R	R	MR	R	MR	MR	R	R	S	NG	S	S	S	S	S	S	S	S	S
54	HBL888	R	R	R	R	R	R	R	MS	MS	R	MS	R	R	NG	R	R	R	NG	R	R	R	R	R
55	HUB290	R	R	R	R	R	R	R	MS	R	R	R	MR	S	S	S	MS	S	S	S	S	S	S	S
56	HUB291	R	R	R	R	R	R	R	MR	S	R	R	R	NG	R	S	MS	S	S	S	S	S	S	S
57	HUB113	R	R	R	R	R	R	R	R	MS	R	MR	MS	S	S	S	S	S	S	S	S	S	S	S
58	HUB287	R	R	R	R	Mix	R	R	MR	MR	R	R	MS	MS	S	NG	MS	MR	S	S	MS	MS	S	MS
59	HUB288	S	S	S	S	S	S	R	R	R	MS	MS	MR	R	S	MS	MR	MR	MIX	S	R	S	S	MS
60	HUB293	S	NG	S	NG	Mix	S	NG	NG	MR	NG	R	NG	S	R	NG	R	R	NG	R	NG	NG	NG	NG
61	HUB294	S	S	S	S	S	S	MS	MS	MS	S	MS	R	S	S	S	MIX	S	R	S	R	R	S	MS
62	JHSBB19	R	R	R	R	R	R	R	R	R	MS	MR	MS	S	S	S	S	S	S	S	S	S	S	S
63	JHSBD11	R	R	R	R	R	R	R	S	S	MR	R	MS	S	MS	S	MS	MS	MS	S	S	MS	NG	S
64	JHSBD22	R	R	R	R	R	R	R	MR	R	MS	R	MR	S	S	S	S	S	S	S	S	S	S	S
65	JHSBE16	R	Mix	Mix	R	R	S	S	R	MR	S	R	MR	S	S	S	MS	S	MS	S	S	S	S	S
66	JHSBF21	R	R	R	R	R	R	R	R	R	MR	MR	MR	S	S	S	S	S	R	S	R	S	S	S
67	JHSBF28	R	R	R	R	R	R	R	R	MR	MR	MR	MS	S	S	S	S	S	S	S	S	S	S	S
68	K1149(C)	S	R	S	S	S	S	S	NG	NG	S	R	R	NG	NG	NG	S	S	S	S	NG	NG	NG	NG
69	K603(C)	S	S	S	S	S	S	S	MS	MR	MR	MS	MR	S	S	S	S	S	S	S	S	S	S	S
70	KARAN16(C)	S	S	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	MS	NG	NG	NG	NG	NG	NG	NG	NG	S
71	KB2212	S	R	S	S	R	R	R	MR	R	MS	R	MR	NG	NG	NG	NG	R	NG	R	NG	R	NG	R
72	KB2031	NG	NG	NG	S	NG	NG	R	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
73	KB2201	S	MS	MS	MS	Mix	R	MS	R	R	R	R	NG	R	NG	R	R	R	NG	R	R	NG	NG	R
74	KB2203	S	S	S	S	S	S	S	NG	MS	S	R	NG	NG	S	NG	S	S	S	R	NG	MS	MIX	NG
75	KB2231	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
76	NDB1173(C)	MS	R	R	R	R	R	R	MR	S	R	MS	MR	S	S	S	MS	S	S	S	R	MR	NG	S
77	NDB1821	R	S	S	R	R	R	R	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	R
78	NDB1829	MS	S	S	S	S	S	MS	MS	S	R	MR	MS	R	R	R	R	R	R	R	R	R	R	R
79	NDB1833	MS	MR	MS	MR	S	MS	MS	MR	R	MR	R	MR	MS	S	S	MS	MS	S	S	R	S	S	S
80	PL954	S	MS	S	S	SMS	MS	MR	MS	MS	R	MS	MR	S	S	S	S	S	S	S	S	S	S	S
81	PL955	R	R	R	R	R	R	R	MR	MS	MR	MS	R	S	MR	S	MS	S	R	MS	S	S	S	S
82	PL956	R	R	R	R	R	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	MR	R
83	PL891(C)	NG	R	NG	MS	NG	NG	R	R	NG	R	NG	R	NG	NG	R	NG	R	R	NG	R	NG	NG	R
84	PL957	S	MS	S	S	S	MS	MS	S	S	NG	R	NG	S	S	S	R	MS	S	S	S	MS	S	S
85	PL958	MS	R	R	S	S	S	R	S	R	MR	R	R	S	S	MS	MS	MS	R	S	S	MS	S	S
86	PL959	S	R	S	MS	R	MR	R	R	MR	MR	MS	R	MS	S	S	S	S	MS	S	S	S	MS	S
87	PL960	S	S	S	S	S	R	S	MS	MS	NG	MR	NG	R	S	MS	MR	MS	MS	R	NG	S	S	S

88	RD2552 (C)	R	R	R	R	R	R	R	S	R	S	MR	MS	S	MS	S	MR	S	S	S	S	MS	S	S
89	RD2715 (C)	R	R	R	R	R	R	R	MR	S	MS	MS	MS	R	R	R	R	R	R	R	R	R	R	R
90	RD3095	R	R	R	R	R	R	R	S	MR	S	MR	S	MS	MS	S	R	MS	MS	S	S	S	S	S
91	RD2794 (C)	R	R	R	R	R	R	R	R	MR	MS	MS	MR	S	S	S	S	S	S	S	S	S	S	S
92	RD2849 (C)	S	MS	S	R	R	R	R	MR	MR	R	R	R	S	S	S	S	S	S	S	S	S	S	S
93	RD2899 (C)	R	R	R	R	R	R	R	MS	MS	S	S	MS	S	MS	S	S	S	S	S	R	MS	S	S
94	RD2907(C)	R	R	R	R	R	R	R	R	MS	S	MS	MS	S	S	S	S	S	S	S	S	MS	S	S
95	RD3064 (C)	S	S	S	S	S	S	S	MR	MS	MS	R	R	S	S	S	S	MS	S	S	S	S	MS	MS
96	RD3080	R	R	R	R	R	R	R	S	MR	S	S	S	R	R	R	R	R	R	R	R	R	R	R
97	RD3084	S	S	S	S	MS	MS	S	MR	MR	MR	R	R	S	S	S	S	S	S	S	S	S	S	S
98	RD3085	S	S	S	R	R	MS	R	MS	MS	MR	R	R	MR	S	S	R	MR	Mix	MS	MS	R	MS	S
99	RD3086	MS	S	MS	MS	MS	S	S	MS	MS	MR	MR	MR	Mix	S	S	R	MS	R	MS	R	R	MR	MR
100	RD3087	S	S	S	MS	S	S	S	S	S	S	R	R	MS	S	S	R	MR	R	S	S	MS	S	MS
101	RD3088	R	R	R	R	R	R	R	S	MR	MR	R	NR	R	R	MS	R	R	R	MR	R	R	MS	S
102	RD3089	R	R	R	R	R	R	R	MR	S	MR	MR	R	R	MR	R	R	R	R	R	MIX	R	MS	R
103	RD3090	R	R	R	R	R	R	R	R	MS	MR	MR	MR	R	R	R	R	R	R	R	MR	R	R	R
104	RD3091	MS	S	S	MS	R	R	MS	MR	MS	MR	R	MS	R	S	S	R	MS	MS	S	MS	MS	MS	MS
105	RD3092	MS	S	S	S	R	MS	R	R	R	MS	NG	NG	NG	R	R	R	R	R	R	R	R	R	NG
106	RD3093	R	R	R	R	R	R	R	MR	MS	R	MS	MR	R	R	R	R	R	R	R	R	R	R	R
107	RD-3094	S	S	MS	S	MS	S	S	S	S	MR	MR	MR	R	Mix	MS	R	R	R	MS	R	R	R	R
108	RD3096	R	R	R	R	R	R	R	MR	NG	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R
109	RD3097	R	R	R	R	R	R	R	S	MS	MR	MR	MS	R	R	R	R	R	R	R	R	R	R	R
110	RD3098	S	S	S	S	S	S	S	S	MS	MS	MS	MR	MS	S	MS	R	S	R	MS	MS	MR	MS	MS
111	RD3099	S	S	S	S	S	S	S	S	S	MR	MS	MR	R	Mix	Mix	R	S	R	MS	MS	R	R	R
112	RD3100	R	R	R	R	R	R	R	S	MS	R	MR	R	R	R	R	R	R	R	R	R	R	R	R
113	RD3101	MS	MS	MS	S	S	S	S	MR	S	S	S	MS	S	S	S	R	MS	S	MS	MIX	S	R	S
114	RD3102	R	R	R	R	R	R	R	MS	S	S	S	MR	S	S	MS	MS	MS	S	S	S	MR	S	S
115	RD3103	R	R	R	R	R	R	R	R	MS	MR	MS	R	S	S	R	R	Mix	Mix	R	R	R	Mix	R
116	RD3104	R	R	R	R	R	R	R	MR	MS	MS	MS	MR	R	R	R	R	R	R	R	R	R	R	R
117	RD3105	MS	MR	MS	MS	MS	R	R	R	R	MR	R	R	S	S	S	S	S	S	S	S	S	S	S
118	RD3106	MS	MS	MR	MS	MS	S	MR	S	R	MR	MS	MR	S	S	MS	R	MS	R	S	R	R	MR	MS
119	RD3107	MR	MS	MS	MS	MS	S	R	S	MS	MS	MR	MR	R	R	R	R	R	R	R	R	R	R	R
120	RD3108	R	R	R	R	R	R	R	MR	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
121	RD3109	S	S	S	S	S	S	S	MR	S	MR	MS	MR	S	S	R	R	MR	R	S	R	R	S	R
122	RD3110	MS	MS	MS	MS	S	S	S	R	S	R	S	MR	MR	MS	S	R	MS	MS	MS	R	MR	S	S
123	RD3111	R	R	R	R	R	R	R	MR	MR	S	MR	R	S	S	S	S	S	S	S	S	MS	S	S
124	UPB1106	S	S	S	S	S	S	S	MR	S	MS	MS	MS	S	S	S	S	S	S	S	S	S	S	S
125	UPB1122	R	R	R	R	R	R	R	MS	MR	MR	R	R	S	S	S	S	S	S	S	S	S	S	S
126	UPB1123	R	R	R	R	R	R	R	R	R	MR	R	MR	S	MS	S	S	S	MS	MS	S	S	S	S
127	UPB1118	R	R	R	MR	MS	R	R	R	MS	S	R	NG	MS	NG	S	S	S	S	S	R	S	S	S
128	UPB1119	R	R	R	R	R	R	R	R	MS	S	MR	R	MIX	MS	S	S	S	MS	S	R	MR	S	MR
129	UPB1120	R	R	R	R	R	R	R	MS	R	MS	MR	S	S	MS	S	S	S	MS	S	S	S	S	S
130	UPB1121	MS	MS	MS	MS	MS	S	MS	S	MS	MR	R	MS	R	R	R	R	R	R	R	R	R	R	R
131	UPB1124	S	S	S	MS	MS	S	MS	R	R	R	R	R	S	NG	S	MS	S	S	NG	S	S	S	S
132	UPB1125	S	S	S	MS	MS	S	R	R	MR	R	MR	R	S	S	R	R	R	R	Mix	Mix	R	R	R
133	VLB118(C)	MS	S	S	S	MS	MS	MS	MR	S	S	MR	MR	R	R	R	R	R	R	R	R	R	MR	R
134	VLB184	R	MR	MS	R	Mix	R	R	R	S	MS	MS	R	R	R	R	R	R	R	R	R	MS	R	
135	VLB185	S	S	S	S	S	S	S	S	MR	MR	R	MS	MS	S	S	MS	S	S	MS	S	MS	MIX	S
136	VLB186	MS	S	S	S	MS	MS	MR	MS	MR	MS	MR	MS	R	R	R	R	R	R	R	R	R	R	R
137	VLB187	S	S	S	MS	S	S	S	MR	S	S	R	NG	MIX	MS	R	R	R	MR	R	R	R	R	R
138	VLB188	S	S	S	MS	R	S	R	MR	MS	R	MR	MR	MS	R	S	R	MR	MS	S	S	MR	S	S
139	VLB189	MS	S	S	S	MS	R	R	R	MS	MR	MR	MR	R	R	S	R	MS	R	R	R	R	MS	R
*H1=31H7, H2=31H15, H3=55H7, H4=15H7, H5=7H7, H6=7H5, H7=31H11, H8=31H3, H9=23H3, H10=23H15 and H11=23H7																								

Table 3.13. Seedling Resistance Test results of EBDSN (2023-24) against Yellow, Black & Brown rusts at ICAR-IIWBR, RS, Shimla.

S. No.	Line/ Variety	Pathotypes																					
		Yellow Rust							Black rust					Brown rust*									
		M	24	57	Q	G	6S0	7S0	11	21A-2	40A	117-6	122	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11
1	BH462-IC335830	S	S	S	S	S	S	S	MS	S	MS	S	S	S	S	S	S	S	S	S	S	S	S	S
2	BHS474	R	R	R	R	R	R	R	S	MS	MR	MR	MR	R	R	R	R	R	R	R	R	R	R	R
3	BHS478	R	R	R	R	R	R	R	MR	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R
4	BHS479	R	R	R	R	R	R	R	MR	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R
5	BHS480	S	S	S	S	S	R	MR	MS	MS	MR	R	R	R	R	R	R	NG	R	NG	R	R	MS	R
6	BHS481	R	R	R	R	R	R	R	MS	MR	MR	MR	R	R	R	R	R	R	R	R	R	R	R	R
7	BHS483	S	NG	MS	NG	NG	S	R	MS	NG	NG	NG	NG	NG	NG	S	NG	S	NG	NG	S	NG	NG	NG
8	BHS485	R	NG	MS	MS	MS	R	MS	NG	MS	NG	R	R	S	NG	S	S	S	S	S	S	NG	S	S
9	BHS486	MS	MS	MS	MS	R	R	R	MS	S	MR	R	MS	R	R	R	R	R	R	R	R	R	R	R
10	DWR47-IC443614	S	S	S	S	R	S	NG	R	MR	R	R	MR	MS	S	S	NG	MS	MS	S	MR	MS	S	MS
11	DWRB127	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	MR
12	DWRB128	S	MS	MS	S	MS	R	R	R	MS	MR	R	MS	S	S	S	S	S	S	S	S	S	S	S
13	DWRB137	R	R	R	R	R	R	R	MS	MS	MS	MS	MR	S	S	S	S	MS	S	S	S	S	S	S
14	DWRB143	R	R	R	R	R	R	R	MS	MS	R	MR	R	MIX	MS	MS	R	S	R	MS	S	MS	S	S
15	DWRB182	R	R	R	R	R	R	R	R	R	R	R	R	MS	S	MS	R	MS	S	S	MS	S	S	MS
16	DWRB190	MS	MS	MS	S	S	MR	S	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R
17	DWRB206	Mix	NG	NG	MS	R	MS		R	R	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	R	NG	S
18	DWRB207	R	R	R	R	R	MS	R	MS	MR	MR	MR	MS	S	S	S	S	S	S	S	S	S	S	S
19	DWRB239	S	R	S	MS	R	MS	R	MR	MS	R	R	MR	S	S	S	R	S	S	S	S	S	S	R
20	DWRB240	S	R	S	MS	R	MS	R	S	MS	MR	MR	MS	R	R	R	R	R	R	R	R	R	R	R
21	DWRB6	R	NG	NG	NG	R	NG	NG	NG	NG	NG	NG	R	NG	NG	NG	NG	R	R	NG	NG	NG	NG	NG
22	DWRUB52	S	S	S	R	R	S	R	R	MR	MS	R	R	S	S	MS	MS	S	S	S	S	MS	S	S
23	HLR103	MS	R	R	MS	R	R	R	R	MR	R	R	R	R	R	MS	R	R	R	MS	R	R	MS	R
24	HLR115	R	R	R	R	NG	R	R	R	MR	R	R	R	R	R	R	R	R	R	MS	R	R	R	R
25	HLR134	R	R	R	R	R	R	R	MR	MR	R	R	R	S	S	S	S	S	S	S	S	S	S	S
26	HLR137	R	R	S	R	NG	R	R	MR	MS	NG	MS	R	R	S	MS	R	S	NG	R	R	R	R	R
27	HLR271	R	R	R	R	R	R	R	MS	MS	MR	MS	R	S	S	S	S	S	S	S	S	S	NG	S
28	HLR272	R	R	R	R	R	R	R	MR	R	MR	R	R	S	S	S	S	S	S	S	S	S	S	S
29	HLR273	R	R	R	R	R	R	R	R	R	R	MS	R	S	S	S	S	S	S	S	S	S	S	S

30	HLR75	S	R	R	MR	R	MS	R	MS	S	R	R	R	MS	R	R	R	R	R	R	NG	R	R	R
31	HVS14	S	S	S	S	S	S	S	R	S	R	R	MR	MS	S	R	MS	S	MS	MR	S	MS	S	Mix
32	HVS27	R	R	R	R	R	R	R	MS	MR	MS	R	NG	S	S	MS	S	S	S	S	S	S	S	S
33	HVS28	S	S	S	S	S	S	S	NG	MS	R	R	R	R	R	MS	R	R	R	R	R	MS	MR	
34	HVS32	S	S	S	S	S	S	S	R	S	MR	MR	R	S	S	MS	MR	MR	S	NG	R	MS	S	MR
35	HVS33	S	MS	S	MS	S	MS	S	R	MR	R	R	MR	R	S	MS	MS	R	R	MIX	NG	S	S	R
36	HVS40	S	MS	MS	R	S	MS	S	R	MS	MR	MR	R	R	MIX	R	S	R	R	R	R	R	R	R
37	HVS42	S	S	S	MS	S	S	S	MS	S	R	MS	MS	NG	S	MS	S	S	MS	R	S	MR	MR	Mix
38	HVS43	S	MR	S	MR	S	MR	MS	R	R	R	R	MS	MS	R	MS	MS	NG	MS	MS	R	MS	NG	S
39	HVS44	R	MS	MS	S	MS	MS	S	NG	MS	MR	MR	R	R	R	R	MR	R	S	R	R	NG	R	R
40	HVS45	MS	S	S	Mix	S	MS	R	R	MR	R	R	R	MR	MIX	NG	MS	MS	S	MS	S	MS	S	MS
41	HVS7	S	MS	MS	S	S	R	S	MS	MR	R	R	MR	R	S	S	MS	MIX	MS	S	MS	MS	R	S
42	HVS9	MS	MS	S	MS	R	S	MS	R	R	R	R	R	R	R	R	R	MR	R	R	R	MS	R	MR
43	KB2160	R	R	NG	NG	NG	R	R	R	R	R	MR	MS	NG	NG	R	S	NG	S	NG	S	MS	NG	S
44	RD2794	R	R	R	R	R	R	R	R	MR	MS	MS	MR	S	S	S	S	S	S	S	S	S	S	S
45	RD2907	R	R	R	R	R	R	R	R	MS	S	MS	MS	MIX	S	S	S	S	S	MIX	S	MS	S	S
46	RD3065	R	S	R	R	R	R	R	R	R	MR	R	MR	S	S	S	S	S	S	S	S	S	S	S
47	RD3077	R	R	R	R	R	R	R	MR	S	MR	MS	MR	R	R	R	R	R	R	R	R	R	R	MS
48	RD3078	R	R	R	R	R	R	R	MR	S	MR	R	MS	R	R	R	R	R	R	R	R	R	R	MR
49	VLB175	S	R	MS	MS	MS	S	MS	MS	MR	MR	MR	MR	R	R	R	R	R	R	R	R	R	R	R
50	VLB183	S	R	S	MS	R	R	R	S	MR	R	MR	R	R	MS	R	R	R	R	MS	R	R	R	R
*H1=31H7, H2=31H15, H3=55H7, H4=15H7, H5=7H7, H6=7H5, H7=31H11, H8=31H3, H9=23H3, H10=23H15 and H11=23H7																							

ENTOMOLOGY

Summary

- A total of 154 NBDSN entries were screened at seven locations viz., Ludhiana, Karnal, Kanpur, Khudwani, and Durgapura to determine aphid resistance sources.
- Majority of the entries at all the locations harboured aphids in different numbers depending upon their incidence level except Khudwani and Durgapura locations where aphid infestation was recorded very low.
- Entries were found to be either found to be in susceptible (grade 4) or highly susceptible (grade 5) or moderately resistance (grade 3) or resistance (grade 2) categories based on the average score of three locations i.e. Ludhiana, Kanpur and Karnal.
- Based on the average score of three locations i.e. Ludhiana, Kanpur and Karnal, 17 entries viz., DWRB2303, RD3093, DWRB2319, DWRB2301, DWRUB64, HUB113, GB2, RD 2552, DWRB137, VLB-184, BHS-501, HBL-886, UPB-1120, VLB-187, RD-3090, DWRB-2306, UPB-1125 showed moderately resistance (grade 3) reaction.
- An experiment on management of aphids through foliar application of new bio-chemical molecules was conducted at three locations viz., Ludhiana, Kanpur and Karnal. Foliar spray of pymetrozine 50 WG @ 100 g/ha and 120 g/ha was found effective in reducing aphid population.
- Survey conducted during 2023-24, aphid infestation on the barley crop was found to be low to moderate at the Ludhiana, Kanpur, and Karnal locations throughout the crop season. Termite damage in barley fields stayed low to moderate. Predators including coccinellid beetles, chrysoperla, and syrphid flies were regularly observed preying on barley aphids.

Progress Report

During the cropping season of 2023-24, the following experiments were allotted for barley entomology program these are listed as below:-

Experiment number	Title	Centres
1	Screening of NBDSN barley entries against foliar aphids	Ludhiana, Karnal, Durgapura, Kanpur, Khudwani
2.	Management of aphids through foliar application of new bio-chemical molecules	Ludhiana, Kanpur and Karnal
3.	Survey and surveillance of insect-pests and their natural enemies in barley	All centres

Experiment 1: Screening of NBDSN barley entries (2023-24) against foliar aphids

A total of one hundred and fifty-four barley NBDSN entries were screened against aphids at five locations viz., Ludhiana, Karnal, Durgapura, Kanpur, Khudwani, during 2023-24. The seeds were supplied by IIWBR, Karnal. Aphid population per shoot was recorded at weekly intervals from all these entries and grades were given according to 5 point system as described below.

Grade/ Score	Approx. numbers of aphids/shoot	Rating
1	0	Immune (I)
2	1-5	Resistant (R)
3	6-10	Moderately resistant (MR)
4	11-20	Susceptible (S)
5	21 and above	Highly susceptible (HS)

Majority of the entries at all the locations harboured aphids in different range depending upon their incidence level except Khudwani and Durgapura locations where aphid infestation was low.

Hence, data from these locations were not included in the report. The number of aphids recorded per shoot was converted into the scale of 1-5. Based on the scale, the entries were categorized either as immune (grade 1) or resistant (grade 2), or moderately resistant (grade 3) or either susceptible (grade 4) or highly susceptible (grade 5) to aphids.

Out of 154 tested entries, none of the entry showed the resistance (grade 2) reaction based on the average score of three locations i.e. Ludhiana, Kanpur and Karnal. All entries were found to be either in the susceptible (grade 4) or highly susceptible (grade 5) or moderately resistant (grade 3) category (Table 1). Based on the average score of three locations, 17 entries viz., DWRB2303, RD3093, DWRB2319, DWRB2301, DWRUB64, HUB113, GB2, RD 2552, DWRB137, VLB-184, BHS-501, HBL-886, UPB-1120, VLB-187, RD-3090, DWRB-2306, UPB-1125 showed moderately resistance (grade 3) reaction.

At Kanpur centre, 22 entries showed the moderately resistance (grade 2) response against aphids reaction. Three entries viz., RD 2552 ©, UPB-1125 and RD-3110 gave moderately resistance (grade 3) response at Karnal location. At Ludhiana centre, no entry showed resistant (grade 2) or moderately resistance (grade 3) response.

Table 3.10. Screening of National Barley Disease Screening Nursery (NBDSN) entries against foliar aphids during 2023-24.

Entry No.	Entry code	Entry name	Foliar aphid score (1-5 scale)			Average score	Maximum Score
			Karnal	Ludhiana	Kanpur		
1	IVT-IRFB-2301	HUB 291	5	5	3	4.3	5
2	IVT-IRFB-2302	DWRB2303	4	4	3	3.7	4
3	IVT-IRFB-2303	RD3093	4	4	3	3.7	4
4	IVT-IRFB-2304	RD2907 (Filler)	5	5	2	4.0	5
5	IVT-IRFB-2305	PL 954	4	5	4	4.3	5
6	IVT-IRFB-2306	BH1059	5	5	2	4.0	5
7	IVT-IRFB-2307	UPB 1123	4	5	3	4.0	5
8	IVT-IRFB-2308	BH1058	4	5	3	4.0	5
9	IVT-IRFB-2309	HUB 290	4	5	3	4.0	5
10	IVT-IRFB-2310	GB1	5	5	5	5.0	5
11	IVT-IRFB-2311	DWRB 2302	5	5	5	5.0	5
12	IVT-IRFB-2312	PL 956	4	5	3	4.0	5
13	IVT-IRFB-2313	DWRB2319	4	4	3	3.7	4
14	IVT-IRFB-2314	UPB 1122	4	4	4	4.0	4
15	IVT-IRFB-2315	PL 955	5	5	2	4.0	5
16	IVT-IRFB-2316	DWRB137 ©	5	5	5	5.0	5
17	IVT-IRFB-2317	RD3096	4	5	4	4.3	5
18	IVT-IRFB-2318	DWRB 2301	4	5	2	3.7	5
19	IVT-IRFB-2319	DWRUB64 (Filler)	4	5	2	3.7	5
20	IVT-IRFB-2320	RD 3095	4	5	3	4.0	5
20A	**Infector**	**Alfa-93**	**5**	**5**	**5**	**5.0**	**5**
21	IVT-IRFB-2321	KB 2212	4	5	3	4.0	5
22	IVT-IRFB-2322	HUB113 ©	4	5	2	3.7	5
23	IVT-IRFB-2323	GB2	4	5	2	3.7	5
24	IVT-IRFB-2324	RD2899 ©	4	5	4	4.3	5
25	IVT-IRFB-2325	BH 946 ©	5	5	2	4.0	5
26	IVT-DPB-2301	DWRB 2314	4	5	4	4.3	5
27	IVT-DPB-2302	JHSBB19	4	5	3	4.0	5
28	IVT-DPB-2303	RD 2552 ©	3	5	3	3.7	5
29	IVT-DPB-2304	JHSBE16	4	5	4	4.3	5
30	IVT-DPB-2305	JHSBD22	4	5	4	4.3	5
31	IVT-DPB-2306	DWRB2316	5	5	5	5.0	5
32	IVT-DPB-2307	JHSBD11	5	5	5	5.0	5
33	IVT-DPB-2308	RD 2715 ©	4	5	4	4.3	5
34	IVT-DPB-2309	DWRB2317	4	5	4	4.3	5
35	IVT-DPB-2310	DWRB2318	5	5	3	4.3	5
36	IVT-DPB-2311	DWRB 2313	5	5	3	4.3	5
37	IVT-DPB-2312	JHSBF28	5	5	3	4.3	5
38	IVT-DPB-2313	JHSBF21	5	5	3	4.3	5

39	IVT-DPB-2314	DWRB 2315	5	5	3	4.3	5
40	AVT-IRFB-2301	UPB 1106	5	4	3	4.0	5
40A	**Infector**	**Alfa-93**	**5**	**5**	**5**	**5.0**	**5**
41	AVT-IRFB-2302	BH 946	5	5	3	4.3	5
42	AVT-IRFB-2303	HUB113	5	4	3	4.0	5
43	AVT-IRFB-2304	DWRB137	4	4	2	3.3	4
44	AVT-IRFB-2305	BH393 (Filler)	4	5	3	4.0	5
45	IVT-RF-NHZ-1	VLB-188	4	4	2	3.3	4
46	IVT-RF-NHZ-2	BHS-499	4	5	3	4.0	5
47	IVT-RF-NHZ-3	VLB-184	4	5	2	3.7	5
48	IVT-RF-NHZ-4	BHS-501	4	4	2	3.3	4
49	IVT-RF-NHZ-5	HBL-886	4	4	2	3.3	4
50	IVT-RF-NHZ-6	UPB-1120	4	4	3	3.7	4
51	IVT-RF-NHZ-7	BHS-400©	4	5	3	4.0	5
52	IVT-RF-NHZ-8	BHS-497	4	4	4	4.0	4
53	IVT-RF-NHZ-9	HBL-888	5	5	3	4.3	5
54	IVT-RF-NHZ-10	BHS-380©	5	5	4	4.7	5
55	IVT-RF-NHZ-11	UPB-1119	5	5	3	4.3	5
56	IVT-RF-NHZ-12	UPB-1118	5	5	3	4.3	5
57	IVT-RF-NHZ-13	VLB-118©	5	5	4	4.7	5
58	IVT-RF-NHZ-14	BHS-352©	4	5	4	4.3	5
59	IVT-RF-NHZ-15	HBL-884	5	5	5	5.0	5
60	IVT-RF-NHZ-16	HBL-113©	5	5	3	4.3	5
60A	**Infector**	**Alfa-93**	**5**	**5**	**4**	**4.7**	**5**
61	IVT-RF-NHZ-17	VLB-189	5	5	2	4.0	5
62	IVT-RF-NHZ-18	VLB-186	5	5	3	4.3	5
63	IVT-RF-NHZ-19	VLB-185	4	5	4	4.3	5
64	IVT-RF-NHZ-20	BHS-502	4	4	5	4.3	5
65	IVT-RF-NHZ-21	BHS-500	5	5	5	5.0	5
66	IVT-RF-NHZ-22	BHS-498	4	5	4	4.3	5
67	IVT-RF-NHZ-23	HBL-885	5	5	3	4.3	5
68	IVT-RF-NHZ-24	VLB-187	4	5	2	3.7	5
69	IVT-IR-NB-1	PL-960	4	4	4	4.0	4
70	IVT-IR-NB-2	RD-3092	4	4	4	4.0	4
71	IVT-IR-NB-3	RD-3090	4	4	3	3.7	4
72	IVT-IR-NB-4	RD-3091	5	5	3	4.3	5
73	IVT-IR-NB-5	DWRB-2304	5	5	3	4.3	5
74	IVT-IR-NB-6	K-1149©	5	5	3	4.3	5
75	IVT-IR-NB-7	DWRB-2305	5	5	2	4.0	5
76	IVT-IR-NB-8	DWRB-2306	4	4	2	3.3	4
77	IVT-IR-NB-9	KARAN-16©	4	5	4	4.3	5
78	IVT-IR-NB-10	RD-3088	5	5	3	4.3	5
79	IVT-IR-NB-11	PL-891©	5	5	2	4.0	5
80	IVT-IR-NB-12	UPB-1121	5	5	4	4.7	5
80A	**Infector**	**Alfa-93**	**5**	**5**	**4**	**4.7**	**5**
81	IVT-IR-NB-13	RD-3089	5	5	2	4.0	5
82	AVT-IR-NB-NWPZ-1	DWRB-244	5	5	3	4.3	5
83	AVT-IR-NB-NWPZ-2	PL-891©	5	5	3	4.3	5
84	AVT-IR-NB-NWPZ-3	K-1149©	5	5	2	4.0	5
85	AVT-IR-NB-NWPZ-4	DWRB-223	5	5	4	4.7	5
86	AVT-IR-NB-NWPZ-5	KARAN-16©	5	5	3	4.3	5
87	AVT-IR-NB-CZ-1	K-1149©	5	5	2	4.0	5
88	AVT-IR-NB-CZ-2	PL-891©	5	5	2	4.0	5
89	AVT-IR-NB-CZ-3	KARAN-16©	4	5	4	4.3	5
90	AVT-IR-NB-CZ-4	DWRB-244	4	5	4	4.3	5
91	AVT-IR-NB-CZ-5	DWRB-223	4	5	4	4.3	5
92	AVT-MB-1	DWRB-2849 ©	4	5	4	4.3	5
93	AVT-MB-2	DWRB-182 ©	5	5	3	4.3	5
94	AVT-MB-3	DWRBU-52 ©	4	5	4	4.3	5
95	AVT-MB-4	RD-3064 ©	5	5	5	5.0	5
96	AVT-MB-5	DWRB-238	4	5	4	4.3	5
97	AVT-MB-6	DWRB-235	4	5	4	4.3	5
98	AVT-MB-7	DWRB-137 ©	5	5	5	5.0	5
99	IVT-MB-NWPZ-1	PL-959	5	4	5	4.7	5
100	IVT-MB-NWPZ-2	DWRB-182 ©	4	5	4	4.3	5
100A	**Infector**	**Alfa-93**	**5**	**5**	**5**	**5.0**	**5**
101	IVT-MB-NWPZ-3	RD-3105	5	5	5	5.0	5
102	IVT-MB-NWPZ-4	DWRB-137 ©	5	5	5	5.0	5
103	IVT-MB-NWPZ-5	DWRB-2309	4	5	4	4.3	5
104	IVT-MB-NWPZ-6	RD-3087	5	5	5	5.0	5
105	IVT-MB-NWPZ-7	DWRUB-52 ©	5	5	4	4.7	5

106	IVT-MB-NWPZ-8	DWRB-2311	5	5	4	4.7	5
107	IVT-MB-NWPZ-9	PL-957	5	5	5	5.0	5
108	IVT-MB-NWPZ-10	RD-3085	5	5	5	5.0	5
109	IVT-MB-NWPZ-11	DWRB-2308	5	5	5	5.0	5
110	IVT-MB-NWPZ-12	BH-1056	5	5	4	4.7	5
111	IVT-MB-NWPZ-13	BH-1057	5	5	4	4.7	5
112	IVT-MB-NWPZ-14	BH-1055	5	5	5	5.0	5
113	IVT-MB-NWPZ-15	DWRB-2310	4	5	4	4.3	5
114	IVT-MB-NWPZ-16	RD-3106	5	5	5	5.0	5
115	IVT-MB-NWPZ-17	DWRB-2312	5	5	5	5.0	5
116	IVT-MB-NWPZ-18	RD-3107	5	5	5	5.0	5
117	IVT-MB-NWPZ-19	PL-958	5	5	5	5.0	5
118	IVT-MB-NWPZ-20	RD-2849 ©	5	5	5	5.0	5
119	IVT-MB-NWPZ-21	RD-3084	5	5	5	5.0	5
120	IVT-MB-NWPZ-22	RD-3086	5	5	5	5.0	5
120a	**Infector**	**Alfa-93**	**5**	**5**	**5**	**5.0**	**5**
121	IVT-MB-NWPZ-23	DWRB-2307	5	4	5	4.7	5
122	IVT-MB-NWPZ-24	UPB-1124	5	5	5	5.0	5
123	IVT-MB-NWPZ-25	UPB-1125	3	5	3	3.7	5
124	IVT-RF-NEPZ-1	RD-3100	5	5	5	5.0	5
125	IVT-RF-NEPZ-2	RD-3099	5	5	5	5.0	5
126	IVT-RF-NEPZ-3	RD-3094	5	5	5	5.0	5
127	IVT-RF-NEPZ-4	RD-3108	5	5	5	5.0	5
128	IVT-RF-NEPZ-5	KB-2231	NG	4	NG	4.0	4
129	IVT-RF-NEPZ-6	NDB-1833	5	5	5	5.0	5
130	IVT-RF-NEPZ-7	KB-2201	5	5	5	5.0	5
131	IVT-RF-NEPZ-8	RD-3097	5	5	5	5.0	5
132	IVT-RF-NEPZ-9	HUB-287	5	5	5	5.0	5
133	IVT-RF-NEPZ-10	HUB-288	5	5	5	5.0	5
134	IVT-RF-NEPZ-11	K-603©	5	5	4	4.7	5
135	IVT-RF-NEPZ-12	NDB-1821	4	5	5	4.7	5
136	IVT-RF-NEPZ-13	RD-3098	5	5	3	4.3	5
137	AVT-IVT-SST-1	RD-3110	3	5	4	4.0	5
138	AVT-IVT-SST-2	RD-2794 ©	4	5	4	4.3	5
139	AVT-IVT-SST-3	NDB-1173©	4	5	4	4.3	5
140	AVT-IVT-SST-4	BH-1061	4	5	5	4.7	5
140a	**Infector**	**Alfa-93**	**5**	**5**	**5**	**5.0**	**5**
141	AVT-IVT-SST-5	RD-2907©	5	5	5	5.0	5
142	AVT-IVT-SST-6	RD-3103	5	4	5	4.7	5
143	AVT-IVT-SST-7	RD-3109	5	5	5	5.0	5
144	AVT-IVT-SST-8	NDB-1829	5	5	5	5.0	5
145	AVT-IVT-SST-9	RD-3104	5	5	5	5.0	5
146	AVT-IVT-SST-10	RD-3102	5	5	5	5.0	5
147	AVT-IVT-SST-11	HUB-294	5	5	5	5.0	5
148	AVT-IVT-SST-12	RD-3111	5	5	5	5.0	5
149	AVT-IVT-SST-13	KB-2203	5	5	5	5.0	5
150	AVT-IVT-SST-14	RD-3101	5	5	5	5.0	5
151	AVT-IVT-SST-15	RD-3080	5	4	5	4.7	5
152	AVT-IVT-SST-16	HUB-293	5	NG	5	5.0	5
153	AVT-IVT-SST-17	KB-2031	4	5	4	4.3	5
154	AVT-IVT-SST-18	BH-1062	4	NG	4	4.0	4

#Aphid data from locations, Khudwani and Durgapura was not included due to low incidence of aphids.

Experiment 2: Management of aphids through foliar spray of new chemical molecules

Objective: The objective of conducting this experiment is to test the new molecules against aphids infesting barley and to find out the most effective insecticide against the pest

Methodology: The experiment was conducted during 2023-24 field season at three locations; Ludhiana, Karnal and Kanpur with eight treatments.

Five tillers were tagged from each plot and the experiment was replicated three times. The aphids were counted from these tagged plants before spray and after spray to know the efficacy of each treatment. The grain yield was recorded to know the preventable losses by these treatments.

Location: Ludhiana

The studies were conducted under irrigated conditions at Plant Breeding Research Farm, PAU, Ludhiana. The barley variety PL 807 was sown on 4th Nov.2023 in the plots of 6 rows of 6m long in a replicated trial. There were eight treatments including untreated check and each was replicated three times. For recording observations, five tillers were ear-marked in each plot and from these plants observations were

recorded 1 day before spray and then 1, 3, 7 and 15 days after spray.
Aphid population did not differ significantly among all treatments one day before treatment (Table 3.11). When observed one day after spray, pymetrozine 50 WG @ 120 g/ha (1.87 aphids/tiller) recorded the minimum aphid population and was at par with all other treatments and better than untreated control (25.63 aphids/tiller). Similar results were recorded 3 days after treatment however acetamiprid 20 SP recorded the lowest aphid population 7 days (1.49 aphids/earhead) and 15 days (1.72 aphids/tiller) after treatment.
Maximum Grain yield was recorded from pymetrozine 50 WG @ 120 g/ha treated plots (51.24 q/ha) and it is at par with all other pesticide treatments. However, all the foliar insecticidal treatments recorded higher grain yield than untreated check (46.84 q/ha) (Table 3.11).

Location: Karnal

An experiment on the management of aphids through foliar application of new bio-chemical molecules was conducted at Research farm of ICAR-IIWBR Karnal under irrigated conditions. There were seven treatments including untreated check and each was replicated three times. For recording observations, five tillers were ear-marked in each plot and from these plants observations were recorded 1 day before spray and then 1, 3, 7 and 15 days after spray.
Aphid population did not differ significantly among all treatments one day before treatment. When observed one day after spray, pymetrozine 50 WG @ 120 g/ha (1.38 aphids/tiller) recorded minimum aphids/tiller followed by pymetrozine 50 WG @ 100 g/ha (1.67 aphids/tiller) and was better than untreated control (12.08 aphids/tiller). Similar results were recorded thereafter with the lowest population being recorded in pymetrozine 50 WG @ 120 g/ha of 1.08, 0.92 and 0.76 aphids/tiller after 3, 7 and 15 days after treatment.
Grain yield (q/ha) obtained was maximum (47.01 q/ha) from pymetrozine 50 WG @ 120 g/ha treated plots followed by pymetrozine 50 WG @ 100 g/ha (46.82 q/ha) treated plots. However, all the foliar insecticidal treatments recorded higher grain yield than untreated check (32.04 q/ha) (Table 3.12).

Location: Kanpur

The experiment was conducted under the irrigated conditions at the research farm Nawabganj C.S.A. Univ., Kanpur. The barley variety K 551 was sown on 18.12.2023 in plots of 20 rows of 3m length. These were a total of 7 treatments including untreated check and each was replicated thrice. For recording the observation, five shoots were randomly selected in each plot and observations were recorded 24 hr before spray and thereafter at 1, 3, 7 and 15 days interval on these plants.
The number of aphids recorded 24 hours before spray did not differ significantly but after one day of application of insecticides, it was observed that pymetrozine 50 WG @ 120 g/ha
and pymetrozine 50 WG @ 100 g/ha spray after one day recorded 3.80 and 4.33 aphid population, respectively. After 3 and 7 days of application, these insecticides recorded the lowest population of 1.66 and 0.66, and 2.04 and 1.86 aphids/tiller, respectively. After 15 days after spray, there were no aphids recorded in all tested treatments.Grain yield q/ha was maximum (46.61 q/ha) in the treatment of the pymetrozine 50 WG @ 120 g/ha as compared to untreated control which recorded the lowest yield of 34.57 q/ha (Table 3.13).

Location: Vijapur

The number of aphids recorded 24 hours before spray did not differ significantly but after one day of application of insecticides, it was observed that Acetamiprid 20SP @100 gm recorded lowest aphids per tiller (5.20). Even after 3, 7 and 15 days, Acetamiprid 20SP @100 gm recorded the lowest number of aphids i.e.3.53, 1.20 and 1.06 aphids/tiller, respectively.
Grain yield q/ha was maximum (30.80 q/ha) in the treatment of Acetamiprid 20SP @ 100 gm as compared to untreated control which recorded the lowest yield of 22. 60 q/ha (Table 3.14).

Experiment 3: Survey and surveillance of insect-pests and their natural enemies in barley

A survey conducted in 2023–2024 determined the occurrence of insect pests and their natural enemies on barley crops in Punjab, Haryana, Rajasthan, and Uttar Pradesh. In most of the surveyed locations, aphid infestation remained below the economic threshold level during February. The aphid population began to rise in mid-February, reaching its highest peak in March, before gradually declining in late March and becoming very low by early April. Natural enemies, such as coccinellid beetle grubs and adults, syrphid flies, and chrysoperla, were found in most fields with aphid infestations. Coccinellid beetle numbers were low until early February, after which they increased, peaking in mid-March. Additionally, termite damage in barley fields was observed throughout the crop season, with its incidence ranging from low to moderate.

Table 3.11. Management of aphids through foliar application of new chemical molecules in barley during 2023-24 (Location: Ludhiana).

S. No.	Treatments	Dose ml or g / ha	Aphid population per earhead					Grain Yield (q/ha)
			Before spray	After spray				
			1 day	1 day	3 days	7 days	15 days	
1	Pymetrozine 50% WG	80 g	22.39	2.00	1.89	1.67	1.95	50.31
2	Pymetrozine 50% WG	100 g	22.48	1.91	1.77	1.60	1.79	50.62
3	Pymetrozine 50% WG	120 g	22.41	1.87	1.74	1.52	1.78	51.24
4	Thiamethoxam 25% WG	12.5 g	22.63	1.92	1.76	1.57	1.86	49.73
5	Imidacloprid 17.8 SL	100 ml	22.16	1.98	1.78	1.60	1.93	50.13
6	Acetamiprid 20SP	100 g	22.44	1.90	1.66	1.49	1.72	50.04
7	Untreated control	80 g	22.33	25.63	25.32	26.92	26.62	46.84
CD (p=0.05)			NS	0.47	0.37	0.28	0.23	1.47

***Figures within parentheses arc transformed means**

Date of sowing : 04.11.2023 Plot size : 7.5 m^2

Date of insecticidal application : 27.02.2024 Variety : PL 807

Date of harvest : 19.04.2024 Replications : Three

Table 3.12. Management of aphids through foliar application of new chemical molecules during 2023-24 (Location: Karnal)

S. N.	Treatments	Dose ml or g / ha	Aphid population per earhead					Grain Yield (q/ha)
			Before spray	After spray				
				1 day	3 days	7 days	15 days	
1	Pymetrozine 50% WG	80 g	15.03	1.74 (1.65)	1.23 (1.49)	1.15 (1.46)	0.83 (1.35)	46.50
2	Pymetrozine 50% WG	100 g	15.75	1.67 (1.63)	1.13 (1.45)	1.03 (1.42)	0.65 (1.28)	46.82
3	Pymetrozine 50% WG	120 g	15.20	1.38 (1.54)	1.08 (1.44)	0.92 (1.38)	0.76 (1.32)	47.01
4	Thiamethoxam 25% WG	12.5 g	15.99	1.70 (1.64)	1.58 (1.61)	1.08 (1.44)	1.02(1.42)	45.25
5	Imidacloprid 17.8 SL	100 ml	15.05	1.85 (1.68)	1.44 (1.56)	1.07 (1.43)	1.59 (1.60)	43.12
6	Acetamiprid 20SP	100 g	15.35	2.45 (1.86)	1.65 (1.63)	1.11(1.45)	1.90 (1.70)	44.32
7	Untreated control	-	15.27	12.08(3.61)	12.57 (3.68)	12.88(3.72)	13.08 (3.75)	32.04
CD (p=0.05)			NS	(0.78)	(0.87)	(0.89)	(0.74)	(2.89)

*Figures within parentheses arc transformed means

Date of sowing : 15-11-2023 Plot size : Six rows of six-meter length at 25 cm spacing

Date of insecticide application : 03-03-2024 Variety : DWRUB64

Date of harvest : 15-04-2024 Replication : Three

Table 3.13. Management of aphids through foliar application of new bio-chemical molecules during 2023-24 (Location: Kanpur).

S.N.	Treatments	Actual dose ml/g/ha	Aphid population per main shoot					Grain yield (q/ha)
			Before spray	After spray				
			1 day	1 day	3 days	7 days	15 days	
1.	Pymetrozine 50% WG	80 g	9.93	5.64(13.69)	3.07(9.98)	3.13(10.47)	0.00	40.83
2.	Pymetrozine 50% WG	100 g	10.46	4.33(11.97)	2.04(8.13)	1.86(7.71)	0.00	43.79
3.	Pymetrozine 50% WG	120 g	10.33	3.80(11.24)	1.66(7.27)	0.66(4.44)	0.00	46.61
4.	Thiamethoxam 25% WG	12.5 g	11.33	6.02(14.18)	3.10(10.14)	3.37(3.47)	0.00	40.20
5.	Imidacloprid 17.8% SL	100 ml	10.93	5.37(13.31)	2.93(9.81)	2.93(9.81)	0.00	42.44
6.	Acetamiprid 20 SP	100 g	11.13	4.02(11.54)	1.98(7.92)	1.66(7.27)	0.00	44.75
7.	Control	-	10.40	27.66(31.69)	41.77(40.22)	19.33(26.06)	0.00	34.57
S.Em +		NS	0626	0.546	0.608	--	0.296	
CD 5%		NS	1.950	1.701	1.894	--	0.922	

Date of sowing : 18.12.2023
Date of insecticidal application : 17.02.2024
Date of harvest : 06.04.2024
Design : R.B.D.
Plot size : 4 m x 4.5m = 18 Sqm
Variety : K1055 (Prakhar)
No. of rows/plot : 20
Replications : Three

Table 3.14. Management of aphids through foliar application of new chemical molecules during 2023-24 (Location:Vijapur).

Sr. N.	Treatments	Doses g or ml / ha	Aphid population per shoot					Grain yield q/ha
			Before spray	After spray				
				1 day	2 days	7 days	15 days	
1.	Pymetrozine 50% WG	160 g	48.66	15.53	7.66	2.86	2.26	25.66
2.	Pymetrozine 50% WG	200 g	51.13	10.40	7.46	2.93	2.00	28.20
3.	Pymetrozine 50% WG	240 g	46.60	11.73	7.20	4.20	1.60	28.73
4.	Thiamethoxam 25% WG	50 g	48.80	7.53	4.26	1.66	1.53	28.72
5.	Imidacloprid 17.8 SL	560 ml	50.66	5.40	3.60	3.46	1.33	30.00
6.	Acetamiprid 20SP	500 g	50.80	5.20	3.53	1.20	1.06	30.80
7.	Untreated Check	-	43.40	36.4	23.06	26.66	21.26	22.60

List of Entomology Cooperators in Barley Crop Protection (2023-24)

Entomology		
No.	**Scientist (s)**	**Centre**
1	Dr. Poonam Jasrotia	**Coordinating unit, IIWBR, Karnal**
2	Dr. Beant Singh	Ludhiana
3	Dr. J. Kumar	Kanpur
4	Mr. R. V. Thakkar	Vijapur
5	Dr. Shabir Hussain Wani	Khudwani,Srinagar
6	Dr. B.N.Sharma	Durgapura

RESOURCE MANAGEMENT

The varietal evaluation programme for higher productivity under different agronomic conditions with optimum input is of continuous nature under resource management programme and various centres of different zones are actively engaged in this evaluation. The priority researchable areas in barley agronomy includes input management under resource scarce conditions, fine-tuning of sowing dates under changing climatic conditions, investigations on dry/marginal lands, limited and brackish water resource, late sowing conditions, saline-alkali soils and resource poor farmers, malt barley under good management conditions and dual purpose barley in dry areas. In spite of the fact that the crop is being grown mostly on marginal and problematic lands, there is an increasing trend in the average grain productivity per unit area during recent years. This indicates the important contribution of the improved technologies developed recently. New plant type of malt barley, fertilizer responsiveness and use of disease resistant barley germplasm has broaden the scope of raising the production potential of this crop through agronomic research in near future. There is need to develop lodging resistant varieties as barley is prone to lodging under high input application. Input management for feed, fodder and malt barley for increased input use efficiency and higher profitability is also an area of concern.

The barley resource management group is involved in the evaluation of advanced barley genotypes and updating the package of practices under the "All India Coordinated Wheat and Barley Improvement Project". During 2023-24, the experiments were carried out at 12 locations.

In NHZ, no coordinated trial was constituted. In NWPZ, out of 4 proposed trials, all the trials were successfully conducted. In NEPZ, out of 05 proposed trials, all trials were successfully conducted. In CZ, out of 03 proposed trials, all the trials were conducted and one trial at Vijapur was rejected by monitoring team. The centres where the trials were not conducted or where the trials were rejected have been listed in the Table 4.1.

Table 4.1. Zone-wise details of the coordinated varietal evaluation trials.

Trial Series	Locations	Trials conducted	Trials not conducted		Rejected	
			Number	Centres	Number	Centres
North Western Plain Zone						
IR-TS-HL-DOS (Barley)	03	03	-	-	-	-
IR-SL- LON (Barley)	01	01	-	-	-	-
Total	**04**	**04**				
North Eastern Plain Zone						
IR-SL- LON (Barley)	02	02	-	-	-	-
IR-TS-FB- DOS (Barley)	03	03	-	-	-	-
Total	**05**	**05**				
Central Zone						
IR-TS-HL-DOS (Barley)	03	03	-	-	01	Vijapur
Total	**03**	**03**			**01**	
Grand Total	**12**	**12**			**01**	

The details of the special trials conducted in different zones are presented in table 4.2. In all, trials were proposed at 21 locations, out of which trials were conducted at 18 locations. The maximum numbers of special trials were conducted in NWPZ (09) followed by CZ (04), NHZ(03) and NEPZ (02).

Table 4.2. Zone-wise details of the special agronomic trials.

Trial Series	Locations	Trials conducted	Trials not conducted	
			Number	Centres
Northern Hill Zone				
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	02	02	-	-
SPL-6: Effect of seed rate and growth regulators on barley productivity	01	01	-	-
Total	**03**	**03**	-	-
North Western Plains Zone				
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	04	04	-	-
SPL-6: Effect of seed rate and growth regulators on barley productivity	06	05	01	Ludhiana

Total	**10**	**09**	**01**	
North Eastern Plains Zone				
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	04	02	02	Kalyani, Kanpur
Total	**04**	**02**	**02**	
Central Zone				
SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley	04	04	-	-
Total	**04**	**04**	**-**	
Grand Total	**21**	**18**	**03**	

Irrigated Timely Sown Hulless Barley

The performance of one hulless barley test entry DWRB 223 against three checks (PL 891, Karan 16 and NDB 943) was evaluated at three locations of NWPZ *i.e.* Durgapura, Karnal and Ludhiana under timely and late sown conditions. The perusal of pooled data in Fig. 4.1 revealed that there was a significant decline in yield from normal (46.78 q/ha) to late (29.12 q/ha) sown condition. This yield reduction was due to significant reduction in earhead/m^2, grains/earhead and thousand grain weight under late sown conditions. Yield decline in late sown condition was 37.7% as compared to timely sown condition. On average basis, the check variety Karan 16 (C) ranked first with mean yield of 43.64 q/ha and it was significantly superior to rest of the check varieties and test entry. The check variety Karan 16 was top yielder under both the timely and late sown conditions.

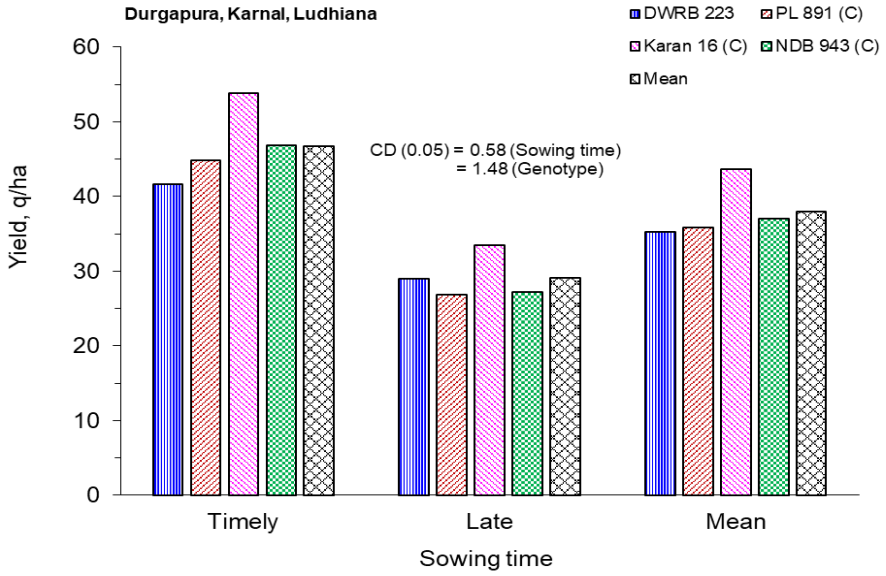


Fig. 4.1. Performance of hulless barley genotypes under timely sown conditions in NWPZ.

In irrigated timely sown trial of hulless barley, one test entry DWRB 223was evaluated against three check varieties (PL 891, Karnal 16 and NDB 943) at three locations of CZ *i.e.* Gwalior, Udaiur and Vijapur under timely and late sown conditions. The trial at Vijapur centre was rejected by the monitoring team. The perusal of pooled data of two centres presented in Fig. 4.2 revealed that shifting the sowing from timely conditions to late conditions reduced the grain yield by 8.8%. The mean grain yield of test entry DWRB 223 was significantly inferior to the best check Karan16. The maximum test weight of grains (37.16 gfor 1000 grains) was recorded for check entry PL 891, which was significantly higher than other genotypes.

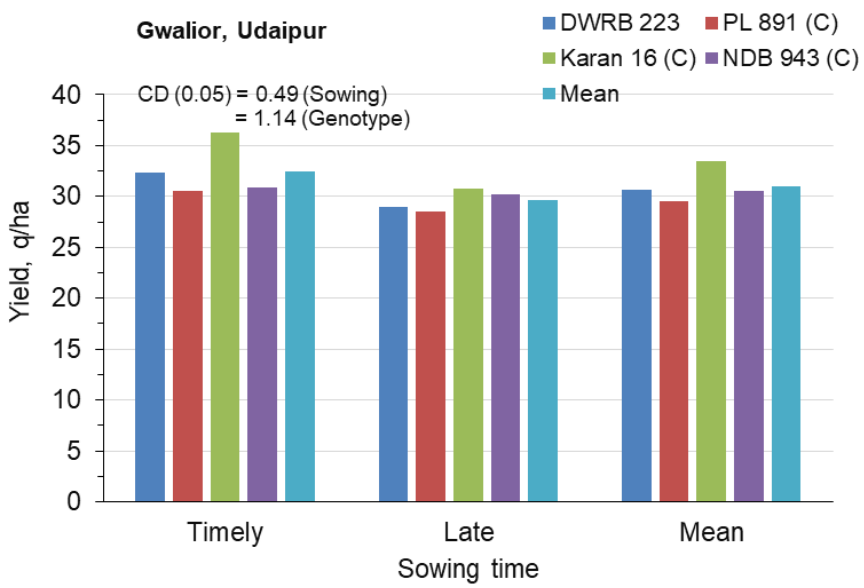


Fig. 4.2. Performance of hulless barley genotypes under timely sown conditions in CZ.

Genotypes response to different N levels under salinity conditions

In NWPZ, the performance of one barley test entry KB 2031 against three checks (RD 2794, RD 2907 and NDB 1173) was evaluated at two locations *i.e.* Hisar (CCS HAU) and Hisar (IIWBR) with three nitrogen levels (60, 75 and 90 kg/ha) under salinity conditions. The perusal of pooled data in Fig. 4.3 revealed that there was a significant increase in yield from 60 kg N/ha (36.19 q/ha) to 90 kg N/ha (42.48 q/ha). This yield increase was due to significant increase in earhead/m^2 under higher N levels. The differences among genotypes were non-significant and on average basis, the check variety NDB 1173 produced the numerically highest yield and it was followed by test entry KB 2031.

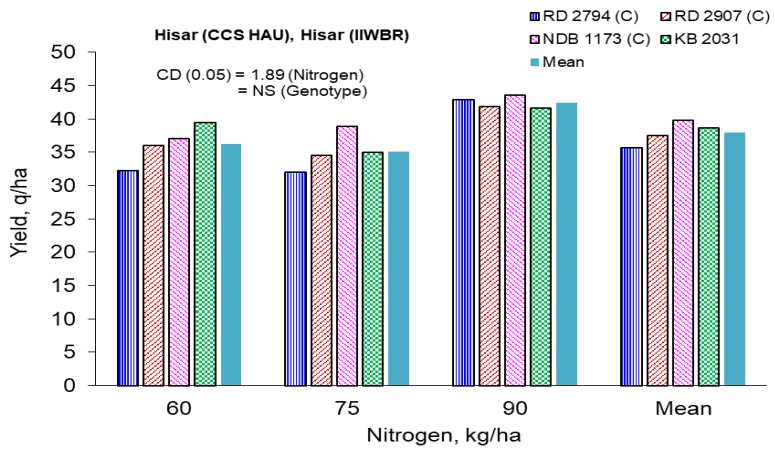


Fig. 4.3 Genotypes response to different N levels under salinity conditions in NWPZ.

In NEPZ, one test entry of feed barley KB 2031 was evaluated with different nitrogen levels against three check varieties*viz.* RD 2794(C), RD 2907(C) and NDB 1173 (C) at two locations (Ayodhya and Kanpur) under salinity conditions. Under salinity condition, yield increased significantly with increase in nitrogen doses on mean basis and yield increase was 10.37% when N dose was increased from 60 kg/ha to 90 kg/ha (Fig. 4.4). The yield increase was due to significantly higher 1000 grains weight. On mean basis, the test entry KB 2031 was the highest yielder (34.76 q ha^{-1}) and recorded significantly higher grain yield compared to all check varieties.

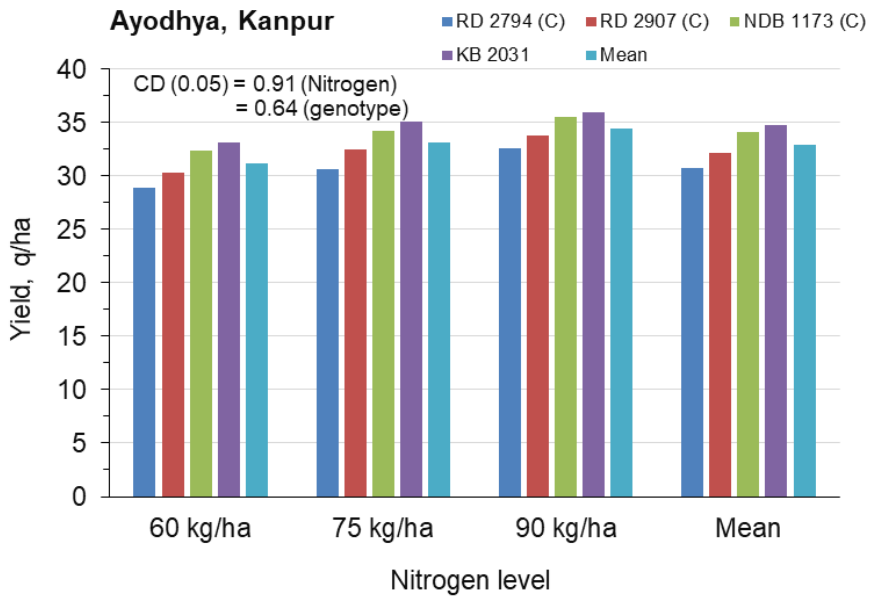


Fig. 4.4. Genotypes response to different N levels under salinity conditions in NEPZ.

Irrigated Timely Sown Feed Barley

One test entry of feed barley UPB 1106 was evaluated against three checks *viz.* HUB 113(C), BH 946(C) and DWRB 137(C) at three locations (Ayodhya, Kanpur and Ranchi) under timely (11th November to 20th November) and late (6th December to 15th December) sown conditions. Timely sowing registered higher yield of all genotypes compared to late sown conditions and on mean basis, yield declined by 14.84% when sowing was delayed from timely to late sowing condition (Fig. 4.5). The yield decline was due to significant reduction in effective tillers under late sown condition as compared to timely sown condition. On mean basis, the check variety HUB 113 was the highest yielder (35.06 q/ha), which was significantly at par to DWRB 137 (C) and UPB 1106 but significantly higher than BH 946 (C). Under timely sown conditions, yield of HUB 113 (C) was significantly higher than other genotypes.

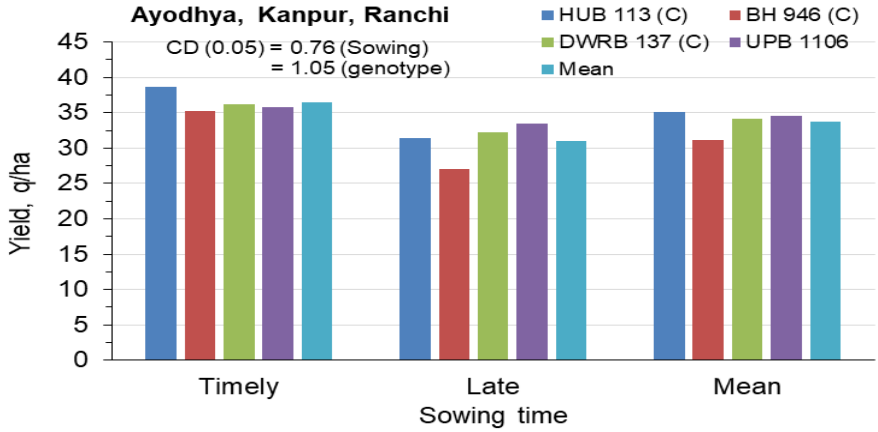


Fig. 4.5. Performance of feed barley under timely sowing conditions in NEPZ.

SPL-5: Efficacy of herbicides against broad-leaved weed flora of barley

In NHZ, this trial was conducted at Khudwani and Malan centres. The data presented in Fig. 4.6(a) and Fig. 4.6(b) revealed that the maximum grain yield of 34.7 q/ha was recorded under weed free condition possibly due to proper utilization of moisture, light, nutrients and space by the crop plants.Among herbicide treatments, the maximum yield of 31.2 q/ha was recorded with metsulfuron methyl 20 WG + surfactant at 4 g *a.i.*/ha+ 0.2% S application.In terms of weed control, the minimum weed dry weight (5.16 g/m^2) at 90 DAS was recorded with tank-mix application of metsulfuron + carfentrazone + surfactant at 25 (5 + 20) g *a.i.*/ha + 0.2% S. Weed dry weight at 90 DAS under all herbicide treatments except 2,4-D-Na 500 g *a.i.*/ha was statistically similar. In the treatment of 2,4-D-

Na 500 g *a.i.*/ha, weed dry weight of8.37 g/m^2 was recorded at 90 DAS which was significantly higher than those under halauxifen-methyl 1.21% + fluroxypyr 38.9% EC at 200.6 (6.1+194.5) g *a.i.*/ha, metsulfuron

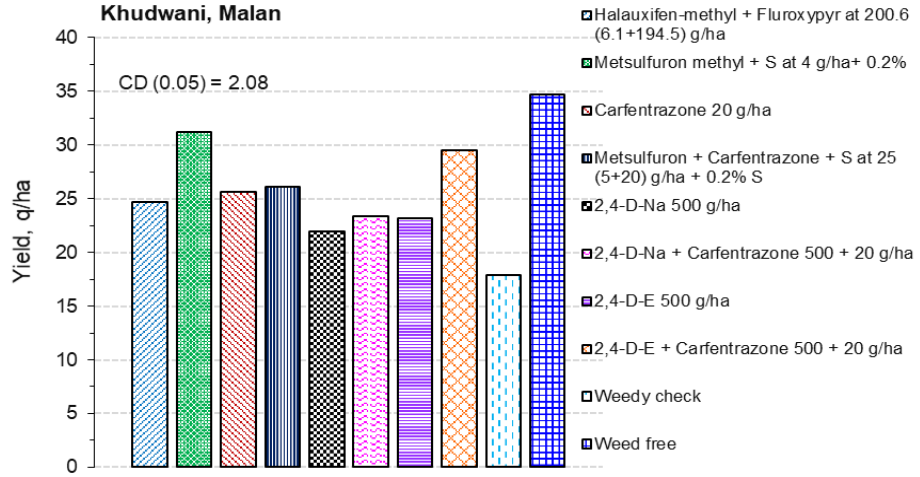


Fig. 4.6(a) Grain yield of barley under different herbicides application in NHZ

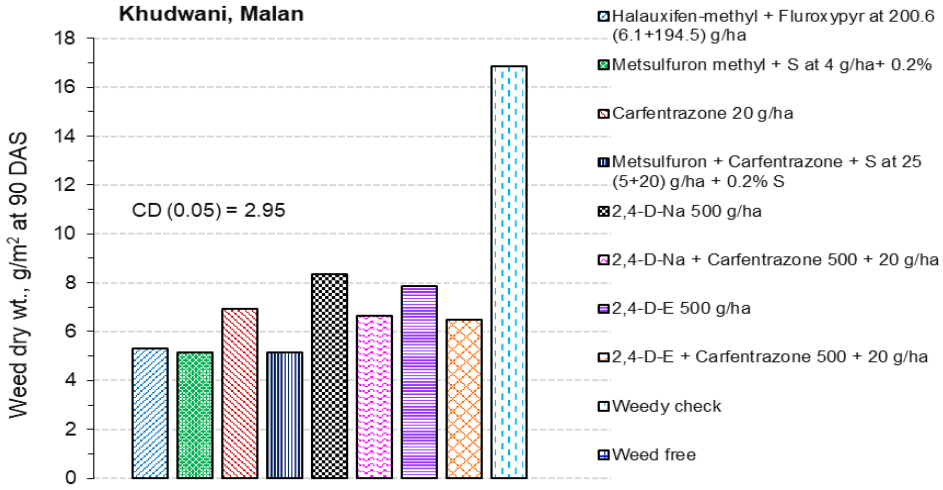


Fig.4.6(b). Efficacy of herbicides against diverse weed flora of barley in NHZ

Methyl 20 WG + surfactant at 4 g *a.i.*/ha+ 0.2% S and metsulfuron + carfentrazone + surfactant at 25 (5+20) g *a.i.*/ha + 0.2% S.

In NWPZ, this trial was conducted at four centres namely Agra, Durgapura, Hisar and Karnal.Theanalysisofpooled data as shownin Fig. 4.7(a) and Fig. 4.7(b) revealed thatweed control treatments produced significant effect on grain yield. The highest yield was obtained under weed free situation (54.33 q/ha) which might be attributed to higher and better use of moisture, light, nutrients and space by the crop plants, whereas the minimum yield was recorded under weedy check (37.59 q/ha) due to strong weed competition.

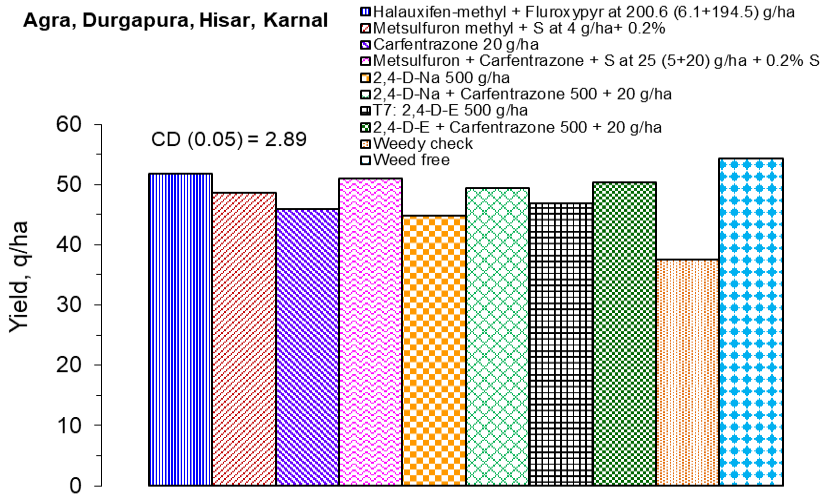


Fig. 4.7(a) Grain yield of barley under different herbicides application in NWPZ.

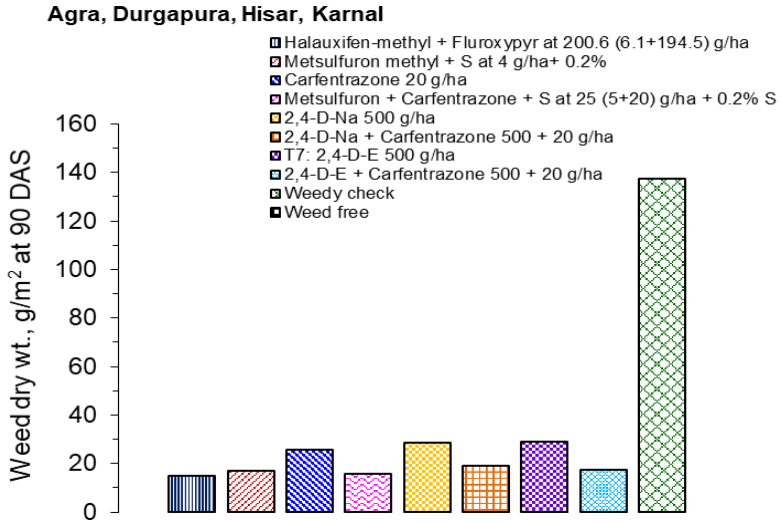


Fig. 4.7(b) Efficacy of herbicides against diverse weed flora of barley in NWPZ.

Among herbicides, ready mixture of halauxifen-methyl + fluroxypyr at 200.6 (6.1+194.5) g/ha showed the least number of weed count of 12.8/m^2 and weed dry weight of 14.9 g/m^2 at 90 DAS, whereas the maximum values of these parameters were observed in weedy check with respective values of 62.8/m^2 and 137.2 g/m^2 at 90 DAS. Carfentrazone tank mixed with either metsulfuron or 2, 4-D Na or 2, 4-D-E also effectively controlled the broadleaved weeds and as a result yield improved as compared to their solo application.

In NEPZ, this trial was conducted at two locations (Ayodhya and Ranchi). The analysis of pooled data as shown in Fig. 4.8(a) and Fig4.8(b) revealed that weed control treatments produced significant effect on grain yield. The highest yield was obtained under weed free situation (34.51 q/ha) which might be attributed to higher and better use of moisture, light,

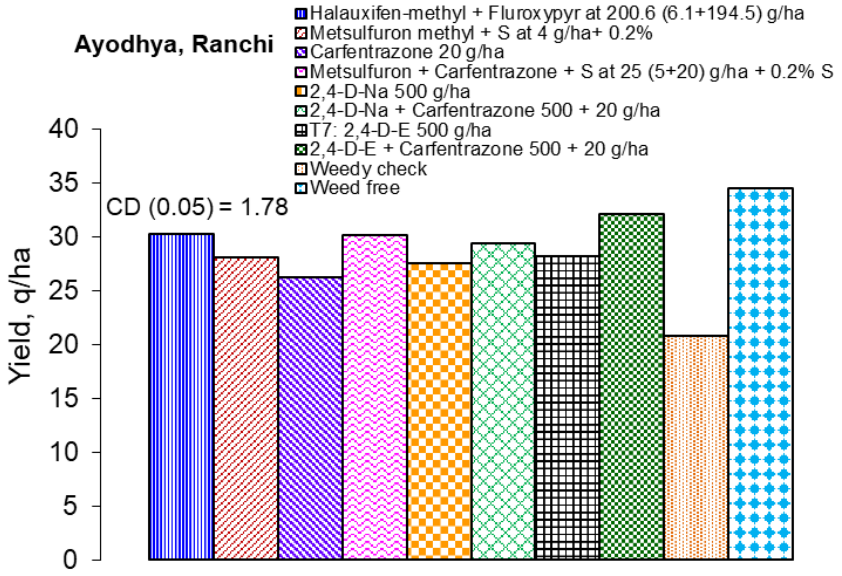


Fig. 4.8(a) Grain yield of barley under different herbicides application in NEPZ.

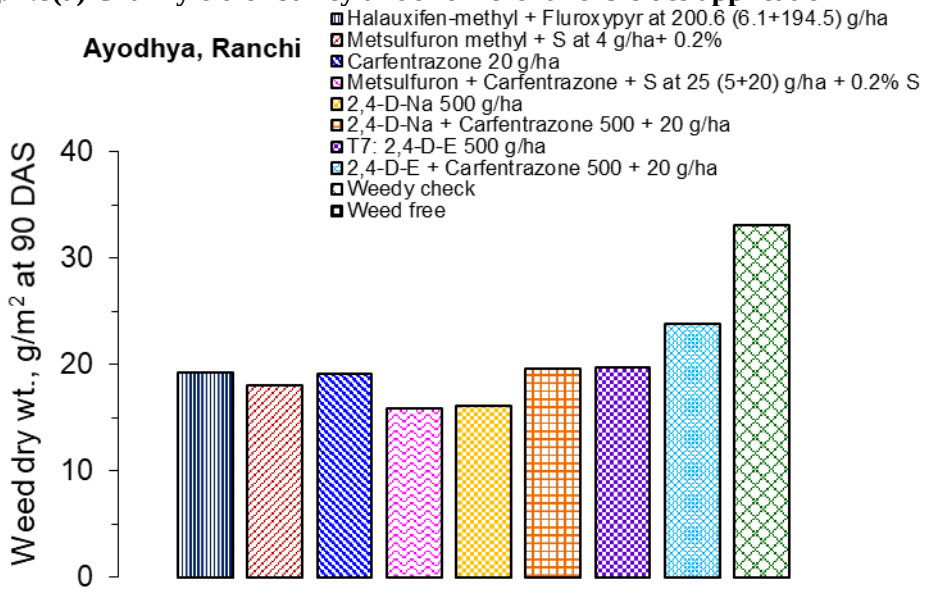


Fig. 4.8(b) Efficacy of herbicides against diverse weed flora of barley in NEPZ.

Nutrients and space by the crop plants, whereas the minimum yield was recorded under weedy check (20.73 q/ha) due to strong weed competition. Among herbicides, metsulfuron + carfentrazone + S at 25 (5+20) g/ha + 0.2% S recorded the least number of weed count (7.9/m^2) and weed dry weight (9.2 g/m^2) at 90 DAS, whereas the maximum values of these parameters were observed in weedy check with respective values of 13.4/m^2 and 17.7 g/m^2 at 90 DAS. All the herbicide applied alone or in combination reduced the weed population and weed dry weight significantly compared to weedy check.

In CZ, this trial was conducted at four locations (Gwalior, Jabalpur, Udaipur and Vijapur). The analysis of pooled data as shown in Fig. 4.9(a) and Fig. 4.9(b) revealed that weed control treatments produced significant effect on grain yield. The highest yield was obtained under weed free situation (43.98 q/ha) which might be attributed to higher and

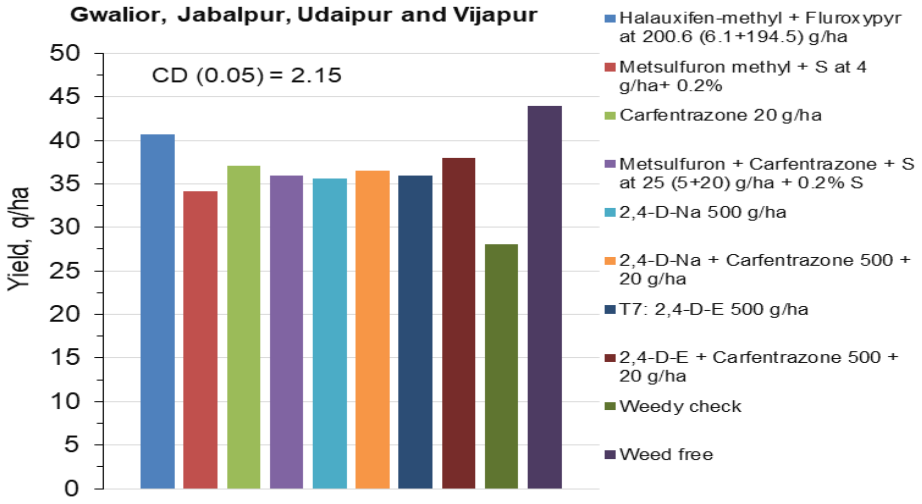


Fig. 4.9(a) Grain yield of barley under different herbicides application in CZ.

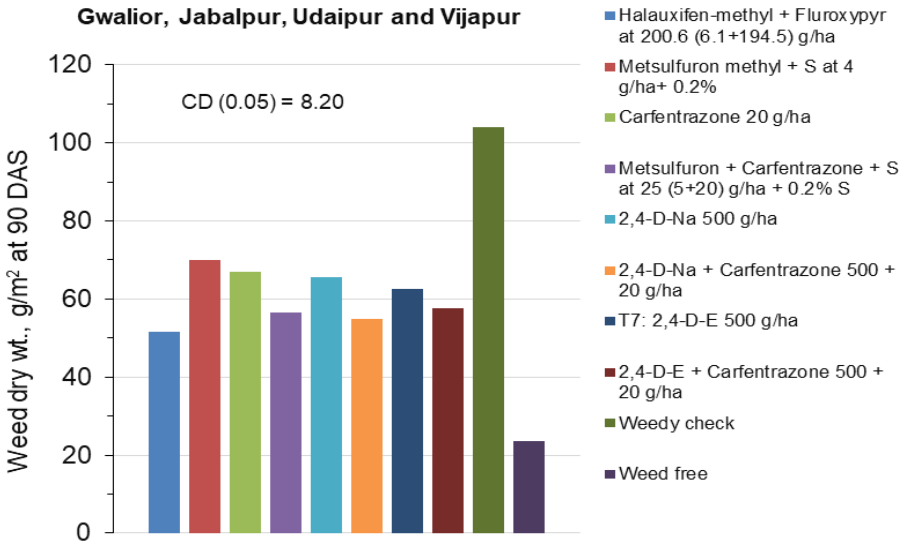


Fig. 4.9(b) Efficacy of herbicides against diverse weed flora of barley in CZ.

Better use of moisture, light, nutrients and space by the crop plants, whereas the minimum yield was recorded under weedy check (28.08 q/ha) due to strong weed competition. Among herbicides, halauxifen-methyl + fluroxypyr at 200.6 (6.1+194.5) g/ha recorded the least number of weed count (29.6/m^2) and weed dry weight (51.7 g/m^2) at 90 DAS,whereas the maximum values of these parameters were observed in weedy check with respective values of 80.2/m^2 and 104.1 g/m^2 at 90 DAS. All the herbicide applied alone or in combination reduced the weed population and weed dry weight significantly compared to weedy check.

SPL-6: Effect of seed rate and growth regulators on barley productivity

In NHZ, this trial was conducted at Almora centre. The data presented in Fig. 4.10 showed that barley yield numerically increased with seed rate without any significant difference. The growth regulator application showed a significant effect on grain yield. The maximum mean grain yield of 35.1 q/ha was recorded with the treatment of drum rolling at 30 and 45 DAS followed by grain yield of 33.9 q/ha withtwo sprays as tank-mix of chlormequat chloride (Lihocin) @ 0.2% + tebuconazole (Folicur 430SC) @0.1% of commercial product dose at the first node and flag leaf. The grain yield with drum rolling (30 and 45 DAS) was significantly higher than all other treatments except the treatment of tank-mix application of chlormequat chloride + tebuconazole. The grain yield of barley increased by 8.6 and 5% with drum rolling and tank-mix application of chlormequat chloride + tebuconazole, respectively, over control (water spray).

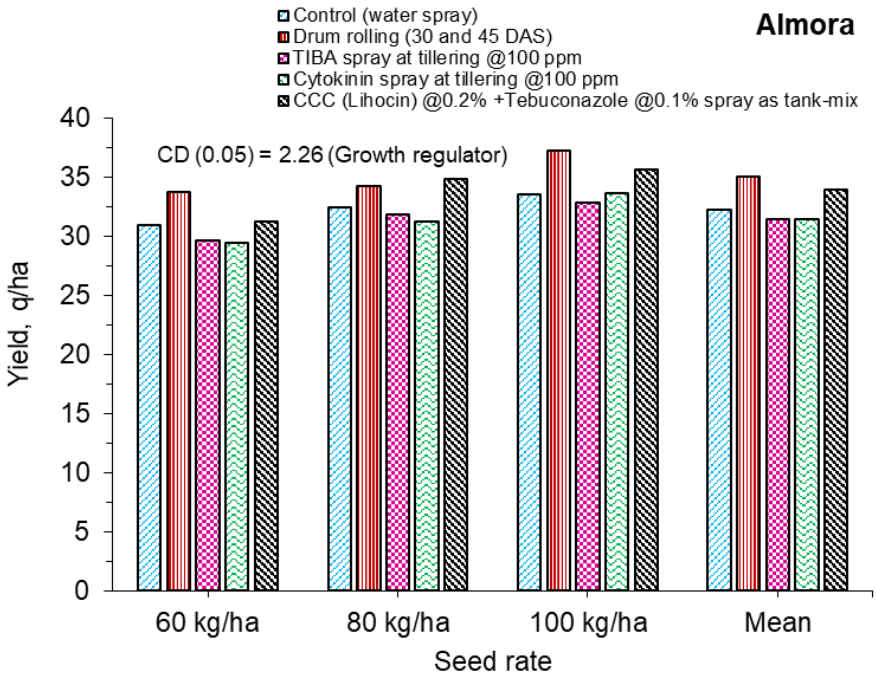


Fig. 4.10. Effect of seed rate and PGRs application on barley productivity in NHZ.

In NWPZ, this trial was conducted at five centres (Agra, Durgapura, Gurdaspur, Hisar and Karnal). The pooled analysis of data presented in Fig. 4.11 revealed that the maximum mean grain yield (49.77 q/ha) was produced under the treatment of 100 kg/ha seed rate and it was significantly superior to both the lower seed rates (60 and 80 kg/ha). The effect of growth regulators was also significant. Among growth regulators treatments, TIBA-100 ppm produced the maximum grain yield (47.68 q/ha) and it was statistically at par with CCC + tebuconazole- 0.2% +0.1%- 2 sprays. All the three growth regulators treatments were significantly superior to drum rolling and control treatments.

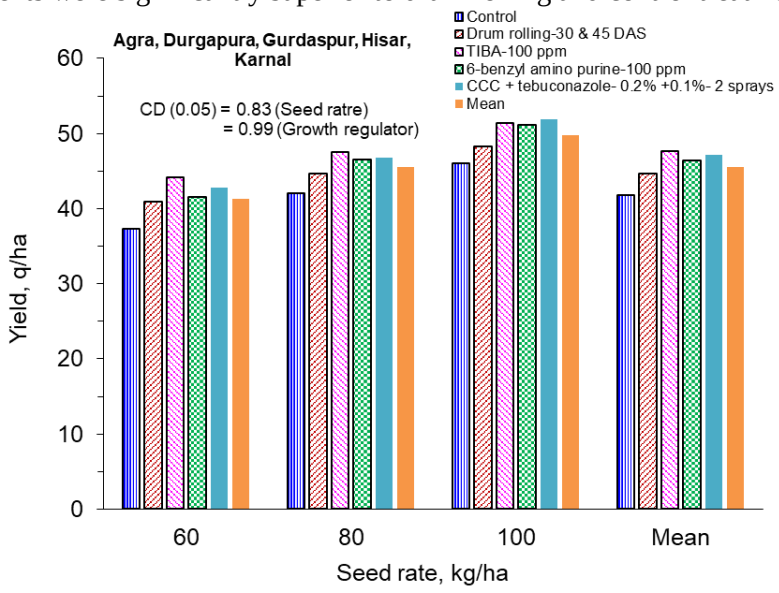


Fig. 4.11. Effect of seed rate and PGRs application on barley productivity in NWPZ.

Resource Management group of AICRP Wheat and Barley are engaged in agronomic evaluation of new genotypes and updating the package of practices under different agro climatic conditions. Input management *viz.* Nutrients under salinity conditions, sowing timings in different zones under changing climatic conditions, and other crop management practices for yield maximization are the priority researchable areas in barley agronomy. In spite of the fact that the crop is being grown mostly on fringe and problematic lands, the productivity increased during the recent years and the newly developed improved technologies contributes in the increased productivity.

Irrigated Timely Sown Hulless Barley

The performance of one hulless barley test entry DWRB 223 against three checks (PL 891, Karan 16 and NDB 943) was evaluated at three locations of NWPZ *i.e.* Durgapura, Karnal and Ludhiana under timely and late sown conditions. The timely sowing time was from 6th to 15th November and late sowing was from 1st to 10th December. The trial was laid out in a split plot design with sowing time in main plots and genotypes in sub-plots with three replications. The sowing was done using the normalized (adjusted considering 1000 grains weight of 38 g) seed rate of 100 kg/ha at a row-to-row spacing of 23 cm. Nitrogen was applied in two splits (half at sowing and remaining half nitrogen at first irrigation), whereas full phosphorus and potash were applied as basal.

The centrewise yield and zonal mean yield are given in Table 4.3. The pooled data are presented in Table 4.4. The perusal of pooled data in Table 7.1 and 7.2 revealed that there was a significant decline in yield from normal (46.78 q/ha) to late (29.12 q/ha) sown condition. This yield reduction was due to significant reduction in earhead/m^2, grains/earhead and thousand grains weight under late sown conditions. Yield decline in late sown condition was 37.7% as compared to timely sown condition. On average basis, the check variety Karan 16 (C) ranked first with a mean yield of 43.64 q/ha and it was significantly superior to rest of the check varieties and test entry. The check variety Karan 16 was top yielder under both the timely and late sown conditions. On mean basis, check variety Karan 16 recorded the maximum earhead density (325/m^2) and grains/earhead (35.33). Whereas PL 891 (C) recorded the bolder grains (1000 grains weight 44.14 g). The interaction effect was significant for yield.

In CZ, this trial was conducted at three locations (Gwalior, Udaipur and Vijapur). However, trial at Vijapur centre was rejected by the monitoring team. Therefore, data of two centres (Gwalior and Udaipur) were considered for analysis and pool. The centrewise yield and Zonal mean yield are given in Table 4.5. The pooled data are presented in Table 4.6. The perusal of pooled data in Table 4.9 and 4.10 revealed that there was a significant decline in yield from normal (32.48 q/ha) to late (29.61 q/ha) sown condition, causing a yield reduction of 8.8%. This yield reduction was due to significant

Table 4.3. North Western Plain Zone		**IR-TS-HL-DOS**	**Centrewise**	**Yield, q/ha**	**2023-24**
Sowing Time	Genotype	**Durgapura**	**Karnal**	**Ludhiana**	**Zonal mean**
Timely	DWRB 223	43.47	37.82	43.50	41.59
	PL 891 (C)	52.39	37.87	44.30	44.85
	Karan 16 (C)	64.33	39.34	57.75	53.81
	NDB 943 (C)	58.70	32.07	49.83	46.87
	Mean	54.72	36.77	48.84	46.78
Late	DWRB 223	25.30	34.38	27.17	28.95
	PL 891 (C)	22.77	34.14	23.71	26.88
	Karan 16 (C)	26.94	35.43	38.04	33.47
	NDB 943 (C)	20.20	29.50	31.92	27.21
	Mean	23.80	33.36	30.21	29.12
Mean	DWRB 223	34.38	36.10	35.33	35.27
	PL 891 (C)	37.58	36.01	34.00	35.86
	Karan 16 (C)	45.63	37.38	47.90	43.64
	NDB 943 (C)	39.45	30.79	40.87	37.04
	Mean	39.26	35.07	39.53	37.95
CD (0.05)	Sowing (A)	1.51	0.81	1.98	0.58
	Genotype (B)	3.19	1.57	3.08	1.48
	B within A	4.50	2.22	4.36	2.10
	A within B	4.01	1.98	3.96	2.16
Date of Sowing:	Timely	09.11.2023	12.11.2023	15.11.2023	
	Late	07.12.2023	10.12.2023	10.12.2023	
Date of Harvesting:	Timely	04.03.2024	15.04.2024	12.04.2024	
	Late	18.03.2024	22.04.2024	12.04.2024	

reduction in earhead/m^2 under late sown conditions. On average basis, the check variety Karan 16 (C) ranked first with a mean yield of 33.50 q/ha and it was significantly superior to rest of the check varieties and test entry. The check variety Karan 16 was top yielder under both the timely and late sown conditions. On mean basis check Karan 16 recorded the maximum earhead density (327/m^2). Whereas PL 891 (C) recorded the bolder grains (1000 grain weight 37.16 g). The interaction effect was significant for yield.

Table 4.4. North Western Plain Zone			**IR-TS-HL-DOS**		**Pooled**	**2023-24**
Genotype	**Date of Sowing**				**Mean**	**Rk**
	Timely	Rk	Late	Rk		
Yield, q/ha						
DWRB 223	41.59	4	28.95	2	35.27	4
PL 891 (C)	44.85	3	26.88	4	35.86	3
Karan 16 (C)	53.81	1	33.47	1	43.64	1
NDB 943 (C)	46.87	2	27.21	3	37.04	2
Mean	46.78		29.12		37.95	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	0.58		1.48		2.10	2.16
Earhead/sq.m.						
DWRB 223	324.70	4	266.05	3	295.37	3
PL 891 (C)	335.08	3	270.83	2	302.95	2
Karan 16 (C)	367.97	1	282.43	1	325.20	1
NDB 943 (C)	338.17	2	249.70	4	293.93	4
Mean	341.48		267.25		304.36	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	4.71		8.46		11.97	12.71
Grains/earhead						
DWRB 223	31.91	3	29.37	3	30.64	3
PL 891 (C)	29.57	4	23.73	4	26.65	4
Karan 16 (C)	39.07	1	31.59	1	35.33	1
NDB 943 (C)	33.70	2	30.84	2	32.27	2
Mean	33.56		28.88		31.22	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	1.31		1.81		NS	2.82
1000 grains weight, g						
DWRB 223	40.67	3	38.23	3	39.45	2
PL 891 (C)	45.32	1	42.96	1	44.14	1
Karan 16 (C)	38.97	4	38.63	2	38.80	4
NDB 943 (C)	41.52	2	37.35	4	39.43	3
Mean	41.62		39.29		40.45	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	1.37		1.13		NS	2.03
Centres: Durgapura, Karnal, Ludhiana						

Table 4.5. Central Zone IR-TS-HL-DOS		**Centrewise Yield, q/ha**		**2023-24**
Sowing time	**Genotype**	**Gwalior**	**Udaipur**	**Zonal mean**
Timely	DWRB 223	21.52	43.12	32.32
	PL 891 (C)	17.45	43.62	30.53
	Karan 16 (C)	22.97	49.52	36.25
	NDB 943 (C)	21.18	40.48	30.83
	Mean	20.78	44.19	32.48
Late	DWRB 223	20.79	37.16	28.98
	PL 891 (C)	16.81	40.12	28.47
	Karan 16 (C)	16.56	44.93	30.75
	NDB 943 (C)	21.54	38.97	30.25
	Mean	18.93	40.30	29.61
Mean	DWRB 223	21.15	40.14	30.65
	PL 891 (C)	17.13	41.87	29.50
	Karan 16 (C)	19.77	47.23	33.50
	NDB 943 (C)	21.36	39.72	30.54
	Mean	19.85	42.24	31.05
CD (0.05)	Sowing time (A)	1.04	0.87	0.49
	Genotype (B)	1.15	2.08	1.14
	B within A	1.63	2.94	1.61
	A within B	1.54	2.60	1.79
Date of Sowing:	Timely	11.11.2023	06.11.2023	
	Late	09.12.2023	01.12.2023	
Date of Harvesting:	Timely	09.04.2024	05.03.2024	
	Late	12.04.2024	18.03.2024	

Table 4.6. Central Zone			IR-TS-HL-DOS		Pooled	2023-24
Entry	Date of Sowing				Mean	Rk
	Timely	Rk	Late	Rk		
			Yield, q/ha			
DWRB 223	32.32	2	28.98	3	30.65	2
PL 891 (C)	30.53	4	28.47	4	29.50	4
Karan 16 (C)	36.25	1	30.75	1	33.50	1
NDB 943 (C)	30.83	3	30.25	2	30.54	3
Mean	32.48		29.61		31.05	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	0.49		1.14		1.61	1.79
			Earhead/sqm			
DWRB 223	328	2	300	3	314	2
PL 891 (C)	311	4	286	4	299	4
Karan 16 (C)	345	1	309	1	327	1
NDB 943 (C)	323	3	302	2	313	3
Mean	327		299		313	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	NS		13.05		NS	27.22
			Grains/Earhead			
DWRB 223	27.42	2	27.47	3	27.44	2
PL 891 (C)	25.20	4	26.64	4	25.92	4
Karan 16 (C)	28.06	1	28.20	1	28.13	1
NDB 943 (C)	25.70	3	28.07	2	26.89	3
Mean	26.60		27.59		27.10	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	N.S.		N.S.		N.S.	N.S.
1000 Grains Weight, g						
DWRB 223	35.88	4	34.89	3	35.39	4
PL 891 (C)	37.88	1	36.43	1	37.16	1
Karan 16 (C)	36.50	2	34.40	4	35.45	3
NDB 943 (C)	36.43	3	35.22	2	35.82	2
Mean	36.67		35.23		35.95	
	Sowing (A)		Genotype (B)		B within A	A within B
CD (0.05)	N.S.		1.15		N.S.	2.11
Centres:	Gwalior, Udaipur					

Entries response to different N levels under salinity conditions

The performance of one barley test entry KB 2031 against three checks (RD 2794, RD 2907 and NDB 1173) was evaluated at two locations in NWPZ *i.e.* Hisar (CCS HAU) and Hisar (IIWBR) and two locations of NEPZ (Ayodhya and Kanpur) with three nitrogen levels (60, 75 and 90 kg/ha) under salinity conditions. The trial was laid out in a split plot design with N levels in main plots and genotypes in sub-plots with three replications. The sowing was done using the normalized (adjusted considering 1000 grains weight of 38 g) seed rate of 100 kg/ha at a row-to-row spacing of 23 cm. Nitrogen was applied in two splits (half at sowing and remaining half nitrogen at first irrigation), whereas full phosphorus (60 kg/ha) and potash (20 kg/ha) were applied as basal.

In NWPZ, this trial was conducted at two centres namely Hisar (CCS HAU) and Hisar (IIWBR). The centre wise yield and zonal mean yield are given in Table 4.7. The pooled data are presented in Table 4.8. The perusal of pooled data in Table 7.5 and 7.6 revealed that there was a significant increase in yield with increase in N dose from 60 kg/ha (36.19 q/ha) to 90 kg/ha (42.48 q/ha). This yield increase was due to significant increase in earhead/m^2 under higher N levels. The differences among genotypes were non-significant and on average basis, check variety NDB 1173 produced the numerically highest yield followed by test entry KB 2031. Among genotypes, test entry KB 2031 produced the boldest grains with 1000 grains weight of 47.49 g.

Table 4.7. North Western Plain Zone		IR-SL-LON	Centrewise Yield, q/ha	2023-24
Nitrogen	Genotype	Hisar (CCS HAU)	Hisar (IIWBR)	Zonal mean
60 kg/ha	RD 2794 (C)	31.08	33.33	32.21
	RD 2907 (C)	32.63	39.33	35.98
	NDB 1173 (C)	36.17	38.00	37.09
	KB 2031	34.35	44.67	39.51
	Mean	33.56	38.83	36.19
75 kg/ha	RD 2794 (C)	34.29	29.67	31.98
	RD 2907 (C)	35.18	33.93	34.56
	NDB 1173 (C)	37.85	39.83	38.84

	KB 2031	35.94	34.00	34.97
	Mean	35.81	34.36	35.09
90 kg/ha	RD 2794 (C)	36.79	49.00	42.90
	RD 2907 (C)	36.65	47.00	41.82
	NDB 1173 (C)	40.08	47.00	43.54
	KB 2031	37.29	46.00	41.64
	Mean	37.70	47.25	42.48
Mean	RD 2794 (C)	34.05	37.33	35.69
	RD 2907 (C)	34.82	40.09	37.45
	NDB 1173 (C)	38.03	41.61	39.82
	KB 2031	35.86	41.56	38.71
	Mean	35.69	40.15	37.92
CD (0.05)	Nitrogen (A)	2.97	4.79	1.89
	Genotype (B)	2.65	5.68	NS
	B within A	4.60	9.83	NS
	A within B	4.57	9.25	4.52
Date of Sowing:		15.11.2023	24.11.2023	
Date of Harvesting:		12.04.2024	27.04.2024	

Table 4.8. North Western Plain Zone				**IR-SL-LON**		**Pooled**	**2023-24**
Entry	**Nitrogen Levels, kg/ha**					**Mean**	**Rk**
	60	**Rk**	**75**	**Rk**	**90**	**Rk**	
	Yield, q/ha						
RD 2794 (C)	32.21	4	31.98	4	42.90	2	35.69	4
RD 2907 (C)	35.98	3	34.56	3	41.82	3	37.45	3
NDB 1173 (C)	37.09	2	38.84	1	43.54	1	39.82	1
KB 2031	39.51	1	34.97	2	41.64	4	38.71	2
Mean	36.19		35.09		42.48		37.92	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	1.89		NS		NS		4.52	
	Earhead/sq.m.						
RD 2794 (C)	380	4	416	2	443	1	413	3
RD 2907 (C)	396	3	415	3	433	2	415	2
NDB 1173 (C)	428	1	423	1	411	4	420	1
KB 2031	396	2	383	4	433	3	404	4
Mean	400		409		430		413	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	13.89		NS		27.44		29.14	
	Grains/earhead						
RD 2794 (C)	20.94	1	18.75	3	20.75	3	20.15	3
RD 2907 (C)	19.90	3	18.26	4	20.92	2	19.69	4
NDB 1173 (C)	19.86	4	22.96	1	24.75	1	22.53	1
KB 2031	20.91	2	19.76	2	20.15	4	20.27	2
Mean	20.40		19.93		21.64		20.66	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	NS		1.62		NS		NS	
	1000 grains weight, g						
RD 2794 (C)	40.79	4	41.19	3	46.37	3	42.78	3
RD 2907 (C)	46.08	2	45.90	2	46.67	2	46.22	2
NDB 1173 (C)	43.99	3	40.37	4	43.27	4	42.54	4
KB 2031	47.51	1	46.78	1	48.18	1	47.49	1
Mean	44.59		43.56		46.12		44.76	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	NS		1.59		NS		3.05	
Centres: Hisar (CCS HAU) and Hisar (IIWBR)								

In NEPZ, this trial was conducted at two centres (Ayodhya and Kanpur). The centre wise yield and zonal mean yield are given in Table 4.9. The pooled data are presented in Table 4.10. Under salinity condition, yield increased significantly with increase in nitrogen doses on mean basis and yield increase was 10.37% when N dose was increased from 60 kg/ha to 90 kg/ha. The yield increase was due to significantly higher 1000 grains weight. On mean basis, the test entry KB 2031 was the highest yielder (34.76 q ha^{-1}) and recorded significantly higher grain yield compared to all check varieties. The earheads/m^2were statistically at par among all the genotypes. Significantly maximum grains/earhead were also observed in test entry KB 2031 (23.52 grains/earhead) followed by check variety NDB 1173 (21.80 grains/earhead), RD 2794(20.13 grains/earhead) and RD 2907 (20.09 grains/earhead). The check variety RD 2907 produced the boldest grains having the mean 1000 grains weight of 41.91 g.

Table 4.9. North Eastern Plain Zone		IR-SL- LON	Centrewise Yield, q/ha	2023-24
Nitrogen Levels	**Genotype**	**Ayodhya**	**Kanpur**	**Zonal mean**
60 kg/ha	RD 2794 (C)	31.1	26.8	28.95
	RD 2907 (C)	32.45	28.3	30.38
	NDB 1173 (C)	35.07	29.8	32.43
	KB 2031	33.80	32.6	33.20
	Mean	33.10	29.38	31.24
75 kg/ha	RD 2794 (C)	32.87	28.4	30.63
	RD 2907 (C)	34.12	30.8	32.46
	NDB 1173 (C)	37.30	31.2	34.25
	KB 2031	35.75	34.4	35.08
	Mean	35.01	31.2	33.10
90 kg/ha	RD 2794 (C)	34.00	31.2	32.60
	RD 2907 (C)	35.12	32.4	33.76
	NDB 1173 (C)	37.65	33.5	35.58
	KB 2031	35.50	36.5	36.00
	Mean	35.57	33.4	34.48
Mean	RD 2794 (C)	32.66	28.8	30.73
	RD 2907 (C)	33.89	30.5	32.20
	NDB 1173 (C)	36.67	31.5	34.09
	KB 2031	35.02	34.5	34.76
	Mean	34.56	31.33	32.94
CD (0.05)	Nitrogen (A)	0.74	2.60	0.91
	Genotype (B)	1.15	1.10	0.64
	B within A	1.98	1.91	NS
	A within B	1.81	2.57	1.35
Date of Sowing:		13.11.2023	20.12.2023	
Date of Harvesting:		01.03.2024	25.04.2023	

Table 4.10. North Eastern Plain Zone				IR-SL-LON		Pooled		2023-24
Entry	**Nitrogen levels, kg/ha**						**Mean**	**Rk**
	60	**Rk**	**75**	**Rk**	**90**	**Rk**		
Yield, q/ha								
RD 2794 (C)	28.95	4	30.63	4	32.60	4	30.73	4
RD 2907 (C)	30.38	3	32.46	3	33.76	3	32.20	3
NDB 1173 (C)	32.43	2	34.25	2	35.58	2	34.09	2
KB 2031	33.20	1	35.08	1	36.00	1	34.76	1
Mean	31.24		33.10		34.48		32.94	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	0.91		0.64		NS		1.35	
Earhead/sq.m.								
RD 2794 (C)	379	4	380	4	381	4	380	4
RD 2907 (C)	382	2	386	2	390	1	386	1
NDB 1173 (C)	385	1	380	3	385	3	383	3
KB 2031	380	3	389	1	387	2	385	2
Mean	382		384		386		384	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	NS		NS		NS		NS	
Grains/earhead								
RD 2794 (C)	20.43	3	19.37	4	20.59	3	20.13	3
RD 2907 (C)	19.82	4	20.03	3	20.42	4	20.09	4
NDB 1173 (C)	22.31	2	21.57	2	21.53	2	21.80	2
KB 2031	23.60	1	24.01	1	22.95	1	23.52	1
Mean	21.54		21.24		21.37		21.39	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	NS		0.82		NS		1.59	
1000 grains weight, g								
RD 2794 (C)	37.43	3	42.38	3	42.17	3	40.66	3
RD 2907 (C)	40.60	1	42.40	2	42.73	2	41.91	1
NDB 1173 (C)	37.68	2	42.62	1	43.57	1	41.29	2
KB 2031	37.08	4	37.67	4	40.67	4	38.47	4
Mean	38.20		41.27		42.28		40.58	
	Nitrogen (A)		Genotype (B)		B within A		A within B	
CD (0.05)	0.25		0.24		0.42		0.47	
Centres: Ayodhya, Kanpur								

Irrigated Timely Sown Feed Barley

One test entry of feed barley UPB 1106 was evaluated against three checks *viz.* HUB 113(C), BH 946(C) and DWRB 137(C) at three locations (Ayodhya, Kanpur and Ranchi) under timely (11^{th}November to 20^{th} November) and late (6^{th} December to 15^{th} December) sown conditions. The trial was conducted in split plot design with dates of sowing in main plots and genotypes in sub-plots. The sowing was done using the normalized (adjusted considering 1000 grains weight of 38 g) seed rate of 100 kg/ha at a row-to-row spacing of 23 cm. Nitrogen was applied in two splits (half at sowing and half at first irrigation *i.e.* at 20-25 days after sowing.), whereas full phosphorus and potash were applied as basal.

In NEPZ, this trial was conducted at three centres (Ayodhya, Kanpur and Ranchi). The centre wise yield and zonal mean yield are given in Table 4.11. The pooled data are presented in Table 4.12.

Table 4.11. North Eastern Plain Zone			**IR-TS- FB-DOS**	**Centrewise Yield, q/ha**	**2023-24**
Sowing Time	**Entry**	**Ayodhya**	**Kanpur**	**Ranchi**	**Zonal Mean**
Timely	HUB 113 (C)	29.33	34.69	52.00	38.68
	BH 946 (C)	31.53	26.31	47.75	35.20
	DWRB 137 (C)	34.33	28.28	45.90	36.17
	UPB 1106	33.07	34.86	39.40	35.77
	Mean	32.07	31.04	46.26	36.45
Late	HUB 113 (C)	23.78	40.60	29.93	31.44
	BH 946 (C)	25.35	29.65	26.07	27.02
	DWRB 137 (C)	28.53	36.77	31.50	32.27
	UPB 1106	27.08	41.24	31.93	33.42
	Mean	26.19	37.07	29.86	31.04
Mean	HUB 113 (C)	26.56	37.65	40.97	35.06
	BH 946 (C)	28.44	27.98	36.91	31.11
	DWRB 137 (C)	31.43	32.52	38.70	34.22
	UPB 1106	30.08	38.05	35.67	34.60
	Mean	29.13	34.05	38.06	33.75
CD (0.05)	Sowing (A)	0.76	2.09	2.61	0.76
	Genotype (B)	1.17	2.11	2.41	1.08
	B within A	1.65	2.98	3.41	1.52
	A within B	1.50	2.88	3.36	1.67
Date of Sowing:	Timely	16.11.2023	11.11.2023	15.11.2023	
	Late	12.12.2023	06.12.2023	14.12.2023	
Date of Harvesting:	Timely	03.03.2024	01.04.2024	25.03.2024	
	Late	29.03.2024	10.04.2024	15.04.2024	

Registered higher yield of all genotypes compared to late sowing and on mean basis, yield declined by 14.84% when sowing was delayed from timely to late sowing condition. The yield decline was due to significant reduction in effective tillers under late sown condition as compared to timely sown condition. On mean basis, the check variety HUB 113 was the highest yielder (35.06 q/ha) and recorded significantly higher grain yield compared to check variety BH 946 but at par to UPB 1106 and DWRB 137 (C). The check entry HUB 113 also recorded maximum effective tillers (378 earheads/m^2). The maximum grains/earhead were also observed in check HUB 113 (24.10 grains/earhead) followed by DWRB 137 (23.18 grains/earhead) and test entry UPB 1106 (23.16 grains/earhead) which were statistically at par with each other. The test entry UPB 1106 produced the boldest grains having the mean 1000 grains weight of 41.55 g.

Table 4.12. North Eastern Plain Zone			IR-TS- FB-DOS		Pooled	2023-24
Entry	Date of Sowing				Mean	Rk
	Timely	Rk	Late	Rk		
Yield, q/ha						
HUB 113 (C)	38.68	1	31.44	3	35.06	4
BH 946 (C)	35.20	4	27.02	4	31.11	3
DWRB 137 (C)	36.17	2	32.27	2	34.22	1
UPB 1106	35.77	3	33.42	1	34.60	2
Mean	36.45		31.04		33.75	
	Sowing (A)	Genotype (B)		B within A		A within B
CD (0.05)	0.76	1.08		1.52		1.67
Earhead/sq.m.						
HUB 113 (C)	399	1	357	3	378	1
BH 946 (C)	396	2	353	4	375	3
DWRB 137 (C)	390	3	365	2	378	2
UPB 1106	375	4	370	1	372	4
Mean	390		361		376	
	Sowing (A)	Genotype (B)		B within A		A within B
CD (0.05)	7.74	NS		10.00		12.00
Grains/earhead						
HUB 113 (C)	25.18	1	23.02	1	24.10	1
BH 946 (C)	22.45	4	21.41	4	21.93	4
DWRB 137 (C)	24.78	2	21.58	3	23.18	2
UPB 1106	23.87	3	22.46	2	23.16	3
Mean	24.07		22.12		23.09	
	Sowing (A)	Genotype (B)		B within A		A within B
CD (0.05)	1.34	1.21		NS		2.11
1000 grains weight, g						
HUB 113 (C)	38.79	3	39.46	3	39.12	3
BH 946 (C)	40.18	2	37.41	4	38.80	4
DWRB 137 (C)	38.69	4	43.13	1	40.91	2
UPB 1106	41.98	1	41.12	2	41.55	1
Mean	39.91		40.28		40.10	
	Sowing (A)	Genotype (B)		B within A		A within B
CD (0.05)	NS	0.63		0.90		1.10
Centres: Ayodhya, Kanpur, Ranchi						

PRODUCTION TECHNOLOGIES

SPL -5: Efficacy of herbicides against broad-leaved weed flora of barley

Broadleaved weeds are major problem in barley production. Chemical weed control is preferred over other weed control methods. Moreover, barley is infested with diverse weed flora and for control of complex weed flora, herbicide combinations are required. Therefore, keeping these in view, an experiment involving ten weed control treatments was conducted across zones at 14 locations.

The sowing was done using the normalized (adjusted considering 1000 grains weight of 38 g) seed rate of 100 kg/ha at a row-to-row spacing of 23 cm. One thirdnitrogen, full phosphorus and potash as basal dose as per treatments and the remaining 2/3rd nitrogen as 1/3rd at the first irrigation and 1/3rd at second irrigation. Weed control measures were followed as per treatments. Herbicide spraying was done using Knapsack sprayer. The observations were recorded on weed density and weed dry weight at 60 and 90 DAS.

In NHZ, this trial was conducted at Khudwani and Malan centres. The data of yield and yield attributes are presented in Table 4.13(a). The results of the pooled data revealed that herbicide treatments introduced a significant effect on yield, earhead density, test weight and biomass yield. The grain yield reduced by 48.5% on switching the treatment from weed free to weedy check. The maximum grain yield (34.7 q/ha) was recorded under weed free condition due to improved earhead density, test weight and biomass yield. Among herbicide

Table 4.13(a). Northern Hill Zone		SPL-5	Pooled			2023-24
Treatments	**Earhead / m²**	**Yield, q/ha**	**1000 grains wt., g**	**GPEH**	**Plant ht., cm**	**Biomass, q/ha**
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	193	24.71	39.11	33.63	100.23	66.33
Metsulfuron methyl + S at 4 g/ha+ 0.2%	224	31.23	42.65	35.70	103.50	75.60
Carfentrazone 20 g/ha	204	25.64	40.44	32.31	98.62	65.20
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	213	26.09	41.56	30.55	102.00	68.41
2,4-D-Na 500 g/ha	195	21.91	39.74	29.75	97.63	61.64
2,4-D-Na + Carfentrazone 500 + 20 g/ha	203	23.38	39.51	30.76	97.53	63.62
2,4-D-E 500 g/ha	192	23.21	39.58	31.84	97.14	62.50
2,4-D-E + Carfentrazone 500 + 20 g/ha	220	29.52	42.38	32.93	80.91	71.90
Weedy check	171	17.86	35.77	32.76	89.65	49.62
Weed free	232	34.67	43.08	36.81	104.07	82.40
CD (0.05)	17.10	2.08	1.96	N.S.	N.S.	4.41
Centres: Khudwani and Malan						

Treatments, the maximum grain yield (31.2 q/ha) was recorded with treatment of metsulfuron methyl 20 WG + surfactant at 4 g *a.i.*/ha + 0.2% S followed by 29.5 q/ha with 2,4-D-E + carfentrazone 500 + 20 g *a.i.*/ha. In terms of weed control as shown in Table 4.13(b), the lowest weed density and dry weight were recorded as 52.3/m^2 and 5.16 g/m^2, respectively, with metsulfuron methyl 20 WG + surfactant at 4 g *a.i.*/ha + 0.2% S application followed by the treatment of 2,4-D-E + carfentrazone 500 + 20 g *a.i.*/ha (58.5/m^2 and 6.5 g/m^2).

Table 4.13(b). Northern Hill Zone		SPL-5	Pooled	2024-25
Treatments	**Weed density, No./m²**		**Weed dry weight, g/m²**	
	60	**90**	**60**	**90**
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	7.48 (56.17)	8.05 (65.83)	2.58 (5.84)	2.48 (5.30)
Metsulfuron methyl + S at 4 g/ha+ 0.2%	6.98 (48.00)	7.26 (52.33)	2.4 (5.24)	2.4 (5.16)
Carfentrazone 20 g/ha	7.93 (62.5)	8.31 (70.67)	2.87 (7.76)	2.77 (6.92)
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	7.14 (51.17)	6.91 (53.50)	2.56 (5.92)	2.45 (5.16)
2,4-D-Na 500 g/ha	8.21 (67.67)	8.59 (76.50)	2.90 (7.98)	2.97 (8.37)
2,4-D-Na + Carfentrazone 500 + 20 g/ha	6.52 (42.33)	7.14 (50.17)	2.65 (6.63)	2.67 (6.66)
2,4-D-E 500 g/ha	6.79 (45.67)	7.35 (53.67)	2.94 (8.30)	2.88 (7.87)
2,4-D-E + Carfentrazone 500 + 20 g/ha	6.75 (45.00)	7.67 (58.50)	2.62 (6.41)	2.65 (6.47)
Weedy check	9.33 (89.17)	9.90 (102.67)	3.55 (12.10)	4.10 (16.85)
Weed free	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
CD(0.05)	0.90	1.51	0.45	0.48
Centres: Khudwani and Malan				

In NWPZ, this trial was conducted at four centres namely Agra, Durgapura, Hisar and Karnal.Theanalysisofpooled data as showninTable 4.14(a) and 4.14(b) revealed thatweed control treatments produced significant effect on grain yield and yield attributes except grains/earhead. The highest yield was obtained under weed free situation (54.33 q/ha) which might be attributed to higher and better use of moisture, light, nutrients and space by the crop plants, whereas the minimum yield was recorded under weedy check (37.59 q/ha) due to strong weed competition. Among herbicides, ready mixture of halauxifen-methyl + fluroxypyr at 200.6 (6.1+194.5) g/ha showed the least number of weed count of 11.6/m^2 and weed dry weight of 14.9 g/m^2 at 90 DAS, whereas the maximum values of these parameters were observed in weedy check with respective values of 127.4/m^2 and 137.2 g/m^2 at 90 DAS. Carfentrazone tank mixed with either metsulfuron or 2,4-D Na or 2,4-D-E also effectively controlled the broadleaved weeds and as a result yield improved as compared to their solo application.

Table 4.14(a). North Western Plains Zone		SPL-5		Pooled	2023-24	
Treatments	**Yield, q/ha**	**Earhead/ sq.m.**	**1000 grains weight, g**	**Grains/ earhead**	**Biomass, q/ha**	**Plant Ht., cm**
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	51.70	344.1	45.11	33.73	124.73	85.3
Metsulfuron methyl + S at 4 g/ha+ 0.2%	48.58	331.3	44.22	33.60	118.58	87.9
Carfentrazone 20 g/ha	45.88	319.5	43.90	33.15	112.67	82.2
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	51.02	342.1	45.07	33.51	124.03	85.8
2,4-D-Na 500 g/ha	44.88	315.3	43.96	32.73	111.23	85.8
2,4-D-Na + Carfentrazone 500 + 20 g/ha	49.44	335.9	44.69	33.43	120.93	84.0
2,4-D-E 500 g/ha	46.83	324.1	44.21	32.99	114.32	86.7
2,4-D-E + Carfentrazone 500 + 20 g/ha	50.27	339.9	44.91	33.37	121.96	85.3
Weedy check	37.59	274.2	42.11	33.07	92.20	83.6
Weed free	54.33	355.8	44.95	34.69	131.80	89.9
CD (0.05)	2.89	10.51	0.87	NS	7.09	NS
Centres: Agra, Durgapura, Hisar and Karnal						

Table 4.14(b). North Western Plains Zone		SPL-5		Pooled	2023-24	
Treatments	**Weed density, No./m^2**			**Weed dry weight, g/m^2**		
	60		**90**	**60**	**90**	
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	3.55(11.8)		3.52(11.6)	3.71(12.8)	3.98(14.9)	
Metsulfuron methyl + S at 4 g/ha+ 0.2%	3.74(13)		6.34(40)	3.93(14.5)	4.24(17)	
Carfentrazone 20 g/ha	5.83(33.1)		6.75(44.7)	4.49(19.1)	5.15(25.5)	
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	4.54(19.7)		4.57(19.9)	3.81(13.6)	4.09(15.8)	
2,4-D-Na 500 g/ha	6.36(39.5)		6.7(43.9)	4.8(22)	5.44(28.6)	
2,4-D-Na + Carfentrazone 500 + 20 g/ha	5.27(26.8)		5.37(27.8)	4.08(15.7)	4.48(19.1)	
2,4-D-E 500 g/ha	6.42(40.3)		6.92(47)	4.95(23.6)	5.45(28.9)	
2,4-D-E + Carfentrazone 500 + 20 g/ha	4.72(21.3)		4.88(22.8)	3.84(13.8)	4.27(17.3)	
Weedy check	9.24(84.6)		11.3(127.4)	7.99(62.8)	11.75(137.2)	
Weed free	1(0)		1(0)	1(0)	1(0)	
CD (0.05)	0.64		1.00	0.33	0.53	
Centres: Agra, Durgapura, Hisar and Karnal						

In NEPZ, this trial was conducted at two locations (Ayodhya and Ranchi). The analysis of pooled data as shown in Table 4.15(a) and 4.15(b) revealed that weed control treatments produced significant effect on grain yield and all the yield attributes. The highest yield was obtained under weed free situation (34.51 q/ha) which might be attributed to higher and better use of moisture, light, nutrients and space by the crop plants. Whereas the minimum yield was recorded under weedy check (20.73 q/ha) due to strong weed competition. Among herbicides, metsulfuron + carfentrazone + S at 25 (5+20) g/ha + 0.2% S recorded the least number of weed count (7.9/ m^2) and weed dry weight (9.2 g/ m^{2}at 90 DAS and whereas maximum values of these parameters were observed in weedy check with respective values of 13.4/m^2 and 17.7 g/m^2 at 90 DAS. All the herbicide applied alone or in combination reduced the weed population and weed dry weight significantly compared to weedy check.

Table 4.15(a). North Eastern Plains Zone		SPL-5	Pooled	2023-24
Treatments	**Yield, q/ha**	**Earhead/ sq.m**	**1000 GW, g**	**Grains/ earhead**
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	30.27	361	37.65	23.45
Metsulfuron methyl + S at 4 g/ha+ 0.2%	28.03	366	37.42	22.07
Carfentrazone 20 g/ha	26.25	356	37.62	21.03
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	30.10	383	38.03	22.72
2,4-D-Na 500 g/ha	27.56	368	37.58	21.87
2,4-D-Na + Carfentrazone 500 + 20 g/ha	29.37	353	37.25	23.73
2,4-D-E 500 g/ha	28.18	352	37.08	23.02
2,4-D-E + Carfentrazone 500 + 20 g/ha	32.04	355	38.05	24.75
Weedy check	20.73	317	36.18	18.66
Weed free	34.51	404	39.12	23.55
CD (0.05)	1.78	17.46	1.44	2.45
Centres: Ayodhya, Ranchi				

Table 4.15(b). North Eastern Plains Zone		SPL-5	Pooled	2023-24
Treatments	**Weed density, No./m²**		**Weed dry weight, g/m²**	
	60	**90**	**60**	**90**
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	3.39(11.4)	2.98(8.3)	3.89(17.4)	3.20(11.0)
Metsulfuron methyl + S at 4 g/ha+ 0.2%	3.34(10.8)	3.05(8.6)	3.86(16.8)	3.23(10.7)
Carfentrazone 20 g/ha	3.40(11.2)	3.02(8.4)	3.95(17.7)	3.17(10.8)
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	3.30(10.6)	2.95(7.9)	3.84(16.8)	2.98(9.2)
2,4-D-Na 500 g/ha	3.42(11.4)	2.98(8.1)	3.86(16.8)	3.00(9.3)
2,4-D-Na + Carfentrazone 500 + 20 g/ha	3.45(11.8)	2.99(8.5)	3.97(18.2)	3.21(11.1)
2,4-D-E 500 g/ha	3.42(11.5)	2.99(8.5)	3.99(18.3)	3.24(11.2)
2,4-D-E + Carfentrazone 500 + 20 g/ha	3.52(12.8)	3.09(9.3)	3.95(17.7)	3.41(13.1)
Weedy check	4.09(17.0)	3.72(13.4)	4.54(24.1)	3.81(17.7)
Weed free	1(0.0)	1(0.0)	1(0.0)	1(0.0)
CD (0.05)	0.08	0.10	0.06	0.08
Centres: Ayodhya, Ranchi				

In CZ, this trial was conducted at four centres namely Gwalior, Jabalpur, Udaipur and Vijapur. The analysis of pooled data as shown in Table 4.16(a) and 4.16(b) revealed that weed control treatments produced significant effect on grain yield and yield attributes except grains/earhead. The highest yield was obtained under weed free situation (43.98 q/ha) which might be attributed to higher and better use of moisture, light, nutrients and space by the crop plants, whereas the minimum yield was recorded under weedy check (28.08 q/ha)

Table 4.16(a). Central Zone		SPL-5		Pooled	2023-24	
Treatments	**Yield, q/ha**	**Earheads/ sqm**	**1000 GW, g**	**Grains/ Earhead**	**Plant Ht, cm**	**Biomass, q/ha**
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	40.69	414	42.32	23.80	87.20	103.24
Metsulfuron methyl + S at 4 g/ha+ 0.2%	34.10	394	43.20	20.40	83.55	92.82
Carfentrazone 20 g/ha	37.04	399	43.01	21.97	84.63	97.54
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	35.98	425	43.28	19.32	85.93	95.06
2,4-D-Na 500 g/ha	35.57	403	45.03	20.45	84.56	97.81
2,4-D-Na + Carfentrazone 500 + 20 g/ha	36.53	419	42.22	20.64	85.61	97.12
2,4-D-E 500 g/ha	35.93	409	41.84	21.38	84.63	96.56
2,4-D-E + Carfentrazone 500 + 20 g/ha	37.94	423	43.71	20.66	84.83	99.32
Weedy check	28.08	377	44.15	17.79	84.51	81.86
Weed free	43.98	427	42.80	24.65	87.27	107.90
CD (0.05)	2.15	21.41	2.50	1.76	2.60	7.05
Centres: Gwalior, Jabalpur, Udaipur and Vijapur						

Table 4.16(b). Central Zone	SPL-5		Pooled	2023-24
Treatments	Weed density, No./m^2		Weed dry weight, g/m^2	
	60	90	60	90
Halauxifen-methyl + Fluroxypyr at 200.6 (6.1+194.5) g/ha	5.44 (28.71)	5.53 (29.62)	6.32 (39.36)	7.26 (51.7)
Metsulfuron methyl + S at 4 g/ha+ 0.2%	6.57 (42.16)	7.06 (48.89)	7.52 (55.74)	8.42 (70.01)
Carfentrazone 20 g/ha	6.35 (40.48)	6.78 (45.11)	7.26 (51.77)	8.24 (66.89)
Metsulfuron + Carfentrazone + S at 25 (5+20) g/ha + 0.2% S	6.38 (39.9)	6.61 (42.78)	6.56 (42.03)	7.57 (56.4)
2,4-D-Na 500 g/ha	6.42 (40.91)	6.49 (41.44)	7.09 (49.52)	8.15 (65.62)
2,4-D-Na + Carfentrazone 500 + 20 g/ha	5.28 (26.84)	6.16 (37)	6.56 (42.07)	7.47 (54.88)
2,4-D-E 500 g/ha	6.16 (37.11)	6.9 (46.67)	6.96 (47.55)	7.96 (62.43)
2,4-D-E + Carfentrazone 500 + 20 g/ha	5.17 (26.11)	5.66 (31)	6.52 (41.61)	7.65 (57.61)
Weedy check	8.79 (76.44)	9.01 (80.22)	9.39 (87.3)	10.25 (104.09)
Weed free	-	-	-	-
CD (0.05)	1.00	0.59	0.68	0.52
Centres: Gwalior, Udaipur and Vijapur				

Due to strong weed competition. Among herbicides, ready mixture of halauxifen-methyl + fluroxypyr at 200.6 (6.1+194.5) g/ha showed the least number of weed count of 29.6/m^2 and weed dry weight of 51.7 g/m^2 at 90 DAS, whereas the maximum values of these parameters were observed in weedy check with respective values of 80.2/m^2 and 104.1 g/m^2 at 90 DAS. Carfentrazone tank mixed with either metsulfuron or 2,4-D Na or 2,4-D-E also effectively controlled the broadleaved weeds and as a result yield improved as compared to their solo application.

SPL-6: Effect of seed rate and growth regulators on barley productivity

Similar to SPL-2 for wheat, a field experiment involving three seed rate and five foliar application of growth regulators in barley was conducted across zones at six locations. This experiment was conducted in split-plot design using seed rate (60, 80, and 100 kg/ha) in main plots and foliar application of growth regulators and mechanical drum rolling {Control as water spray, drum rolling (30 and 45 DAS), spray of 2,3,5-triiodobenzoic acid at tillering @100 ppm, spray of 6-benzyl amino purine at tillering @100 ppm and two sprays of tank-mix of chlormequat chloride (Lihocin) @ 0.2%+ tebuconazole (Folicur 430 SC) @ 0.1% of commercial product dose at first node and flag leaf} in sub-plots with three replications. One-thirdnitrogen, full phosphorus and potash as basal dose and the remaining 2/3rd nitrogen as 1/3rd at first irrigation and 1/3rd at second irrigation were applied. The sowing was done using the seed rate as per treatments (adjusted considering 1000 grains weight of 38 g) at a row-to-row spacing of 23 cm using DBWB 137 variety.

In NHZ, this trial was conducted at Almora centre. The data of yield and yield attributes are presented in Table 4.17. The results of pooled data revealed that earhead density significantly increased with seed rate but there was marginal increase (without statistical difference) in yield with seed rate. The maximum mean grain yield (34.6 q/ha), earhead density (213 per m^2), test weight (45.5 g for 1000 grains) and biomass yield (63.2 q/ha) were recorded at a seed rate of 100 kg/ha. The application of PGRs showed a significant effect on grain yield.The maximum mean grain yield of 35.1 q/ha was observed with drum rolling (30 and 45 DAS), which was significantly higher than all other treatments except tank-mix application of chloremequat chloride + tebuconazole. The treatment of drum rolling increased the grain yield by 8.6% as compared to control (water spray).

In NWPZ, this trial was conducted with an objective to maximise the barley productivity by optimum plant stand and growth regulatorsapplication at five centres (Agra, Durgapura, Gurdaspur, Hisar and Karnal). The pooled analysis of data presented in Table 4.18 revealed that the maximum mean grain yield (49.77 q/ha) was produced under the treatment of 100 kg/ha seed rate and it was significantly superior to both the lower seed rates (60 and 80 kg/ha). The effect of growth regulators was also significant. Among growth regulators treatments, TIBA-100 ppm produced the maximum grain yield (47.68 q/ha) and it was statistically at par with CCC + tebuconazole- 0.2% +0.1%- 2 sprays. All the

three growth regulators treatments were significantly superior to drum rolling and control treatments. There was significant increase in earhead density with increase in the seed rate from 60 to 100 kg/ha. Control and drum rolling treatments were significantly inferior to three growth regulator treatments for the earhead density. The grain weight was not affected by seed rate. All the growth regulators treatments as well as the drum rolling had significantly bolder grains compared to control. Crop biomass was significantly increased with increase in seed rate from 60 to 100 kg/ha. All growth regulator treatments produced significantly higher crop biomass compared to control.

Table 4.17. Northern Hill Zone		**SPL-6**		**Almora**		**2023-24**	
Growth regulator	**Seed rate, kg/ha**					**Mean**	**Rk**
	60	**Rk**	**80**	**Rk**	**100**	**Rk**	
Yield, q/ha							
Control (water spray)	30.93	3	32.44	3	33.58	4	32.32	3
Drum rolling (30 and 45 DAS)	33.77	1	34.27	2	37.23	1	35.09	1
TIBA spray at tillering @100 ppm	29.62	4	31.89	4	32.83	5	31.44	5
Cytokinin spray at tillering @100 ppm	29.42	5	31.26	5	33.72	3	31.47	4
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	31.24	2	34.87	1	35.69	2	33.93	2
Mean	31.00		32.95		34.61		32.85	
	Seed rate (A)		Growth regulator (B)		B within A		A within B	
CD (0.05)	N.S.		2.26		N.S.		N.S.	
Earheads/sqm								
Control (water spray)	175	2	186	1	213	3	192	2
Drum rolling (30 and 45 DAS)	180	1	185	2	212	4	192	1
TIBA spray at tillering @100 ppm	175	3	181	4	216	2	191	3
Cytokinin spray at tillering @100 ppm	169	5	181	5	217	1	189	4
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	172	4	184	3	206	5	187	5
Mean	174		183		213		190	
	Seed rate (A)		Growth regulator (B)		B within A		A within B	
CD (0.05)	9.84		N.S.		N.S.		N.S.	
Grains/Earhead								
Control (water spray)	39.14	4	38.91	4	35.69	3	37.91	3
Drum rolling (30 and 45 DAS)	42.86	1	40.30	2	36.90	2	40.02	2
TIBA spray at tillering @100 ppm	38.13	5	39.10	3	34.18	4	37.14	5
Cytokinin spray at tillering @100 ppm	40.74	2	38.54	5	33.57	5	37.62	4
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	40.61	3	41.23	1	39.30	1	40.38	1
Mean	40.30		39.62		35.93		38.61	
	Seed rate (A)		Growth regulator (B)		B within A		A within B	
CD (0.05)	N.S.		N.S.		N.S.		N.S.	
1000 Grains Weight, g								
Control (water spray)	45.47	1	44.80	4	44.13	5	44.80	4
Drum rolling (30 and 45 DAS)	43.97	4	45.93	2	47.83	1	45.91	1
TIBA spray at tillering @100 ppm	44.67	3	45.00	3	44.83	3	44.83	3
Cytokinin spray at tillering @100 ppm	43.20	5	44.60	5	46.40	2	44.73	5
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	44.80	2	46.00	1	44.43	4	45.08	2
Mean	44.42		45.27		45.53		45.07	
	Seed rate (A)		Growth regulator (B)		B within A		A within B	
CD (0.05)	N.S.		N.S.		N.S.		N.S.	
Plant height, cm								
Control (water spray)	67.42	2	62.62	4	60.61	5	63.55	4
Drum rolling (30 and 45 DAS)	68.76	1	70.50	1	67.82	2	69.03	1
TIBA spray at tillering @100 ppm	65.11	5	62.09	5	63.04	4	63.41	5
Cytokinin spray at tillering @100 ppm	66.99	3	66.31	3	68.42	1	67.24	2
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	65.97	4	67.78	2	65.40	3	66.38	3
Mean	66.85		65.86		65.06		65.92	
CD (0.05)	Seed rate (A)		Growth regulator (B)		B within A		A within B	
	N.S.		N.S.		N.S.		N.S.	
Biomass, q/ha								
Control (water spray)	61.56	1	59.43	4	60.59	5	60.53	5
Drum rolling (30 and 45 DAS)	61.36	2	62.43	1	62.99	3	62.26	1
TIBA spray at tillering @100 ppm	60.60	4	59.44	3	61.78	4	60.61	4
Cytokinin spray at tillering @100 ppm	61.10	3	59.09	5	64.07	2	61.42	3
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	58.18	5	61.22	2	66.43	1	61.94	2
Mean	60.56		60.32		63.17		61.35	
	Seed rate (A)		Growth regulator (B)		B within A		A within B	
CD (0.05)	N.S.		N.S.		N.S.		N.S.	
Date of Sowing: 21.11.2023			Date of Harvesting:		13.05.2024			

Table 4.18. North Western Plain Zone			**SPL-6**		**Pooled**		**2023-24**	
Growth regulators			**Seed rate, kg/ha**				**Mean**	**Rk**
	60	**Rk**	**80**	**Rk**	**100**	**Rk**		
Yield, q/ha								
Control (water spray)	37.28	5	42.07	5	46.01	5	41.79	5
Drum rolling (30 and 45 DAS)	40.88	4	44.62	4	48.33	4	44.61	4
TIBA spray at tillering @100 ppm	44.11	1	47.51	1	51.41	2	47.68	1
Cytokinin spray at tillering @100 ppm	41.50	3	46.59	3	51.16	3	46.42	3
CCC+tebuconazole (0.2%+0.1%) - 2 sprays	42.82	2	46.74	2	51.94	1	47.17	2
Mean	41.32		45.51		49.77		45.53	
	Seed rate (A)		Growth regulators (B)		B within A		A within B	
CD (0.05)	0.83		0.99		NS		1.78	
Earhead/sq.m.								
Control (water spray)	290	5	318	5	338	5	315	5
Drum rolling (30 and 45 DAS)	305	4	333	4	357	4	332	4
TIBA spray at tillering @100 ppm	311	3	348	2	371	2	343	2
Cytokinin spray at tillering @100 ppm	312	2	345	3	366	3	341	3
CCC+ tebuconazole (0.2%+0.1%) - 2 sprays	316	1	351	1	375	1	347	1
Mean	307		339		361		336	
	Seed rate (A)		Growth regulators (B)		B within A		A within B	
CD (0.05)	4.31		6.13		NS		11.38	
Grains/earhead								
Control (water spray)	32.34	3	31.89	3	32.21	4	32.14	5
Drum rolling (30 and 45 DAS)	32.54	2	32.06	2	32.07	5	32.23	4
TIBA spray at tillering @100 ppm	33.23	1	32.42	1	32.70	3	32.78	1
Cytokinin spray at tillering @100 ppm	31.44	5	31.80	4	33.54	1	32.26	3
CCC+ tebuconazole (0.2%+0.1%) - 2 sprays	32.19	4	31.41	5	33.36	2	32.32	2
Mean	32.35		31.92		32.78		32.35	
	Seed rate (A)		Growth regulators (B)		B within A		A within B	
CD (0.05)	0.52		NS		NS		1,46	
1000 grains weight, g								
Control (water spray)	40.62	5	42.19	5	42.75	3	41.85	5
Drum rolling (30 and 45 DAS)	41.82	4	42.57	4	43.03	2	42.47	4
TIBA spray at tillering @100 ppm	43.14	1	42.98	3	43.29	1	43.14	1
Cytokinin spray at tillering @100 ppm	43.12	2	43.36	1	42.69	4	43.06	2
CCC+ tebuconazole (0.2%+0.1%) - 2 sprays	42.64	3	43.02	2	42.33	5	42.66	3
Mean	42.27		42.82		42.82		42.64	
	Seed rate (A)		Growth regulators (B)		B within A		A within B	
CD (0.05)	NS		0.55		0.95		1.06	
Plant height, cm								
Control (water spray)	94.71	3	95.27	3	95.66	3	95.21	3
Drum rolling (30 and 45 DAS)	91.61	4	94.22	4	95.13	4	93.65	4
TIBA spray at tillering @100 ppm	96.67	2	98.12	2	100.51	2	98.43	2
Cytokinin spray at tillering @100 ppm	97.44	1	100.02	1	101.36	1	99.61	1
CCC+ tebuconazole (0.2%+0.1%) - 2 sprays	89.78	5	93.00	5	93.25	5	92.01	5
Mean	94.04		96.13		97.18		95.78	
	Seed rate (A)		Growth regulators (B)		B within A		A within B	
CD (0.05)	0.83		1.01		NS		1.83	
Biomass, q/ha								
Control (water spray)	104.22	5	112.15	5	120.84	5	112.40	5
Drum rolling (30 and 45 DAS)	111.95	2	118.24	4	125.90	4	118.70	4
TIBA spray at tillering @100 ppm	116.56	1	121.33	2	132.50	1	123.46	1
Cytokinin spray at tillering @100 ppm	110.70	4	121.12	3	129.47	2	120.43	3
CCC+ tebuconazole (0.2%+0.1%) - 2 sprays	111.80	3	121.37	1	128.96	3	120.71	2
Mean	111.04		118.84		127.53		119.14	
	Seed rate (A)		Growth regulators (B)		B within A		A within B	
CD (0.05)	2.00		2.46		NS		4.41	
Centres: Agra, Durgapura,Gurdaspur, Hisar, Karnal								

Barley Quality

MALTING QUALITY EVALUATION

The Barley Quality Lab conducted a comprehensive malting quality evaluation of grain samples from the Initial Varietal Trial (IVT) and Advanced Varietal Trial (AVT). These grain samples, each weighing 500 g, were collected from six different locations (Hisar, Karnal, Ludhiana, Pantnagar, Durgapura, and Bawal) for IVT and AVT. All the entries in AVT belong to 1st year. In total, 192 coded samples were received and analyzed at the central facility.

Table 5.1. Details of grain samples received and analyzed for malting quality

State	Location	Trial	No. of Samples
Haryana	Hisar	IVT	25
		AVT	7
	Karnal	IVT	25
		AVT	7
	Bawal	IVT	25
		AVT	7
Punjab	Ludhiana	IVT	25
		AVT	7
Rajasthan	Durgapura	IVT	25
		AVT	7
Uttarakhand	Pantnagar	IVT	25
		AVT	7
Total			**192**

Table 5.2. Malting quality traits analyzed

Grain Quality	Malt Quality
- 1000 Grain Weight (g)	- Malt Yield (%)
- Test Weight (kg/hl)	- Malt Friability (%)
- Germination (at 72 hrs) (%)	- Malt Homogeneity (%)
- Husk Content (%)	- Hot Water Extract % (F.g.d.b.)
- Protein Content (%)	- Diastatic Power (^{0}L)
- Beta-Glucan (%)	- Wort Filtration Rate (ml/hr)
- Kernel Plumpness (%)	- Wort pH
- Proportion of Bold Grain (retained on 2.5 mm and 2.8 mm sieve)	- Saccharification Rate (minutes)
- Proportion of Thin Grain (passed through 2.2 mm sieve)	- Wort β-Glucan Content (ppm)
- Grain Starch Content	Wort FAN Content (ppm)
- Grain Moisture Content	

The grain samples underwent a comprehensive analysis to assess their physical and biochemical parameters crucial for malting, following approved guidelines and procedures. Various traits such as test weight, bold/thin proportion, germinative energy, 1000 grain weight, and husk content were assessed based on the EBC approved protocols. The grain's crude protein content, starch content, and moisture content were predicted using the FOSS NIR system on dry weight basis.

For the micro-malting process, the processed grain samples (with thin grains removed) were utilized, taking 100 grams from each genotype. The micro-malting was conducted using the "Joe White Micro-Malting System" and involved three main phases: steeping, germination, and kilning. Steeping was carried out in three stages with specific durations and temperatures: first, a wet stage lasting 8 hours at 18°C; then, an air rest stage for 16 hours at 18°C; and finally, another wet stage lasting 8 hours at 18°C, summing up to a total duration of 32 hours. Germination occurred in two stages, with a total duration of 48 hours, comprising 24 hours at 18°C followed by 24 hours at 16°C. Kilning, the final phase, lasted for 30 hours and commenced at 30°C, gradually reaching a final temperature of 80°C. By following this scientifically rigorous approach, the micro-malting process provided valuable insights into the malting characteristics of the grain samples, enabling a more thorough understanding of their potential for brewing purposes.

The evaluation of new barley genotypes followed the Analytical Guidelines for Barley Breeders in India (Annexure-1), which were approved by the "National Core Group on Malt Barley Development" (NCGMBD). The minimum standards for physical and biochemical properties of barley grain and malt were adhered to during the assessment. For the determination of various quality parameters, the analytical methods outlined in EBC (Analytica EBC, 2003) were employed. The analysis of diastatic power (D.P.) of malt was done as per the IOB method and expressed in ºLinter value as described in Farzaneh et al. (2017). The impact of germination time on some selected parameters through malting process. *International Journal of Biological Macromolecules*, 94: 663–668.

The following important points may be considered during interpretation of the results.

- *Protein content, Kolbach index, starch content and moisture content has been estimated using NIR system on dry weight basis.*
- *Grain & Wort β- glucan content, malt friability & homogeneity was done in samples of few location/s only.*
- *Husk content analysis was done by Sodium hypo-chlorite method (dry basis) as per EBC procedure.*
- *The wort was filtered through Whatman folded filter papers (2555 1/2, (diameter 320 mm) to determine filtration rate and subsequent analysis of wort.*
- *The DP was done by the method as described above. Results should be inferred under this light.*
- *Hot water extract and other malt quality values should be interpreted in the light that only 100g sample was micro-malted for each genotype and each location. This gives a relative picture in comparison to checks only and therefore industrial values for bulk processing, may differ.*
- *The kilning time was 30 hours starting from 30°C to preserve polysaccharide degradative activity to the maximum.*
- *The maturity period of grain has to bear the varying weather conditions during this year; IVT & AVT entries have different plot size & replications, therefore results of AVT & IVT may be interpreted in that perspective*

Since the dormancy of grain also affects its performance during malting, the details of malting cycles have been given below:

S. N.	Cycle start date	Locations
1	27.05.2024	Karnal, Durgapura, Ludhiana
2	24.06.2024	Karnal, Durgapura, Hisar, Ludhiana, Pantnagar, Bawal

Various genotypes have been identified as excellent sources for specific grain and malt quality traits, as shown in Table 5.3. However, it should be noted that these genotypes may not exhibit favorable values for all other traits under consideration. The zonal performance of the AVT and IVT entries concerning grain and malt quality traits has been recorded in Tables 5.4a, 5.4b, 5.5a, and 5.5b. Detailed location-wise data for each physical and biochemical grain/malt quality parameter can be found in Annexure 2. To identify promising lines, mean values were used, and these lines were compared against the minimum standards established by the 'NCGMBD' (National Committee on Genetic Manipulation and Biotechnology for Development) for malt barley in the country. These standards are subject to periodic revisions, with the latest revision as of 22.06.2020 being considered.

Since many of the grain and malt quality traits are negatively correlated and we have to look for the balanced optimal combination for these traits. There were several entries observed promising for individual traits, after the detailed analysis across locations in the NWP Zone. This was done by the system of scoring giving due weightage to important traits (Table 5.6 & 5.7). Thus, based on the twelve important traits (a maximum possible score of 36), entries were identified as promising.

Table 5.3. Promising entries of AVT and IVT for individual grain and malting quality trait

Trait	Promising entries
Hectoliter weight (>65 for two row; >62 for 6 row)	**AVT:** DWRB235, DWRB238, DWRUB52©**, RD-2849©,** DWRUB137© **IVT: BH1057, DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312, PL957, PL958, PL959, RD3084, RD3086, RD3087, UPB1124, UPB1125, DWRB182©, RD2849©,** DWRUB137©
Bold Grains (>90% for two row; >80% for 6 row)	**AVT:** DWRB235, DWRB238, DWRUB137© **IVT: BH1055, BH1056, DWRB2307, DWRB2312, PL957, PL959, RD3084, RD3087, RD3105, RD3106, RD3107, UPB1124,** DWRUB137©
**Husk Content (<11% for both types)	**AVT:** DWRUB52©**,** DWRUB137© **IVT: DWRB2309, DWRB2310, PL959, RD3084, RD3107, UPB1124,** DWRUB52©
**Grain Beta Glucan (<4% for both types)	**AVT:** NIL **IVT: RD3084, RD3105**
Malt Friability (>70% for two row; >65% for 6 row)	**AVT:** NIL **IVT:** RD3105
Hot water extract (>80% for both types)	**AVT:** NIL **IVT: NIL**
Filtration Rate (>250 min. for both types)	**AVT:** DWRUB137©**,** DWRB182© **IVT: NIL**
Diastatic Power (>90 ^{0}L for both types)	**AVT:** DWRB235, DWRB238, RD-3064, DWRUB52©**,** DWRUB137©**,** DWRB182©**, RD-2849©** **IVT: BH1055, BH1056, BH1057, DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312, , PL957, PL958, PL959, RD3084, RD3085, RD3086, RD3087, RD3105, RD3106, RD3107, UPB1124, UPB1125,** DWRUB52©**,** DWRUB137©**,** DWRB182©**, RD-2849©**
FAN Content (>150 ppm for both types)	**AVT:** DWRB235, DWRB238, RD-3064, DWRUB52©**,** DWRUB137©**,** DWRB182©**, RD-2849©** **IVT: BH1055, BH1056, BH1057, DWRB2307, DWRB2308, DWRB2309, DWRB2310, DWRB2311, DWRB2312, , PL957, PL958, PL959, RD3085, RD3086, RD3087, RD3105, RD3106, UPB1124, UPB1125,** DWRUB52©**,** DWRUB137©**, RD-2849©**
Wort β- glucan (<300 ppm for both types)	**AVT: NIL** **IVT:** RD3105
**Over all Malt Quality (weighted performance compared to best check)	**AVT:** DWRB238

**Six row; ** Compared to the best check*

Table 5.4a. Variability in grain quality of AVT malt barley entries.

S.N.	Code	Entry	TGW (g)	Test Wt. (kg/hl)	Bold (%)	Thin (%)	GER (%)	Protein (%)	Husk (%)	BG (%)**	Moisture %	Starch %
1	AVT-MB-TS-6	DWRB-235	50.4 (43.4-55.9)	68.6 (64.6-72.0)	91.4 (85.7-95.0)	1.5 (0.3-2.9)	98 (90-100)	11.6 (10.0-12.7)	11.4 (10.0-13.2)	5.2 (5.0-5.5)	9.4 (8.2-10.2)	63.1 (62.5-63.9)
2	AVT-MB-TS-5	DWRB-238	51.8 (48.9-56.8)	65.7 (60.4-70.1)	95.4 (92.0-98.6)	0.9 (0.3-1.7)	97.7 (94-100)	11.1 (8.7-14.1)	11.6 (10.2-13.2)	6.2 (5.6-6.8)	9.5 (9.2-10.3)	62.8 (61.3-64.0)
3	AVT-MB-TS-4	RD-3064	55.1 (42.2-67.7)	64.1 (61.6-68.8)	88.1 (79.0-98.4)	3.0 (0.3-6.8)	97.7 (94-100)	11.7 (9.9-14.7)	11.1 (8.5-13.3)	6.2 (5.9-6.6)	9.5 (9.1-10.2)	61.9 (60.1-62.9)
4	AVT-MB-TS-3	DWRUB-52 ©	47.1 (40.1-55.1)	67.8 (64.8-72.7)	83.3 (72.0-94.1)	2.7 (0.7-6.9)	99 (98-100)	10.8 (8.7-14.3)	10.1 (8.3-11.9)	5.1 (4.9-5.4)	9.4 (8.7-10.0)	63.5 (60.9-64.8)
5	AVT-MB-TS-7	DWRB-137 ©*	45.9 (41.8-55.2)	63.2 (60.7-66.9)	87.1 (81.4-95.0)	3.0 (0.9-5.0)	96.3 (92-100)	10.1 (8.7-12.5)	10.9 (5.5-13.4)	5.4 (5.4-5.5)	9.7 (8.7-10.3)	62.7 (61.4-64.5)
6	AVT-MB-TS-2	DWRB-182 ©	43.7 (40.4-50.6)	64.1 (57.7-70.2)	80.7 (68.7-93.6)	4.1 (1.0-7.5)	99.3 (96-100	11.3 (9.2-14.3)	12.4 (10.5-13.6)	4.2 (3.9-4.6)	9.6 (8.9-10.5)	62.5 (60.8-63.8)
7	AVT-MB-TS-1	RD-2849 ©	48.5 (44.4-55.1)	68 (64.0-72.7)	85.5 (78.2-91.6)	2.5 (0.9-6.2)	98 (96-100)	11.3 (9.3-13.6)	11.7 (9.8-13.3)	5.3 (5.0-5.6)	9.5 (8.8-10.3)	63.3 (61.4-65.1)
Overall			**48.9 (40.1-67.7)**	**65.9 (57.7-72.7)**	**87.4 (72.0-98.4)**	**2.5 (0.3-7.5)**	**98 (90-100)**	**11.1 (8.7-14.7)**	**11.3 (5.5-13.6)**	**5.4 (3.9-6.8)**	**9.5 (8.2-10.5)**	**62.8 (60.1-65.1)**

**Six row; **Two locations only; values are mean across the locations; range in brackets; (TGW: Thousand Grain Weight; Bold: Bold Grain; Thin: Thin Grain; GER: Germinative Energy; BG: Beta Glucan)*

Table 5.4b: Variability in malt quality of AVT malt barley entries

S.N.	Code	Entry	MY (%)	Friab (%)	Homo (%)	HWE (% fgdb)	FR (ml/hr.)	DP (^{0}L)	SR (min.)	W- pH	W- FAN (ppm)	W- BG** (ppm)
1	AVT-MB-TS-6	DWRB-235	87.3 (78.1-91.2)	47.4 (32.0-57.3)	84.8 (65.6-98.6)	77.4 (73.0-82.7)	245 (180-325)	93.2 (79.4-119.0)	5 (5.0-5.0)	5.6 (5.5-5.7)	162.7 (130-189)	1304.4 (1213-1396)
2	AVT-MB-TS-5	DWRB-238	88.2 (85.8-89.6)	63.4 (52.0-75.2)	97.6 (96.3-99.2)	79 (75.5-82.5)	236.7 (200-280)	113.1 (106.4-119.0)	7.5 (5.0-10.0)	5.7 (5.7-5.8)	196.9 (77-219)	638.8 (619-659)
3	AVT-MB-TS-4	RD-3064	88.5 (86.6-90.3)	55.1 (45.8-63.2)	87.6 (77.3-94.6)	77.5 (74.6-81.0)	240 (155-275)	110.4 (106.4-119.0)	5 (5.0-5.0)	5.7 (5.6-5.8)	162.7 (142-182)	854.0 (468-1240)
4	AVT-MB-TS-3	DWRUB-52 ©	88.0 (86.2-90.1)	61.9 (51.9-73.1)	96.3 (92.9-99.0)	77.9 (74.6-84.3)	223.3 (190-260)	89 (61.0-106.4)	8.3 (5.0-10.0)	5.6 (5.1-5.7)	189.9 (172-221)	927.2 (665-1190)
5	AVT-MB-TS-7	DWRB-137 ©*	88.1 (84.9-90.4)	55.3 (48.0-62.2)	82.5 (88.0-92.3)	75.9 (72.0-80.0)	253.3 (225-265)	110.4 (106.4-116.3)	6.7 (5.0-10.0)	5.8 (5.8-5.9)	156.1 (135-187)	553.3 (529-578)
6	AVT-MB-TS-2	DWRB-182 ©	88.5 (86.9-91.1)	64.3 (55.8-69.5)	90.5 (80.4-96.1)	76.8 (71.8-80.8)	280 (240-310)	113.5 (106.4-122.0)	5.8 (5.0-10.0)	5.8 (5.7-5.9)	160.3 (136-178)	699.8 (493-907)
7	AVT-MB-TS-1	RD-2849 ©	88.2 (86.1-90.5)	60.3 (50.8-72.0)	95.4 (90.9-98.5)	77.8 (73.3-83.3)	207.5 (175-230)	96.2 (79.4-119.0)	5 (5.0-5.0)	5.7 (5.6-5.8)	196.0 (172-236)	1026.2 (875-117)
Overall			**88.1 (78.1-91.2)**	**58.3 (32.0-75.2)**	**90.7 (65.6-99.2)**	**78.7 (71.8-84.3)**	**240.8 (155-325)**	**103.7 (61.0-122.0)**	**6.2 (5.0-10.0)**	**5.7 (5.1-5.9)**	**174.9 (77.0-236.0)**	**857.7 (468-1396)**

**Six row; **Two location only; range in brackets; (MY: Malt Yield; Fraib: Friability; Homo: Homogeneity; HWE: Hot Water Extract; FR: Filtration rate; DP: Diastatic Power; SR: Saccharification Rate; W—pH: Wort pH; KI: Kolbach Index; W-FAN: Wort Free Amino Nitrogen; W-BG: Wort Beta Glucan)*

Table 5.5a. Variability in grain quality of IVT malt barley entries.

S.N.	Code	Genotype	TGW (g)	Test Wt. (kg/hl)	Bold (%)	Thin (%)	GER (%)	Protein (%)	Husk (%)	BG (%)**	Moisture %	Starch %
1	IVT-MB-TS-14	BH-1055	51.6 (48.0-55.6)	64.3 (56.7-67.9)	94.3 (92.7-96.7)	1.2 (0.4-2.2)	100 (100-100)	11.6 (10.7-12.7)	12.5 (10.5-14.1)	5.7	9.5 (8.8-10.0)	62.2 (61.7-62.9)
2	IVT-MB-TS-12	BH-1056	53.0 (48.7-58.2)	63.9 (59.3-68.6)	95.1 (92.6-98.0)	0.9 (0.4-1.5)	99 (97-100)	11.2 (9.1-12.9)	11.8 (10.2-13.6)	6.7	9.6 (8.4-10.2)	63.0 (62.3-63.9)
3	IVT-MB-TS-13	BH-1057	48.6 (41.9-54.0)	66.4 (62.8-71.9)	86.2 (72.3-96.3)	3.0 (0.5-8.7)	99.2 (98-100)	12.2 (9.2-16.0)	11.4 (9.5-12.7)	5.6	9.6 (9.1-9.9)	61.7 (59.0-63.8)
4	IVT-MB-TS-23	DWRB-2307	52.7 (49.3-58.1)	72.2 (60.8-71.0)	92.6 (91.2-94.1)	0.9 (0.5-1.6)	97.5 (90-100)	10.9 (8.9-14.5)	11.4 (9.7-13.1)	6.8	9.4 (8.7-9.7)	62.8 (60.6-63.7)
5	IVT-MB-TS-11	DWRB-2308	46.1 (41.5-50.9)	66.3 (62.1-70.2)	81.6 (66.6-94.1)	3.5 (0.6-9.8)	96.5 (89-100)	11.8 (9.3-16.2)	11.2 (9.2-13.1)	5.4	9.5 (8.5-10.2)	62.3 (59.5-64.7)
6	IVT-MB-TS-5	DWRB-2309	48.8 (45.1-53.1)	67.4 (63.2-70.3)	87.9 (83.0-95.4)	2.0 (0.4-3.6)	99.2 (96-100)	11.3 (9.6-13.7)	10.8 (8.9-13.1)	5.5	9.5 (8.3-10.2)	63.2 (61.6-64.5)
7	IVT-MB-TS-15	DWRB-2310	47.5 (42.2-54.2)	70.0 (65.1-72.5)	89.1 (84.4-97.4)	2.0 (0.5-3.3)	98.7 (97-100)	12.0 (8.5-14.4)	10.8 (9.0-12.2)	5.7	9.7 (9.0-10.1)	62.6 (60.6-65.3)
8	IVT-MB-TS-8	DWRB-2311	49.9 (44.4-55.8)	68.6 (63.4-71.8)	89.3 (82.7-95.9)	2.0 (0.4-4.5)	96.0 (90-99)	10.7 (8.0-13.6)	11.4 (10.2-13.2)	5.4	9.5 (8.7-10.2)	63.4 (61.5-64.6)
9	IVT-MB-TS-17	DWRB-2312	49.9 (45.3-54.2)	65.8 (59.5-69.5)	92.4 (80.8-97.8)	1.5 (0.2-4.8)	96.5 (90-100)	11.9 (8.9-14.2)	11.7 (10.1-12.6)	7.1	9.4 (8.5-9.9)	62.9 (60.8-64.7)
10	IVT-MB-TS-9	PL-957	57.9 (49.9-64.0)	65.5 (62.4-67.6)	93.6 (90.6-98.5)	0.9 (0.2-1.3)	98.5 (95-100)	10.7 (7.6-14.3)	11.2 (10.1-13.3)	6.5	9.7 (8.9-10.1)	62.7 (60.5-64.1)
11	IVT-MB-TS-19	PL-958	49.4 (44.4-58.2)	66.7 (61.7-71.1)	84.9 (77.7-94.6)	2.5 (0.9-6.8)	98.2 (96-100)	10.5 (8.8-13.3)	11.7 (9.5-12.8)	5.5	9.4 (8.4-9.8)	63.1 (61.2-64.0)
12	IVT-MB-TS-1	PL-959	49.6 (43.9-55.1)	67.9 (63.9-71.0)	90.6 (80.1-94.6)	1.9 (0.8-3.8)	99.0 (96-100)	10.9 (9.3-15.3)	10.6 (9.3-12.1)	4.8	9.4 (8.7-10.0)	62.9 (60.1-64.7)
13	IVT-MB-TS-21	RD-3084	54.3 (49.4-61.3)	66.1 (64.1-68.9)	94.9 (93.3-97.3)	0.9 (0.3-1.5)	98.0 (96-100)	10.8 (9.1-12.7)	10.9 (7.6-13.5)	4.0	9.6 (8.4-10.1)	62.8 (61.1-64.3)
14	IVT-MB-TS-10	RD-3085	48.8 (41.2-53.9)	64.3 (59.1-69.8)	85.4 (68.0-96.0)	3.0 (0.5-8.7)	98.3 (97-100)	11.5 (9.5-13.9)	11.9 (9.7-13.6)	5.5	9.5 (8.4-10.0)	62.0 (59.7-64.0)
15	IVT-MB-TS-22	RD-3086	48.0 (44.9-50.4)	65.4 (59.9-69.6)	84.3 (74.1-94.7)	3.3 (0.6-5.1)	98.3 (96-100)	11.2 (8.7-14.9)	11.8 (8.6-15.1)	6.0	9.5 (8.8-10.0)	62.0 (59.9-63.4)
16	IVT-MB-TS-6	RD-3087	54.8 (51.8-60.0)	65.5 (62.2-69.8)	95.9 (92.7-98.0)	0.7 (0.2-1.3)	99.0 (96-100)	12.7 (9.9-15.1)	11.6 (9.2-14.0)	5.2	9.8 (8.7-10.4)	61.8 (60.2-63.1)
17	IVT-MB-TS-3	RD-3105	50.8 (46.0-60.9)	65.2 (61.2-67.7)	93.8 (86.8-98.2)	1.1 (0.2-3.3)	98.5 (97-100)	10.4 (8.1-12.5)	11.6 (9.4-14.2)	3.8	9.4 (8.7-9.8)	63.4 (61.7-65.0)
18	IVT-MB-TS-16	RD-3106	58.5 (48.2-67.1)	64.5 (58.6-67.7)	94.2 (89.5-99.2)	0.7 (0.2-1.4)	96.8 (90-100)	13.0 (10.0-14.5)	11.7 (10.0-13.6)	5.5	9.6 (8.8-10.2)	60.9 (59.8-61.6)
19	IVT-MB-TS-18	RD-3107	57.5 (53.3-63.4)	64.7 (60.1-67.6)	96.6 (94.7-98.9)	0.5 (0.2-0.9)	99.0 (96-100)	13.5 (10.8-15.5)	10.9 (8.7-12.3)	5.1	9.5 (8.5-10.1)	61.6 (60.6-63.3)
20	IVT-MB-TS-24	UPB-1124	48.2 (44.9-52.1)	68.5 (63.8-71.7)	90.8 (85.7-96.4)	1.5 (0.6-2.5)	99.0 (97-100)	11.2 (9.4-14.0)	10.7 (8.1-11.9)	5.5	9.3 (8.7-9.7)	63.8 (61.4-65.3)
21	IVT-MB-TS-25	UPB-1125	48.0 (41.2-52.2)	66.3 (62.0-69.6)	73.5 (54.3-82.0)	4.6 (1.6-13.7)	98.0 (95-100)	11.7 (9.1-15.8)	11.9 (10.4-12.7)	7.3	9.1 (7.8-9.6)	62.4 (58.9-64.2)
22	IVT-MB-TS-7	DWRUB-52 ©	46.4 (42.8-51.4)	67.5 (60.3-72.2)	81.3 (66.7-94.6)	3.6 (1.3-10.3)	97.8 (96-100)	11.1 (8.4-14.1)	10.9 (7.8-12.4)	5.3	9.3 (8.3-9.7)	63.1 (60.8-64.8)
23	IVT-MB-TS-4	DWRB-137 ©*	46.8 (39.1-55.6)	62.5 (59.2-66.1)	86.4 (70.6-95.8)	3.3 (1.0-7.4)	95.8 (90-98)	10.2 (8.6-12.0)	12.2 (8.4-16.9)	4.7	9.6 (8.6-10.0)	62.2 (60.9-64.0)
24	IVT-MB-TS-2	DWRB-182 ©	42.3 (36.5-49.1)	65.0 (55.5-71.0)	78.9 (64.8-95.6)	5.5 (0.5-13.2)	97.5 (93-100)	11.6 (7.9-14.5)	12.7 (10.4-14.9)	4.2	9.5 (8.3-10.2)	62.7 (60.6-64.7)
25	IVT-MB-TS-20	RD-2849 ©	48.3 (44.3-53.3)	67.5 (63.3-71.4)	87.3 (78.7-95.7)	1.8 (0.5-4.7)	97.7 (94-100)	11.0 (8.2-15.0)	11.1 (9.2-13.9)	4.3	9.1 (7.8-9.7)	63.2 (60.5-66.0)
Overall			**50.3 (36.5-67.1)**	**66.3 (55.5-72.5)**	**88.8 (54.3-99.2)**	**2.1 (0.2-13.7)**	**98.1 (89-100)**	**11.4 (7.6-16.2)**	**11.5 (7.6-16.9)**	**5.5 (3.8-7.1)**	**9.5 (7.8-10.4)**	**62.6 (58.9-66.0)**

**Six row barley; **One location; values are mean across the locations; range in brackets; (TGW: Thousand Grain Weight; Bold : Bold Grain; Thin: Thin Grain; GER: Germinative Energy; BG: Beta Glucan)*

Table 5.5b. Variability in malt quality of IVT malt barley entries.

S.N.	Code	Entry	MY (%)	Friab (%)	Homo (%)	HWE (% fgdb)	FR (ml/hr.)	DP (^{0}L)	SR (min.)	W- pH	W- FAN	W- BG** (ppm)
1	IVT-MB-TS-14	BH-1055	88.2 (87.0-90.1)	40.7 (36.8-46.3)	66.5 (59.0-74.6)	74.1 (68.8-73.1)	171.7 (140-195)	108.7 (96.2-116.3)	5.0 (5.0-5.0)	5.7 (5.6-5.9)	161.9 (116-208)	1188
2	IVT-MB-TS-12	BH-1056	88.6 (86.7-90.1)	46.3 (45.0-47.9)	79.0 (78.7-79.5)	75.7 (72.9-80.3)	196.7 (180-205)	109.9 (102-119)	5.0 (5.0-5.0)	5.7 (5.7-5.8)	168.9 (156-189)	916
3	IVT-MB-TS-13	BH-1057	87.6 (86.6-88.3)	55.1 (52.6-57.0)	94.6 (92.6-96.8)	73.6 (71.8-74.7)	181.7 (145-210)	101.0 (75.8-116.3)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	169.7 (159-191)	741
4	IVT-MB-TS-23	DWRB-2307	88.7 (87.6-89.8)	47.7 (41.0-53.7)	89.3 (84.7-94.0)	73.7 (72.9-74.9)	186.7 (135-225)	113.7 (100-122)	5.0 (5.0-5.0)	5.8 (5.6-5.9)	162.8 (138-180)	756
5	IVT-MB-TS-11	DWRB-2308	87.3 (86.1-89.4)	56.5 (51.2-62.1)	96.9 (94.3-98.3)	76.8 (73.3-81.3)	186.7 (130-255)	101.0 (62.1-122.0)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	157.4 (138-191)	803
6	IVT-MB-TS-5	DWRB-2309	87.7 (85.0-89.1)	55.0 (52.2-57.3)	93.7 (91.3-95.8)	73.0 (69.6-76.0)	188.3 (120-280)	112.2 (106.4-119.0)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	178.3 (155-191)	680
7	IVT-MB-TS-15	DWRB-2310	88.2 (87.0-89.3)	43.7 (39.9-48.3)	86.4 (85.3-88.4)	72.7 (71.1-74.3)	166.7 (160-175)	100.1 (82.0-116.3)	10.0 (10.0-10.0)	5.7 (5.6-5.8)	179.5 (169-206)	904
8	IVT-MB-TS-8	DWRB-2311	89.2 (87.7-91.0)	49.7 (43.3-54.9)	87.6 (85.1-90.3)	75.6 (74.8-77.0)	213.3 (185-265)	98.7 (98.0-100.0)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	179.0 (165-201)	617
9	IVT-MB-TS-17	DWRB-2312	87.6 (86.0-88.8)	59.6 (48.1-65.9)	95.8 (91.1-98.7)	77.4 (74.1-81.2)	195 (175-215)	104.1 (98.0-116.3)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	156.8 (133-171)	813
10	IVT-MB-TS-9	PL-957	87.4 (85.7-89.1)	52.1 (46.8-60.5)	91.1 (89.0-92.9)	73.1 (70.3-75.0)	196.7 (160-220)	100.9 (87.7-108.7)	6.7 (5.0-10.0)	5.8 (5.6-5.8)	163.5 (152-180)	1037
11	IVT-MB-TS-19	PL-958	87.6 (86.5-88.7)	59.4 (56.1-65.7)	95.6 (94.4-96.7)	74.4 (72.0-76.3)	183.3 (165-205)	97.6 (86.2-108.7)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	184.1 (166-205)	764
12	IVT-MB-TS-1	PL-959	86.9 (85.1-87.8)	64.5 (52.3-73.7)	95.2 (87.4-99.4)	77.4 (76.1-79.5)	180 (145-205)	109.5 (108.7-111.1)	8.3 (5.0-10.0)	5.8 (5.7-5.9)	160.7 (152-170)	627
13	IVT-MB-TS-21	RD-3084	87.2 (84.8-89.2)	61.5 (56.5-64.1)	99.1 (98.8-99.2)	76.3 (71.0-81.8)	161.7 (125-200)	106.9 (98.0-116.3)	8.3 (5.0-10.0)	5.6 (5.6-5.8)	142.8 (119-175)	359
14	IVT-MB-TS-10	RD-3085	86.3 (84.8-87.9)	64.1 (61.5-66.7)	97.1 (95.2-99.5)	74.4 (72.1-78.2)	188.3 (135-220)	110.8 (94.3-119)	8.3 (5.0-10.0)	5.7 (5.6-5.8)	188.9 (179-197)	526
15	IVT-MB-TS-22	RD-3086	87.5 (86.8-88.8)	49.0 (46.6-52.2)	71.2 (67.3-76.3)	70.7 (67.5-74.6)	175 (140-210)	105.3 (83.3-116.3)	5.0 (5.0-5.0)	5.8 (5.7-5.9)	168.8 (138-205)	945
16	IVT-MB-TS-6	RD-3087	87.0 (85.8-88.9)	58.3 (54.1-61.3)	92.4 (84.3-97.3)	70.0 (69.0-71.1)	221.7 (205-235)	110.3 (108.7-111.1)	8.3 (5.0-10.0)	5.7 (5.6-5.9)	162.1 (160-165)	364
17	IVT-MB-TS-3	RD-3105	87.1 (84.9-89.2)	71.7 (63.8-78.5)	99.5 (99.4-99.7)	73.4 (71.2-76.2)	235 (185-285)	104.8 (96.2-122)	5.0 (5.0-5.0)	5.7 (5.6-5.9)	154.3 (123-193)	94
18	IVT-MB-TS-16	RD-3106	87.7 (85.1-88.8)	49.2 (43.5-54.1)	90.2 (88.3-94.0)	72.9 (72.2-73.5)	130 (100-175)	105.1 (98.0-116.3)	5.0 (5.0-5.0)	5.6 (5.4-5.8)	156 (138-170)	972
19	IVT-MB-TS-18	RD-3107	87.6 (85.9-89.0)	58.1 (50.3-62.2)	96.5 (93.0-99.2)	73.7 (73.1-75.0)	205 (185-235)	110.2 (100-122)	6.7 (5.0-10.0)	5.8 (5.6-5.9)	146 (111-172)	908
20	IVT-MB-TS-24	UPB-1124	87.2 (86.3-88.7)	56.3 (51.6-58.7)	91.7 (87.7-94.5)	74.4 (74.2-74.6)	171.7 (165-175)	104.0 (89.3-116.3)	5.0 (5.0-5.0)	5.7 (5.6-5.8)	152 (129-187)	840
21	IVT-MB-TS-25	UPB-1125	88.0 (87.1-89.4)	40.7 (37.0-46.7)	73.6 (67.9-83.1)	71.4 (68.1-74.6)	103.3 (75-120)	103.5 (100-106.4)	6.7 (5.0-10.0)	5.7 (5.6-5.8)	181.6 (166-207)	1472
22	IVT-MB-TS-7	DWRUB-52 ©	88.3 (86.7-90.3)	54.0 (47.3-59.9)	96.1 (93.1-97.9)	73.0 (71.6-75.4)	171.7 (115-225)	106.4 (104.2-108.7)	5.0 (5.0-5.0)	5.7 (5.6-5.8)	156.4 (139-172)	604
23	IVT-MB-TS-4	DWRB-137 ©*	88.8 (88.6-89.1)	46.7 (34.2-59.1)	72.5 (54.7-91.0)	70.6 (67.6-72.5)	193.3 (180-215)	105.1 (98.0-108.7)	6.7 (5.0-10.0)	5.9 (5.8-6.0)	162.5 (145-189)	429
24	IVT-MB-TS-2	DWRB-182 ©	87.4 (85.9-88.4)	59.3 (57.9-60.5)	86.9 (82.5-89.3)	71.9 (66.2-77.1)	241.7 (230-255)	117.5 (108.7-122.0)	5.0 (5.0-5.0)	5.8 (5.7-5.9)	145.9 (123-161)	516
25	IVT-MB-TS-20	RD-2849 ©	88.2 (86.8-89.8)	53.8 (48.6-59.8)	95.2 (91.7-97.1)	74.9 (70.7-78.7)	163.3 (105-210)	98.1 (74.6-111.1)	8.3 (5.0-10.0)	5.6 (5.6-5.7)	184.5 (174-200)	1069
			87.7 (84.8-91.0)	**54.1 (34.2-78.5)**	**89.3 (54.7-99.7)**	**73.7 (66.2-81.8)**	**184.3 (75-285)**	**105.8 (62.1-122.0)**	**6.5 (5.0-10.0)**	**5.7 (5.4-6.0)**	**165 (111-208)**	**757.8**

**Six row barley; **One location; range in brackets; (MY: Malt Yield; Fraib: Friability; Homo: Homogeneity; HWE: Hot Water Extract; FR: Filtration rate; DP: Diastatic Power; SR: Saccharification Rate; W—pH: Wort pH; W-FAN: Wort Free Amino Nitrogen; W-BG: Wort Beta Glucan)*

Table 5.6. Weighted performances of AVT entries for malting quality.

S.N.	Code	Entry	HW	Bold	Husk	Pro	BG**	Fria	HWE	FR	DP	FAN	WBG**	Total (33)
1	AVT-MB-TS-6	DWRB-235	3	3	2	2	0	0	1	2	3	3	0	**19**
2	AVT-MB-TS-5	DWRB-238	3	3	1	2	0	1	2	2	3	3	0	**20**
3	AVT-MB-TS-4	RD-3064	2	2	2	2	0	0	1	2	3	3	0	**17**
4	AVT-MB-TS-3	DWRUB-52 ©	3	0	2	2	0	1	1	2	2	3	0	**16**
5	AVT-MB-TS-7	DWRB-137 ©*	2	3	2	2	0	0	1	3	3	3	0	**19**
6	AVT-MB-TS-2	DWRB-182 ©	2	0	1	2	2	1	1	3	3	3	0	**18**
	AVT-MB-TS-1	RD-2849 ©	3	1	1	2	0	1	1	2	3	3	0	**17**

*Six row; **Two location only

Score range

HW	(Two Row): <61=0, 61.0- 63=1, 64.0-65.0=2, >65.0=3	(Six Row): <60=0, 60.0- 62.0=1, 63.0-64.0.0=2, >64.0=3
Bold	(Two-Row): >90.0=3, 88.0-90.0=2, 85.0-87.0=1, <85.0=0	(Six-row): >80= 3, 78.0-80.0=2, 76.0-77.0=1, <76=0
Husk	<10.5=3, 10.6-11.5=2, 11.6-12.5=1, >12.5=0	
Protein	<10.0=1, 10.0-11.0=2, 12-13=3 14=2, >14.0=1	
B. glucan	<3.5=3, 3.5 - 4.5.0=2,4.6-5.0=1,>5.0=0	
Friability	>70=3, 66-70=2, 60-65=1, <60=0	
HWE	Two-row: >80.0=3, 79-80=2, 76-78=1, <76=0	Six-row: >78=3, 77-78=2, 74-76=1, <74=0
FR	>250=3, 201-250=2, 150-200=1, <150=0	
DP	>90=3, 81-90=2, 70-80=1, <70=0	
KI	40-45 = 3, 38-39 & 46-48=2, 35-37=1, <35 & >48=0	
WBG	<300=3, 301-350=2, 351-400=1, >400=0	
FAN	>150=3, 126-150=2, 100-125=1, <100=0	

TW= Hectoliter Weight/Test weight, Bold= Bold grain, Husk= Husk (%), Pro= Protein % dwb, BG= B-glucan, HWE= Hot water extract (%), FR= Filtration rate (ml/hr.), DP= Diastatic power (^{0}L), KI= Kolbach index (%), WBG=Wort Beta Glucan, FAN=Free Amino Nitrogen

Table 5.7. Weighted performances of IVT entries for malting quality.

S.N.	Code	Entry	HW	Bold	Husk	Pro	BG**	Fria	HWE	FR	DP	FAN	WBG**	Total (33)
1	IVT-MB-TS-14	BH-1055	2	3	1	2	0	0	0	1	3	3	0	**15**
2	IVT-MB-TS-12	BH-1056	2	3	1	2	0	0	0	1	3	3	0	**15**
3	IVT-MB-TS-13	BH-1057	3	1	2	3	0	0	0	1	3	3	0	**16**
4	IVT-MB-TS-23	DWRB-2307	3	3	2	2	0	0	0	1	3	3	0	**17**
5	IVT-MB-TS-11	DWRB-2308	3	0	2	2	0	0	1	1	3	3	0	**15**
6	IVT-MB-TS-5	DWRB-2309	3	1	2	2	0	0	0	1	3	3	0	**15**
7	IVT-MB-TS-15	DWRB-2310	3	2	2	3	0	0	0	1	3	3	0	**17**
8	IVT-MB-TS-8	DWRB-2311	3	2	2	2	0	0	0	2	3	3	0	**17**
9	IVT-MB-TS-17	DWRB-2312	3	3	1	2	0	0	1	1	3	3	0	**17**
10	IVT-MB-TS-9	PL-957	3	3	2	2	0	0	0	1	3	3	0	**17**
11	IVT-MB-TS-19	PL-958	3	0	1	2	0	0	0	1	3	3	0	**13**
12	IVT-MB-TS-1	PL-959	3	3	2	2	1	1	1	1	3	3	0	**20**
13	IVT-MB-TS-21	RD-3084	3	3	2	2	2	1	1	1	3	2	1	**21**
14	IVT-MB-TS-10	RD-3085	2	1	1	2	0	1	0	1	3	3	0	**14**
15	IVT-MB-TS-22	RD-3086	3	0	1	2	0	0	0	1	3	3	0	**13**
16	IVT-MB-TS-6	RD-3087	3	3	1	3	0	0	0	2	3	3	1	**19**
17	IVT-MB-TS-3	RD-3105	3	3	1	2	2	3	0	2	3	3	3	**25**
18	IVT-MB-TS-16	RD-3106	2	3	1	3	0	0	0	0	3	3	0	**15**
19	IVT-MB-TS-18	RD-3107	2	3	2	3	0	0	0	2	3	2	0	**17**
20	IVT-MB-TS-24	UPB-1124	3	3	2	2	0	0	0	1	3	3	0	**17**
21	IVT-MB-TS-25	UPB-1125	3	0	1	2	0	0	0	0	3	3	0	**12**
22	IVT-MB-TS-7	DWRUB-52 ©	3	0	2	2	0	0	0	1	3	3	0	**14**
23	IVT-MB-TS-4	DWRB-137 ©*	1	3	1	2	1	0	0	1	3	3	0	**15**
24	IVT-MB-TS-2	DWRB-182 ©	3	0	0	2	2	0	0	2	3	2	0	**14**
25	IVT-MB-TS-20	RD-2849 ©	3	1	2	2	2	0	0	1	3	3	0	**17**

*=Six- row barley; ** One locations only

Score range

HW	(Two Row): <61=0, 61.0- 63=1, 64.0-65.0=2, >65.0=3	(Six Row): <60=0, 60.0- 62.0=1, 63.0-64.0.0=2, >64.0=3
Bold	(Two-Row): >90.0=3, 88.0-90.0=2, 85.0-87.0=1, <85.0=0	(Six-row): >80= 3, 78.0-80.0=2, 76.0-77.0=1, <76=0
Husk	<10.5=3, 10.6-11.5=2, 11.6-12.5=1, >12.5=0	
Protein	<10.0=1, 10.0-11.0=2, 12-13=3 14=2, >14.0=1	
Berta glucan	<3.5=3, 3.5 - 4.5.0=2,4.6-5.0=1,>5.0=0	
Friability	>70=3, 66-70=2, 60-65=1, <60=0	
HWE	Two-row: >80.0=3, 79-80=2, 76-78=1, <76=0	Six-row: >78=3, 77-78=2, 74-76=1, <74=0
FR	>250=3, 201-250=2, 150-200=1, <150=0	
DP	>90=3, 81-90=2, 70-80=1, <70=0	
KI	40-45 = 3, 38-39 & 46-48=2, 35-37=1, <35 & >48=0	
WBG	<300=3, 301-350=2, 351-400=1, >400=0	
FAN	>150=3, 126-150=2, 100-125=1, <100=0	

TW= Hectoliter Weight/Test weight, Bold= Bold grain, Husk= Husk (%), Pro= Protein % dwb, BG= B- glucan, HWE= Hot water extract (%), FR= Filtration rate (ml/hr.), DP= Diastatic power (^{0}L), KI= Kolbach index (%), WBG=Wort Beta Glucan, FAN=Free Amino Nitrogen

Annexure - 1

ANALYTICAL GUIDELINES FOR BARLEY BREEDERS IN INDIA
(Revised on 22.06.2020)

S.N.	Parameter	Desirable Values	
		Two Row	**Six Row**
GRAIN PARAMETERS			
1	Moisture (%)	<12.0	<12.0
2	Hectoliter Weight (kg/hl)	> 65.0	> 62.0
3	Kernel Size Bold (On 2.5 mm) Thin (Through 2.2mm)	Uniform plump >90% <3%	Uniform plump >80% <5%
4	1000 grain weight(g)	42-46	40-46
5	Husk Content	<11.0%	<11.0%
6	Protein Content (dry weight basis)	9.0-13%	9.0-13%
7	Germination Capacity (%)	>96%	>96%
8	Germinative Energy (72hrs) (%)	>96%	>96%
9	β-glucan (dry weight basis)	<4.0%	<4.0%
MALT PARAMETERS			
7.	Malt Homogeneity	>90%	>90%
8.	Malt Friability	>70.0	>65.0
9.	Total Protein (dry weight basis)	4-5 %	4-5 %
10.	Soluble/ total Protein (S/T) Ratio (Kolbach Index)	40-45%	40-45%
11.	Malt Extract (minimum) (fgdb)	>80.0%	>78.0
12.	Wort Viscosity	<1.500 mPas	<1.500 mPas
13.	Wort turbidity	Clear	Clear
14.	Diastatic Power (^{0}L)	>90	>90
15.	Wort β-glucan (ppm)	<300 ppm	<300 ppm
16.	FAN (ppm)	>150 ppm	>150 ppm

PARAMETERS & WEIGHTAGE/SCORE FOR SELECTION OF PROMISING MALT BARLEY GENOTYPES (BOTH SIX & TWO ROW Type) IN INDIA (Revised on 22.06.2020)

S. No.	Parameter	Range (Score/ weight age)	
		Two Row	Six Row
	GRAIN PARAMETERS		
1.	**Test weight / Hectoliter weight (kg/hl)**	<61=0 61.0- 63.0=1 64.0-65.0=2, >65.0=3	<60=0 60.0- 62.0=1 63.0-64.0.0=2, >64.0=3
2	**Bold grains (%) Grains retained on 2.5 mm screen**	>90.0=3 88.0-90.0=2 85.0-87.0=1 <85.0=0	>80= 3 78.0-80.0=2 76.0-77.0=1 <76=0
3.	**Protein content (% dwb)**	<10.0=1 10.0-11.0=2 12-13=3 14=2 >14.0=1	<10.0=1 10.0-11.0=2 12-13=3 14=2 >14.0=1
4.	**Husk content (%dwtb)**	<10.5=3 10.6-11.5=2 11.6-12.5=1 >12.5=0	<10.5=3 10.6-11.5=2 11.6-12.5=1 >12.5=0
5.	**Grain β- glucan content (%dwtb)**	<3.5=3 3.5 - 4.5.0=2 4.6-5.0=1 >5.0=0	<3.5=3 3.5 - 4.5.0=2 4.6-5.0=1 >5.0=0
	MALT PARAMETERS		
6.	**Malt Friability (%)**	>70=3 66-70=2 60-65=1 <60=0	>70=3 65-70=2 60-66=1 <60=0
7.	**Filtration rate (ml/hr)**	>250=3 201-250=2 150-200=1 <150=0	>250=3 201-250=2 150-200=1 <150=0
8.	**Hot Water Extract (fine grind dry weight basis)**	>80.0=3 79-80=2 76-78=1, <76=0	>78=3 77-78=2 74-76=1 <74=0
9.	**Diastatic Power(^{o}L)**	>90=3 81-90=2 70-80=1 <70=0	>90=3 81-90=2 70-80=1 <70=0
10.	**Wort β- glucan content (ppm)**	<300 = 3 300-350= 2 351-400 = 1 >400 = 0	<300 = 3 300-350= 2 351-400 = 1 >400 = 0
11.	**Free Amino Nitrogen (FAN content in ppm)**	>150 = 3 126-150 = 2 100-125 = 1 < 100 = 0	>150 = 3 126-150 = 2 100-125 = 1 < 100 = 0
12.	**Wort Viscosity (mPas)**	<1.500 = 3 1.501-1.550 =2 1.550-1.600 = 1 >1.600=0	<1.500 = 3 1.501-1.550 =2 1.550-1.600 = 1 >1.600=0
13.	**Kolbach index (%)**	40-45 = 3 38-39 & 46-48=2 35-37=1 <35 & >48=0	40-45 = 3 38-39 & 46-48=2 35-37=1 <35 & >48=0

** Finalized in first meeting of the "NATIONAL CORE GROUP ON MALT BARLEY DEVELOPMENT" at DWR, Karnal on 12 Dec., 1995 and revised during the annual workshop at IARI, New Delhi in August 2004 and further on 05.03.2016 at ICAR-IIWBR, Karnal. Latest revision on 22.06.2020.*

Annexure 2: AVT-TS-NWPZ-MALT BARLEY
GRAIN PARAMETERS

Table 5.2.1. Thousand grain weight (g) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	47.2	55.8	43.4	52.4	55.9	47.9	**50.4**
2	AVT-MB-TS-5	DWRB-238	50.7	53.8	48.9	50.7	56.8	49.8	**51.8**
3	AVT-MB-TS-4	RD-3064	55.2	52.1	42.2	62.5	67.7	50.6	**55.1**
4	AVT-MB-TS-3	DWRUB-52 ©	46.8	40.1	43.4	51.4	55.1	46.1	**47.1**
5	AVT-MB-TS-7	DWRB-137 ©*	44.0	43.3	44.5	46.6	55.2	41.8	**45.9**
6	AVT-MB-TS-2	DWRB-182 ©	40.4	45.8	40.9	46.1	50.6	38.6	**43.7**
7	AVT-MB-TS-1	RD-2849 ©	51.1	44.4	44.9	50.0	55.1	45.7	**48.5**
Average			**47.9**	**47.9**	**44.0**	**51.4**	**56.6**	**45.8**	**48.9**

**Six row*

Table 5.2.2: Test weight (kg/hl) of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	64.6	70.7	72.0	66.5	71.7	66.1	**68.6**
2	AVT-MB-TS-5	DWRB-238	60.4	68.6	67.9	63.5	70.1	63.7	**65.7**
3	AVT-MB-TS-4	RD-3064	61.6	63.2	61.9	64.9	68.8	64.1	**64.1**
4	AVT-MB-TS-3	DWRUB-52 ©	64.8	68.2	68.4	66.5	72.7	66.3	**67.8**
5	AVT-MB-TS-7	DWRB-137 ©*	60.7	63.2	64.4	61.3	66.9	62.7	**63.2**
6	AVT-MB-TS-2	DWRB-182 ©	57.7	64.6	63.3	65.3	70.2	63.5	**64.1**
7	AVT-MB-TS-1	RD-2849 ©	64.0	69.1	69.7	66.2	72.7	66.2	**68.0**
Average			**62.0**	**66.8**	**66.8**	**64.9**	**70.4**	**64.7**	**65.9**

**Six row*

Table 5.2.3: Proportion of bold grains (%) of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	87.2	96.4	89.2	95.0	94.9	85.7	**91.4**
2	AVT-MB-TS-5	DWRB-238	96.7	92.3	97.3	95.2	98.6	92.0	**95.4**
3	AVT-MB-TS-4	RD-3064	88.6	79.0	79.5	96.1	98.4	87.0	**88.1**
4	AVT-MB-TS-3	DWRUB-52 ©	85.4	72.0	77.9	92.2	94.1	78.6	**83.3**
5	AVT-MB-TS-7	DWRB-137 ©*	88.6	81.4	86.7	88.9	95.0	82.3	**87.1**
6	AVT-MB-TS-2	DWRB-182 ©	68.7	76.3	87.8	88.7	93.6	69.3	**80.7**
7	AVT-MB-TS-1	RD-2849 ©	89.5	78.2	86.2	87.5	91.6	80.0	**85.5**
Average			**86.4**	**82.2**	**86.4**	**91.9**	**95.2**	**82.1**	**87.4**

**Six row*

Table 5.2.4: Proportion of thin grains (%) of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	2.5	0.3	1.8	0.7	0.7	2.9	1.5
2	AVT-MB-TS-5	DWRB-238	0.8	1.0	0.5	0.9	0.3	1.7	0.9
3	AVT-MB-TS-4	RD-3064	2.9	6.8	4.2	0.6	0.3	3.4	3.0
4	AVT-MB-TS-3	DWRUB-52 ©	2.3	6.9	2.4	0.8	0.7	3.4	2.7
5	AVT-MB-TS-7	DWRB-137 ©*	2.5	5.0	3.2	3.1	0.9	3.5	3.0
6	AVT-MB-TS-2	DWRB-182 ©	7.5	5.4	1.9	2.0	1.0	6.5	4.1
7	AVT-MB-TS-1	RD-2849 ©	0.9	6.2	1.7	1.8	1.5	2.7	2.5
Average			**2.8**	**4.5**	**2.2**	**1.4**	**0.8**	**3.5**	**2.5**

**Six row*

Table 5.2.5: Germinative energy (% 72hrs) of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	100.0	100.0	90.0	98.0	100.0	100.0	**98.0**
2	AVT-MB-TS-5	DWRB-238	96.0	100.0	100.0	94.0	98.0	98.0	**97.7**
3	AVT-MB-TS-4	RD-3064	100.0	100.0	96.0	96.0	94.0	100.0	**97.7**
4	AVT-MB-TS-3	DWRUB-52 ©	98.0	100.0	98.0	100.0	98.0	100.0	**99.0**
5	AVT-MB-TS-7	DWRB-137 ©*	98.0	100.0	92.0	90.0	100.0	98.0	**96.3**
6	AVT-MB-TS-2	DWRB-182 ©	96.0	100.0	100.0	100.0	100.0	100.0	**99.3**
7	AVT-MB-TS-1	RD-2849 ©	96.0	100.0	96.0	100.0	96.0	100.0	**98.0**
Average			**97.7**	**100.0**	**96.0**	**96.9**	**98.0**	**99.4**	**98.0**

**Six row*

Table 5.2.6: Protein content (%)# of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	12.4	11.7	12.7	10.0	11.7	11.1	**11.6**
2	AVT-MB-TS-5	DWRB-238	11.7	14.1	11.7	8.7	9.7	10.6	**11.1**
3	AVT-MB-TS-4	RD-3064	14.3	14.7	9.9	9.9	10.5	10.9	**11.7**
4	AVT-MB-TS-3	DWRUB-52 ©	11.5	14.3	9.5	8.7	10.1	10.8	**10.8**
5	AVT-MB-TS-7	DWRB-137 ©*	9.6	12.5	10.3	9.8	8.7	9.7	**10.1**
6	AVT-MB-TS-2	DWRB-182 ©	12.9	14.3	10.7	9.2	10.5	10.4	**11.3**
7	AVT-MB-TS-1	RD-2849 ©	11.4	13.6	12.3	9.3	10.7	10.4	**11.3**
Average			**12.0**	**13.6**	**11.0**	**9.4**	**10.3**	**10.6**	**11.1**

**Six row; # Predicted values through NIR*

Table 5.2.7: Husk content (%) of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	10.0	10.8	13.2	13.1	10.2	11.3	**11.4**
2	AVT-MB-TS-5	DWRB-238	10.6	10.8	12.3	13.2	10.2	12.4	**11.6**
3	AVT-MB-TS-4	RD-3064	8.5	10.8	13.2	13.3	9.4	11.1	**11.1**
4	AVT-MB-TS-3	DWRUB-52 ©	8.6	11.5	11.9	8.3	9.4	10.6	**10.1**
5	AVT-MB-TS-7	DWRB-137 ©*	11.7	12.8	13.4	5.5	10.2	12.1	**10.9**
6	AVT-MB-TS-2	DWRB-182 ©	11.9	13.2	13.6	13.0	10.5	12.0	**12.4**
7	AVT-MB-TS-1	RD-2849 ©	11.5	12.4	12.1	13.3	9.8	11.2	**11.7**
Average			**10.4**	**11.7**	**12.8**	**11.4**	**9.9**	**11.5**	**11.3**

**Six row*

Table 5.2.8: β--glucan content (% dwb) of AVT entries from different locations

S.N	Code	Entry	Karnal	Durgapura	Mean
1	AVT-MB-TS-6	DWRB-235	5.0	5.5	**5.2**
2	AVT-MB-TS-5	DWRB-238	6.8	5.6	**6.2**
3	AVT-MB-TS-4	RD-3064	5.9	6.6	**6.2**
4	AVT-MB-TS-3	DWRUB-52 ©	4.9	5.4	**5.1**
5	AVT-MB-TS-7	DWRB-137 ©*	5.4	5.5	**5.4**
6	AVT-MB-TS-2	DWRB-182 ©	3.9	4.6	**4.2**
7	AVT-MB-TS-1	RD-2849 ©	5.0	5.6	**5.3**
Average			**5.3**	**5.5**	**5.4**

**Six row*

Table 5.2.9: Moisture content in grains (%) # of AVT entries from different locations

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	8.7	10.0	9.8	10.2	8.2	9.6	**9.4**
2	AVT-MB-TS-5	DWRB-238	9.2	9.4	9.7	10.3	9.2	9.2	**9.5**
3	AVT-MB-TS-4	RD-3064	9.2	9.6	9.6	10.2	9.1	9.2	**9.5**
4	AVT-MB-TS-3	DWRUB-52 ©	8.9	10.0	10.0	9.6	8.7	9.2	**9.4**
5	AVT-MB-TS-7	DWRB-137 ©*	10.0	9.8	9.5	10.3	8.7	9.8	**9.7**
6	AVT-MB-TS-2	DWRB-182 ©	8.9	9.6	9.9	10.5	9.1	9.5	**9.6**
7	AVT-MB-TS-1	RD-2849 ©	9.2	9.6	10.3	10.1	8.8	8.9	**9.5**
Average			**9.2**	**9.7**	**9.8**	**10.2**	**8.8**	**9.3**	**9.5**

**Six row; # Predicted values through NIR*

Table 5.2.10: Starch content in grains (%dwt basis) # of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	62.7	62.9	62.6	63.9	63.7	62.5	**63.1**
2	AVT-MB-TS-5	DWRB-238	63.5	61.3	62.4	63.4	64.0	62.2	**62.8**
3	AVT-MB-TS-4	RD-3064	61.1	60.1	62.2	62.7	62.9	62.6	**61.9**
4	AVT-MB-TS-3	DWRUB-52 ©	63.4	60.9	63.7	64.7	64.8	63.2	**63.5**
5	AVT-MB-TS-7	DWRB-137 ©*	63.2	61.4	62.5	62.0	64.5	62.8	**62.7**
6	AVT-MB-TS-2	DWRB-182 ©	62.4	60.8	61.7	63.5	63.8	62.9	**62.5**
7	AVT-MB-TS-1	RD-2849 ©	63.5	61.4	62.3	63.6	65.1	63.6	**63.3**
Average			**62.8**	**61.3**	**62.5**	**63.4**	**64.1**	**62.8**	**62.8**

**Six row; # Predicted values through NIR*

MALT PARAMETERS

Table 5.2.11: Malt yield (%) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	78.1	88.5	89.0	88.5	91.2	88.5	**87.3**
2	AVT-MB-TS-5	DWRB-238	89.6	85.8	88.1	87.5	89.6	88.8	**88.2**
3	AVT-MB-TS-4	RD-3064	89.7	86.6	87.3	88.4	90.3	88.8	**88.5**
4	AVT-MB-TS-3	DWRUB-52 ©	90.1	86.2	86.5	87.2	89.5	88.3	**88.0**
5	AVT-MB-TS-7	DWRB-137 ©*	90.4	84.9	87.2	89.2	90.3	86.7	**88.1**
6	AVT-MB-TS-2	DWRB-182 ©	89.6	86.9	87.8	87.6	91.1	87.9	**88.5**
7	AVT-MB-TS-1	RD-2849 ©	89.4	86.1	87.4	87.4	90.5	88.4	**88.2**
Average			**88.1**	**86.4**	**87.6**	**88.0**	**90.3**	**88.2**	**88.1**

**Six row*

Table 5.2.12: Malt friability (%) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	45.7	57.4	41.5	50.8	32.0	57.3	**47.4**
2	AVT-MB-TS-5	DWRB-238	62.3	52.0	58.8	75.2	65.5	66.6	**63.4**
3	AVT-MB-TS-4	RD-3064	45.8	52.7	59.0	58.8	51.3	63.2	**55.1**
4	AVT-MB-TS-3	DWRUB-52 ©	59.6	51.9	70.7	73.1	53.0	63.2	**61.9**
5	AVT-MB-TS-7	DWRB-137 ©*	56.9	48.0	58.0	48.5	58.4	62.2	**55.3**
6	AVT-MB-TS-2	DWRB-182 ©	62.6	64.0	64.5	69.5	55.8	69.3	**64.3**
7	AVT-MB-TS-1	RD-2849 ©	63.2	50.8	57.8	72.0	54.5	63.7	**60.3**
Average			**56.6**	**53.8**	**58.6**	**64.0**	**52.9**	**63.7**	**58.3**

**Six row*

Table 5.2.13: Malt homogeneity (%) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	85.3	98.6	78.6	86.0	65.6	94.6	**84.8**
2	AVT-MB-TS-5	DWRB-238	98.0	97.3	96.3	99.2	98.2	96.6	**97.6**
3	AVT-MB-TS-4	RD-3064	77.3	86.6	85.0	90.8	91.2	94.6	**87.6**
4	AVT-MB-TS-3	DWRUB-52 ©	97.0	94.5	98.8	99.0	92.9	95.7	**96.3**
5	AVT-MB-TS-7	DWRB-137 ©*	81.5	83.7	83.5	68.0	86.0	92.3	**82.5**
6	AVT-MB-TS-2	DWRB-182 ©	89.2	96.0	88.6	92.8	80.4	96.1	**90.5**
7	AVT-MB-TS-1	RD-2849 ©	97.8	90.9	95.7	98.5	93.0	96.6	**95.4**
Average			**89.5**	**92.5**	**89.5**	**88.6**	**86.8**	**95.2**	**90.7**

**Six row*

Table 5.2.14: Hot water extract (% fgdb) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	77.7	73.0	82.7	79.4	73.9	77.4	**77.4**
2	AVT-MB-TS-5	DWRB-238	75.5	76.3	82.5	78.3	80.8	80.4	**79.0**
3	AVT-MB-TS-4	RD-3064	75.5	74.6	79.9	75.7	81.0	78.2	**77.5**
4	AVT-MB-TS-3	DWRUB-52 ©	74.7	74.6	76.5	75.9	84.3	81.4	**77.9**
5	AVT-MB-TS-7	DWRB-137 © *	80.0	72.0	78.2	78.4	73.7	73.0	**75.9**
6	AVT-MB-TS-2	DWRB-182 ©	71.8	76.8	NA	80.8	78.5	76.0	**76.8**
7	AVT-MB-TS-1	RD-2849 ©	74.2	79.3	73.3	83.3	77.2	79.8	**77.8**
Average			**75.6**	**75.2**	**78.8**	**78.8**	**78.5**	**78.0**	**77.5**

**Six row*

Table 5.2.15: Wort filtration rate (ml/hr) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	255.0	180.0	195.0	325.0	315.0	200.0	**245.0**
2	AVT-MB-TS-5	DWRB-238	205.0	235.0	280.0	275.0	200.0	225.0	**236.7**
3	AVT-MB-TS-4	RD-3064	275.0	250.0	260.0	270.0	155.0	230.0	**240.0**
4	AVT-MB-TS-3	DWRUB-52 ©	215.0	230.0	240.0	260.0	190.0	205.0	**223.3**
5	AVT-MB-TS-7	DWRB-137 ©*	265.0	260.0	225.0	265.0	245.0	260.0	**253.3**
6	AVT-MB-TS-2	DWRB-182 ©	305.0	310.0	295.0	280.0	250.0	240.0	**280.0**
7	AVT-MB-TS-1	RD-2849 ©	205.0	210.0	230.0	195.0	175.0	230.0	**207.5**
Average			**246.4**	**239.3**	**246.4**	**267.1**	**218.6**	**227.1**	**240.8**

**Six row*

Table 5.2.16: Diastatic power (^{0}L) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	79.4	119.0	89.3	89.3	94.3	87.7	93.2
2	AVT-MB-TS-5	DWRB-238	116.3	122.0	119.0	108.7	106.4	106.4	113.1
3	AVT-MB-TS-4	RD-3064	106.4	119.0	108.7	111.1	108.7	108.7	110.4
4	AVT-MB-TS-3	DWRUB-52 ©	98.0	106.4	86.2	86.2	61.0	96.2	89.0
5	AVT-MB-TS-7	DWRB-137 ©*	108.7	111.1	116.3	108.7	111.1	106.4	110.4
6	AVT-MB-TS-2	DWRB-182 ©	119.0	122.0	116.3	106.4	108.7	108.7	113.5
7	AVT-MB-TS-1	RD-2849 ©	79.4	104.2	119.0	94.3	82.0	98.0	96.2
Average			101.0	114.8	107.8	100.7	96.0	101.7	103.7

**Six row*

Table 5.2.17: Saccharification rate (minutes) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
2	AVT-MB-TS-5	DWRB-238	10.0	10.0	10.0	5.0	5.0	5.0	**7.5**
3	AVT-MB-TS-4	RD-3064	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
4	AVT-MB-TS-3	DWRUB-52 ©	10.0	5.0	10.0	10.0	5.0	10.0	**8.3**
5	AVT-MB-TS-7	DWRB-137 ©*	5.0	10.0	5.0	10.0	5.0	5.0	**6.7**
6	AVT-MB-TS-2	DWRB-182 ©	5.0	5.0	5.0	5.0	10.0	5.0	**5.8**
7	AVT-MB-TS-1	RD-2849 ©	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Average			**6.4**	**6.4**	**6.4**	**6.4**	**5.7**	**5.7**	**6.2**

**Six row*

Table 5.2.18: Wort Ph of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	5.6	5.6	5.6	5.7	5.5	5.7	**5.6**
2	AVT-MB-TS-5	DWRB-238	5.7	5.7	5.7	5.8	5.8	5.8	**5.7**
3	AVT-MB-TS-4	RD-3064	5.6	5.7	5.8	5.8	5.8	5.8	**5.7**
4	AVT-MB-TS-3	DWRUB-52 ©	5.1	5.7	5.7	5.7	5.7	5.7	**5.6**
5	AVT-MB-TS-7	DWRB-137 ©*	5.8	5.8	5.8	5.9	5.8	5.8	**5.8**
6	AVT-MB-TS-2	DWRB-182 ©	5.7	5.8	5.8	5.9	5.7	5.8	**5.8**
7	AVT-MB-TS-1	RD-2849 ©	5.6	5.7	5.7	5.8	5.6	5.7	**5.7**
Average			**5.6**	**5.7**	**5.7**	**5.8**	**5.7**	**5.8**	**5.7**

**Six row*

Table 5. 2.19: Wort FAN content (ppm) of AVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	AVT-MB-TS-6	DWRB-235	177	167	189	130	139	174	**162.7**
2	AVT-MB-TS-5	DWRB-238	207	203	219	185	177	191	**196.9**
3	AVT-MB-TS-4	RD-3064	145	182	180	153	142	173	**162.7**
4	AVT-MB-TS-3	DWRUB-52 ©	200	180	221	184	172	180	**189.4**
5	AVT-MB-TS-7	DWRB-137 ©*	154	153	187	135	146	162	**156.1**
6	AVT-MB-TS-2	DWRB-182 ©	158	163	178	136	152	175	**160.3**
7	AVT-MB-TS-1	RD-2849 ©	209	186	236	172	176	197	**196.0**
Average			**178.7**	**176.3**	**201.5**	**156.4**	**157.6**	**178.7**	**174.9**

**Six row*

Table 5.2.20: Wort β—Glucan Content (ppm) of AVT entries at one location.

S.N	Code	Entry	Karnal	Durgapura	Mean
1	AVT-MB-TS-6	DWRB-235	1213	1396	**1304.4**
2	AVT-MB-TS-5	DWRB-238	659	619	**638.8**
3	AVT-MB-TS-4	RD-3064	468	1240	**854.0**
4	AVT-MB-TS-3	DWRUB-52 ©	665	1190	**927.2**
5	AVT-MB-TS-7	DWRB-137 © *	529	578	**553.3**
6	AVT-MB-TS-2	DWRB-182 ©	493	907	**699.8**
7	AVT-MB-TS-1	RD-2849 ©	875	1177	**1026.2**
Average			**700.2**	**1015.1**	**857.7**

**Six row*

Annexure 3: IVT-TS-MALT BARLEY

GRAIN PARAMETERS

Table 5.3.1. Thousand grain weight (g) of IVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	IVT-MB-TS-14	BH-1055	50.7	50.4	48.0	55.6	55.2	49.9	51.6
2	IVT-MB-TS-12	BH-1056	49.6	53.4	48.7	58.2	56.2	52.3	53.0
3	IVT-MB-TS-13	BH-1057	50.6	43.2	41.9	53.5	54.0	48.1	48.6
4	IVT-MB-TS-23	DWRB-2307	49.9	52.9	49.3	54.7	58.1	50.9	52.7
5	IVT-MB-TS-11	DWRB-2308	45.0	41.5	43.0	50.8	50.9	45.1	46.1
6	IVT-MB-TS-5	DWRB-2309	46.6	49.3	45.1	50.9	53.1	48.1	48.8
7	IVT-MB-TS-15	DWRB-2310	47.5	47.2	42.2	49.8	54.2	44.4	47.5
8	IVT-MB-TS-8	DWRB-2311	51.8	48.1	44.4	51.7	55.8	47.9	49.9
9	IVT-MB-TS-17	DWRB-2312	45.3	49.7	48.5	54.2	54.2	47.5	49.9
10	IVT-MB-TS-9	PL-957	57.2	63.7	49.9	57.2	64.0	55.4	57.9
11	IVT-MB-TS-19	PL-958	49.0	44.4	45.9	51.3	58.2	47.4	49.4
12	IVT-MB-TS-1	PL-959	50.6	46.7	47.3	54.2	55.1	43.9	49.6
13	IVT-MB-TS-21	RD-3084	51.9	54.9	49.4	57.3	61.3	51.0	54.3
14	IVT-MB-TS-10	RD-3085	51.1	48.5	41.2	53.9	47.2	50.9	48.8
15	IVT-MB-TS-22	RD-3086	47.6	47.6	49.7	50.4	44.9	47.5	48.0
16	IVT-MB-TS-6	RD-3087	53.2	51.8	52.6	60.0	59.1	52.0	54.8
17	IVT-MB-TS-3	RD-3105	47.6	47.4	46.0	53.6	60.9	49.2	50.8
18	IVT-MB-TS-16	RD-3106	56.2	60.0	48.2	63.2	67.1	56.0	58.5
19	IVT-MB-TS-18	RD-3107	55.2	58.3	53.3	60.7	63.4	54.0	57.5
20	IVT-MB-TS-24	UPB-1124	49.6	46.1	46.1	50.6	52.1	44.9	48.2
21	IVT-MB-TS-25	UPB-1125	48.1	41.2	45.8	52.2	51.6	49.1	48.0
22	IVT-MB-TS-7	DWRUB-52 ©	46.0	42.8	45.1	47.7	51.4	45.6	46.4
23	IVT-MB-TS-4	DWRB-137 ©*	46.7	41.8	39.1	48.2	55.6	49.3	46.8
24	IVT-MB-TS-2	DWRB-182 ©	36.5	41.4	39.2	45.0	49.1	42.4	42.3
25	IVT-MB-TS-20	RD-2849 ©	49.4	46.5	44.3	50.3	53.3	46.2	48.3
Average			49.3	48.8	46.2	53.4	55.4	48.8	50.3

**Six row*

Table 5.3.2. Test weight (kg/hl) of IVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	**IVT-MB-TS-14**	**BH-1055**	**56.7**	**66.3**	**65.9**	**64.3**	**67.9**	**64.7**	64.3
2	**IVT-MB-TS-12**	**BH-1056**	**59.3**	**65.9**	**61.0**	**64.1**	**68.6**	**64.2**	63.9
3	**IVT-MB-TS-13**	**BH-1057**	**62.8**	**65.6**	**65.5**	**68.6**	**71.9**	**64.1**	66.4
4	**IVT-MB-TS-23**	**DWRB-2307**	**60.8**	**69.1**	**70.1**	**67.3**	**71.0**	**67.9**	72.2
5	**IVT-MB-TS-11**	**DWRB-2308**	**62.1**	**65.1**	**66.9**	**65.8**	**70.2**	**67.8**	66.3
6	**IVT-MB-TS-5**	**DWRB-2309**	**63.2**	**69.6**	**69.0**	**64.0**	**70.3**	**68.4**	67.4
7	**IVT-MB-TS-15**	**DWRB-2310**	**65.1**	**70.5**	**70.4**	**70.9**	**72.5**	**70.5**	70.0
8	**IVT-MB-TS-8**	**DWRB-2311**	**63.4**	**68.9**	**70.5**	**67.2**	**71.8**	**69.6**	68.6
9	**IVT-MB-TS-17**	**DWRB-2312**	**59.5**	**65.9**	**68.3**	**67.2**	**69.5**	**64.7**	65.8
10	**IVT-MB-TS-9**	**PL-957**	**62.4**	**67.6**	**65.2**	**65.5**	**65.7**	**66.3**	65.5
11	**IVT-MB-TS-19**	**PL-958**	**61.7**	**69.3**	**66.0**	**66.9**	**71.1**	**65.3**	66.7
12	**IVT-MB-TS-1**	**PL-959**	**63.9**	**68.7**	**68.3**	**67.6**	**71.0**	**68.0**	67.9
13	**IVT-MB-TS-21**	**RD-3084**	**64.1**	**68.9**	**64.1**	**64.7**	**68.8**	**65.8**	66.1
14	**IVT-MB-TS-10**	**RD-3085**	**60.0**	**64.7**	**59.1**	**65.9**	**69.8**	**66.1**	64.3
15	**IVT-MB-TS-22**	**RD-3086**	**59.9**	**65.8**	**67.3**	**64.7**	**69.6**	**65.1**	65.4
16	**IVT-MB-TS-6**	**RD-3087**	**62.2**	**64.3**	**68.4**	**63.7**	**69.8**	**64.8**	65.5
17	**IVT-MB-TS-3**	**RD-3105**	**61.2**	**66.1**	**65.8**	**65.6**	**67.7**	**65.0**	65.2
18	**IVT-MB-TS-16**	**RD-3106**	**58.6**	**67.2**	**67.7**	**63.2**	**67.6**	**62.7**	64.5
19	**IVT-MB-TS-18**	**RD-3107**	**60.1**	**66.5**	**63.1**	**67.3**	**67.6**	**63.7**	64.7
20	**IVT-MB-TS-24**	**UPB-1124**	**63.8**	**69.1**	**70.9**	**68.3**	**71.7**	**67.0**	68.5
21	**IVT-MB-TS-25**	**UPB-1125**	**62.0**	**64.2**	**66.4**	**68.1**	**69.6**	**67.8**	66.3
22	**IVT-MB-TS-7**	**DWRUB-52 ©**	**60.3**	**67.1**	**69.3**	**67.7**	**72.2**	**68.6**	67.5
23	**IVT-MB-TS-4**	**DWRB-137 ©***	**59.2**	**62.0**	**60.3**	**62.4**	**65.1**	**66.1**	62.5
24	**IVT-MB-TS-2**	**DWRB-182 ©**	**55.5**	**66.2**	**65.8**	**66.4**	**71.0**	**64.8**	65.0
25	**IVT-MB-TS-20**	**RD-2849 ©**	**64.7**	**68.6**	**69.3**	**63.3**	**71.4**	**67.8**	67.5
Average			61.3	68.0	66.6	66.0	69.7	66.3	66.3

**Six row*

Table 5.3.3. Proportion of bold grains (%) of IVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	IVT-MB-TS-14	BH-1055	96.7	94.6	92.7	95.5	93.3	93.2	94.3
2	IVT-MB-TS-12	BH-1056	92.6	96.5	93.3	98.0	96.0	94.5	95.1
3	IVT-MB-TS-13	BH-1057	90.1	72.3	75.3	95.1	96.3	88.4	86.2
4	IVT-MB-TS-23	DWRB-2307	92.9	91.9	92.0	93.3	94.1	91.2	92.6
5	IVT-MB-TS-11	DWRB-2308	77.6	66.6	79.3	90.9	94.1	80.9	81.6
6	IVT-MB-TS-5	DWRB-2309	83.3	84.8	83.0	95.4	93.5	87.6	87.9
7	IVT-MB-TS-15	DWRB-2310	87.2	85.9	85.5	94.1	97.4	84.4	89.1
8	IVT-MB-TS-8	DWRB-2311	91.9	83.6	82.7	95.2	95.9	86.3	89.3
9	IVT-MB-TS-17	DWRB-2312	80.8	90.5	96.0	97.2	97.8	92.3	92.4
10	IVT-MB-TS-9	PL-957	93.8	98.5	93.4	90.6	93.8	91.7	93.6
11	IVT-MB-TS-19	PL-958	83.3	77.7	83.5	88.1	94.6	82.5	84.9
12	IVT-MB-TS-1	PL-959	93.4	89.4	91.8	94.6	94.5	80.1	90.6
13	IVT-MB-TS-21	RD-3084	93.3	94.3	93.8	97.2	97.3	93.4	94.9
14	IVT-MB-TS-10	RD-3085	89.0	78.3	68.0	92.2	96.0	89.0	85.4
15	IVT-MB-TS-22	RD-3086	82.5	74.1	87.2	89.7	94.7	77.8	84.3
16	IVT-MB-TS-6	RD-3087	94.9	92.7	97.5	98.0	97.6	94.4	95.9
17	IVT-MB-TS-3	RD-3105	94.6	86.8	89.7	98.0	98.2	95.4	93.8
18	IVT-MB-TS-16	RD-3106	92.0	95.4	92.1	99.2	97.0	89.5	94.2
19	IVT-MB-TS-18	RD-3107	96.5	95.0	95.9	98.7	98.9	94.7	96.6
20	IVT-MB-TS-24	UPB-1124	93.6	87.7	87.4	93.7	96.4	85.7	90.8
21	IVT-MB-TS-25	UPB-1125	67.8	54.3	75.1	80.9	82.0	80.6	73.5
22	IVT-MB-TS-7	DWRUB-52 ©	81.5	66.7	75.8	88.5	94.6	80.8	81.3
23	IVT-MB-TS-4	DWRB-137 ©*	92.4	79.7	70.6	91.0	95.8	88.8	86.4
24	IVT-MB-TS-2	DWRB-182 ©	64.9	64.8	75.5	89.2	95.6	83.4	78.9
25	IVT-MB-TS-20	RD-2849 ©	87.1	78.7	85.9	92.4	95.7	84.2	87.3
Average			87.8	83.2	85.7	93.5	95.2	87.6	88.8

**Six row*

Table 5.3.4. Proportion of thin grains (%) of IVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	IVT-MB-TS-14	BH-1055	0.4	1.0	1.4	1.1	2.2	1.0	1.2
2	IVT-MB-TS-12	BH-1056	1.1	0.7	1.5	0.4	0.9	0.7	0.9
3	IVT-MB-TS-13	BH-1057	1.2	8.7	5.2	0.8	0.5	1.7	3.0
4	IVT-MB-TS-23	DWRB-2307	0.8	1.6	1.3	0.5	0.5	0.8	0.9
5	IVT-MB-TS-11	DWRB-2308	3.6	9.8	3.5	0.6	0.6	2.8	3.5
6	IVT-MB-TS-5	DWRB-2309	3.5	3.6	2.4	0.4	1.0	1.2	2.0
7	IVT-MB-TS-15	DWRB-2310	2.2	3.3	3.3	0.5	0.5	2.0	2.0
8	IVT-MB-TS-8	DWRB-2311	0.8	4.5	2.7	0.4	0.7	2.7	2.0
9	IVT-MB-TS-17	DWRB-2312	4.8	1.4	0.8	0.5	0.2	1.3	1.5
10	IVT-MB-TS-9	PL-957	0.9	0.2	1.0	1.3	1.2	0.9	0.9
11	IVT-MB-TS-19	PL-958	1.8	6.8	1.2	1.2	0.9	2.9	2.5
12	IVT-MB-TS-1	PL-959	0.8	3.4	1.1	0.9	1.2	3.8	1.9
13	IVT-MB-TS-21	RD-3084	1.1	1.1	1.5	0.3	0.5	1.1	0.9
14	IVT-MB-TS-10	RD-3085	2.0	5.1	8.7	0.6	0.5	1.5	3.0
15	IVT-MB-TS-22	RD-3086	4.9	5.0	1.6	2.4	0.6	5.1	3.3
16	IVT-MB-TS-6	RD-3087	0.8	1.3	0.4	0.2	0.9	0.6	0.7
17	IVT-MB-TS-3	RD-3105	0.5	3.3	1.6	0.3	0.2	0.9	1.1
18	IVT-MB-TS-16	RD-3106	0.9	0.7	1.4	0.2	0.3	1.0	0.7
19	IVT-MB-TS-18	RD-3107	0.5	0.9	0.8	0.2	0.2	0.5	0.5
20	IVT-MB-TS-24	UPB-1124	0.8	2.5	1.9	0.7	0.6	2.3	1.5
21	IVT-MB-TS-25	UPB-1125	4.2	13.7	3.4	1.6	2.0	2.9	4.6
22	IVT-MB-TS-7	DWRUB-52 ©	1.4	10.3	4.1	1.7	1.3	2.6	3.6
23	IVT-MB-TS-4	DWRB-137 ©*	1.7	5.4	7.4	2.2	1.0	1.9	3.3
24	IVT-MB-TS-2	DWRB-182 ©	13.2	9.7	5.8	1.4	0.5	2.6	5.5
25	IVT-MB-TS-20	RD-2849 ©	1.2	4.7	1.3	0.7	0.5	2.6	1.8
Average			2.2	4.3	2.6	0.8	0.8	1.9	2.1

**Six row*

Table 5.3.5. Germinative energy (% 72hrs) of IVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	IVT-MB-TS-14	BH-1055	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	IVT-MB-TS-12	BH-1056	100.0	100.0	97.0	98.0	99.0	100.0	99.0
3	IVT-MB-TS-13	BH-1057	100.0	99.0	98.0	99.0	100.0	99.0	99.2
4	IVT-MB-TS-23	DWRB-2307	100.0	100.0	90.0	98.0	100.0	97.0	97.5
5	IVT-MB-TS-11	DWRB-2308	89.0	96.0	96.0	98.0	100.0	100.0	96.5
6	IVT-MB-TS-5	DWRB-2309	100.0	100.0	100.0	96.0	100.0	99.0	99.2
7	IVT-MB-TS-15	DWRB-2310	99.0	99.0	98.0	97.0	99.0	100.0	98.7
8	IVT-MB-TS-8	DWRB-2311	97.0	97.0	90.0	96.0	99.0	97.0	96.0
9	IVT-MB-TS-17	DWRB-2312	100.0	100.0	98.0	93.0	90.0	98.0	96.5
10	IVT-MB-TS-9	PL-957	98.0	99.0	95.0	100.0	99.0	100.0	98.5
11	IVT-MB-TS-19	PL-958	96.0	100.0	98.0	97.0	100.0	98.0	98.2
12	IVT-MB-TS-1	PL-959	96.0	100.0	100.0	98.0	100.0	100.0	99.0
13	IVT-MB-TS-21	RD-3084	98.0	100.0	96.0	98.0	98.0	98.0	98.0
14	IVT-MB-TS-10	RD-3085	100.0	98.0	98.0	97.0	98.0	99.0	98.3
15	IVT-MB-TS-22	RD-3086	100.0	100.0	98.0	97.0	96.0	99.0	98.3
16	IVT-MB-TS-6	RD-3087	100.0	100.0	96.0	98.0	100.0	100.0	99.0
17	IVT-MB-TS-3	RD-3105	100.0	100.0	97.0	98.0	98.0	98.0	98.5
18	IVT-MB-TS-16	RD-3106	100.0	99.0	96.0	90.0	96.0	100.0	96.8
19	IVT-MB-TS-18	RD-3107	100.0	98.0	96.0	100.0	100.0	100.0	99.0
20	IVT-MB-TS-24	UPB-1124	100.0	99.0	100.0	99.0	99.0	97.0	99.0
21	IVT-MB-TS-25	UPB-1125	97.0	100.0	99.0	100.0	95.0	97.0	98.0
22	IVT-MB-TS-7	DWRUB-52 ©	100.0	98.0	96.0	98.0	97.0	98.0	97.8
23	IVT-MB-TS-4	DWRB-137 ©*	96.0	96.0	90.0	97.0	98.0	98.0	95.8
24	IVT-MB-TS-2	DWRB-182 ©	99.0	99.0	94.0	93.0	100.0	100.0	97.5
25	IVT-MB-TS-20	RD-2849 ©	98.0	99.0	100.0	94.0	95.0	100.0	97.7
Average			98.5	99.0	96.6	97.2	98.2	98.9	98.1

**Six row*

Table 5.3.6. Protein content (%) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Ludhiana	Pantnagar	Durgapura	Mean
1	IVT-MB-TS-14	BH-1055	12.7	10.7	11.1	11.8	11.6
2	IVT-MB-TS-12	BH-1056	12.9	12.2	9.1	10.7	11.2
3	IVT-MB-TS-13	BH-1057	16.0	13.3	9.2	10.1	12.2
4	IVT-MB-TS-23	DWRB-2307	14.5	10.4	8.9	9.7	10.9
5	IVT-MB-TS-11	DWRB-2308	16.2	12.1	9.3	9.4	11.8
6	IVT-MB-TS-5	DWRB-2309	13.7	11.4	9.6	10.3	11.3
7	IVT-MB-TS-15	DWRB-2310	14.3	14.4	8.5	10.9	12.0
8	IVT-MB-TS-8	DWRB-2311	13.6	11.4	8.0	9.8	10.7
9	IVT-MB-TS-17	DWRB-2312	14.1	10.4	14.2	8.9	11.9
10	IVT-MB-TS-9	PL-957	14.3	9.0	7.6	12.0	10.7
11	IVT-MB-TS-19	PL-958	13.3	9.6	8.8	10.2	10.5
12	IVT-MB-TS-1	PL-959	15.3	9.6	9.3	9.4	10.9
13	IVT-MB-TS-21	RD-3084	12.7	11.0	9.1	10.3	10.8
14	IVT-MB-TS-10	RD-3085	13.9	13.0	9.5	9.7	11.5
15	IVT-MB-TS-22	RD-3086	14.9	9.9	8.7	11.3	11.2
16	IVT-MB-TS-6	RD-3087	15.1	13.7	9.9	12.2	12.7
17	IVT-MB-TS-3	RD-3105	12.5	10.5	8.1	10.6	10.4
18	IVT-MB-TS-16	RD-3106	14.5	13.6	10.0	14.0	13.0
19	IVT-MB-TS-18	RD-3107	15.5	14.1	13.4	10.8	13.5
20	IVT-MB-TS-24	UPB-1124	14.0	11.8	9.5	9.4	11.2
21	IVT-MB-TS-25	UPB-1125	15.8	10.4	9.1	11.5	11.7
22	IVT-MB-TS-7	DWRUB-52 ©	14.1	11.7	8.4	10.2	11.1
23	IVT-MB-TS-4	DWRB-137 ©*	12.0	10.6	9.7	8.6	10.2
24	IVT-MB-TS-2	DWRB-182 ©	14.5	13.5	7.9	10.5	11.6
25	IVT-MB-TS-20	RD-2849 ©	15.0	10.9	8.2	9.9	11.0
Average			14.2	11.6	9.4	10.5	11.4

**Six row; # Predicted values through NIR*

Table 5.3.7. Husk content (%) of IVT entries from different locations.

S.N	Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
1	IVT-MB-TS-14	BH-1055	14.1	12.6	13.4	13.5	10.6	10.5	12.5
2	IVT-MB-TS-12	BH-1056	11.3	12.5	13.6	13.1	10.2	10.2	11.8
3	IVT-MB-TS-13	BH-1057	11.0	12.2	12.7	12.5	9.5	10.6	11.4
4	IVT-MB-TS-23	DWRB-2307	12.0	10.7	13.0	13.1	9.8	9.7	11.4
5	IVT-MB-TS-11	DWRB-2308	9.8	13.1	12.0	12.8	9.2	10.2	11.2
6	IVT-MB-TS-5	DWRB-2309	10.3	10.4	12.2	13.1	8.9	9.9	10.8
7	IVT-MB-TS-15	DWRB-2310	10.4	11.4	11.3	12.2	9.0	10.8	10.8
8	IVT-MB-TS-8	DWRB-2311	10.2	10.8	12.4	13.2	11.1	10.9	11.4
9	IVT-MB-TS-17	DWRB-2312	11.7	12.3	12.6	12.4	10.1	11.0	11.7
10	IVT-MB-TS-9	PL-957	10.4	10.4	12.8	13.3	10.4	10.1	11.2
11	IVT-MB-TS-19	PL-958	12.6	12.5	12.8	12.2	9.5	10.5	11.7
12	IVT-MB-TS-1	PL-959	9.3	10.5	12.1	11.9	9.4	10.6	10.6
13	IVT-MB-TS-21	RD-3084	13.5	9.6	12.1	12.0	7.6	10.8	10.9
14	IVT-MB-TS-10	RD-3085	12.0	12.8	13.6	12.5	9.7	10.6	11.9
15	IVT-MB-TS-22	RD-3086	15.1	11.3	12.1	13.4	8.6	10.6	11.8
16	IVT-MB-TS-6	RD-3087	12.1	11.4	12.6	14.0	9.2	10.5	11.6
17	IVT-MB-TS-3	RD-3105	9.6	11.9	12.4	12.2	14.2	9.4	11.6
18	IVT-MB-TS-16	RD-3106	13.6	11.2	12.3	12.5	10.0	10.4	11.7
19	IVT-MB-TS-18	RD-3107	12.0	9.9	11.7	12.3	8.7	10.6	10.9
20	IVT-MB-TS-24	UPB-1124	10.6	11.9	11.8	11.9	8.1	10.2	10.7
21	IVT-MB-TS-25	UPB-1125	12.6	12.3	12.7	12.7	10.4	10.6	11.9
22	IVT-MB-TS-7	DWRUB-52 ©	10.9	11.6	12.4	12.4	7.8	10.1	10.9
23	IVT-MB-TS-4	DWRB-137 ©*	11.5	12.6	16.9	13.2	10.6	8.4	12.2
24	IVT-MB-TS-2	DWRB-182 ©	14.9	13.6	13.1	13.3	11.1	10.4	12.7
25	IVT-MB-TS-20	RD-2849 ©	11.4	10.5	12.0	13.9	9.2	10.0	11.1
Average			11.7	11.6	12.7	12.8	9.7	10.3	11.5

**Six row*

Table 5.3.8. Moisture content in grains (%) # of IVT (MB) entries from different locations.

S.N	Code	Entry	Karnal	Ludhiana	Pantnagar	Durgapura	Mean
1	IVT-MB-TS-14	BH-1055	9.6	9.5	10.0	8.8	9.5
2	IVT-MB-TS-12	BH-1056	9.7	10.2	10.1	8.4	9.6
3	IVT-MB-TS-13	BH-1057	9.7	9.6	9.9	9.1	9.6
4	IVT-MB-TS-23	DWRB-2307	9.3	9.7	9.7	8.7	9.4
5	IVT-MB-TS-11	DWRB-2308	9.3	10.2	10.1	8.5	9.5
6	IVT-MB-TS-5	DWRB-2309	9.7	9.7	10.2	8.3	9.5
7	IVT-MB-TS-15	DWRB-2310	10.1	9.4	10.1	9.0	9.7
8	IVT-MB-TS-8	DWRB-2311	9.3	9.9	10.2	8.7	9.5
9	IVT-MB-TS-17	DWRB-2312	9.7	9.4	9.9	8.5	9.4
10	IVT-MB-TS-9	PL-957	10.1	9.9	9.9	8.9	9.7
11	IVT-MB-TS-19	PL-958	9.7	9.7	9.8	8.4	9.4
12	IVT-MB-TS-1	PL-959	9.4	9.4	10.0	8.7	9.4
13	IVT-MB-TS-21	RD-3084	10.1	9.8	9.9	8.4	9.6
14	IVT-MB-TS-10	RD-3085	10.0	9.7	9.7	8.4	9.5
15	IVT-MB-TS-22	RD-3086	9.5	9.7	10.0	8.8	9.5
16	IVT-MB-TS-6	RD-3087	10.4	9.8	10.2	8.7	9.8
17	IVT-MB-TS-3	RD-3105	9.6	9.8	9.5	8.7	9.4
18	IVT-MB-TS-16	RD-3106	9.4	9.8	10.2	8.8	9.6
19	IVT-MB-TS-18	RD-3107	9.6	9.9	10.1	8.5	9.5
20	IVT-MB-TS-24	UPB-1124	9.4	9.3	9.7	8.7	9.3
21	IVT-MB-TS-25	UPB-1125	9.5	9.6	9.6	7.8	9.1
22	IVT-MB-TS-7	DWRUB-52 ©	9.6	9.4	9.7	8.3	9.3
23	IVT-MB-TS-4	DWRB-137 ©*	9.9	10.0	10.0	8.6	9.6
24	IVT-MB-TS-2	DWRB-182 ©	9.4	10.2	10.1	8.3	9.5
25	IVT-MB-TS-20	RD-2849 ©	9.3	9.7	9.6	7.8	9.1
Average			9.7	9.7	9.9	8.6	9.5

**Six row; # Predicted values through NIR*

Table 5.3.9. Starch content in grains (%dwt basis) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Ludhiana	Pantnagar	Durgapura	Mean
1	IVT-MB-TS-14	BH-1055	61.7	62.9	62.2	61.8	62.2
2	IVT-MB-TS-12	BH-1056	62.3	62.4	63.3	63.9	63.0
3	IVT-MB-TS-13	BH-1057	59.0	61.3	63.8	62.6	61.7
4	IVT-MB-TS-23	DWRB-2307	60.6	63.2	63.7	63.6	62.8
5	IVT-MB-TS-11	DWRB-2308	59.5	61.8	63.1	64.7	62.3
6	IVT-MB-TS-5	DWRB-2309	61.6	63.9	62.8	64.5	63.2
7	IVT-MB-TS-15	DWRB-2310	60.6	60.7	65.3	63.6	62.6
8	IVT-MB-TS-8	DWRB-2311	61.5	63.2	64.2	64.6	63.4
9	IVT-MB-TS-17	DWRB-2312	60.8	63.2	62.9	64.7	62.9
10	IVT-MB-TS-9	PL-957	60.5	63.9	64.1	62.1	62.7
11	IVT-MB-TS-19	PL-958	61.2	63.5	63.6	64.0	63.1
12	IVT-MB-TS-1	PL-959	60.1	63.9	62.9	64.7	62.9
13	IVT-MB-TS-21	RD-3084	61.1	62.8	63.1	64.3	62.8
14	IVT-MB-TS-10	RD-3085	59.7	60.6	63.7	64.0	62.0
15	IVT-MB-TS-22	RD-3086	59.9	62.9	63.4	61.9	62.0
16	IVT-MB-TS-6	RD-3087	60.2	61.4	62.3	63.1	61.8
17	IVT-MB-TS-3	RD-3105	61.7	63.5	65.0	63.5	63.4
18	IVT-MB-TS-16	RD-3106	60.9	61.6	59.8	61.1	60.9
19	IVT-MB-TS-18	RD-3107	60.6	61.0	61.5	63.3	61.6
20	IVT-MB-TS-24	UPB-1124	61.4	63.5	64.8	65.3	63.8
21	IVT-MB-TS-25	UPB-1125	58.9	62.6	63.9	64.2	62.4
22	IVT-MB-TS-7	DWRUB-52 ©	60.8	62.7	64.0	64.8	63.1
23	IVT-MB-TS-4	DWRB-137 ©*	60.9	60.9	62.9	64.0	62.2
24	IVT-MB-TS-2	DWRB-182 ©	60.6	60.9	64.7	64.6	62.7
25	IVT-MB-TS-20	RD-2849 ©	60.5	62.5	63.6	66.0	63.2
Average			60.7	62.4	63.4	63.8	62.6

**Six row; # Predicted values through NIR*

Table 5.3.10. β--glucan content (% dwb) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Mean
1	IVT-MB-TS-14	BH-1055	5.7	5.7
2	IVT-MB-TS-12	BH-1056	6.7	6.7
3	IVT-MB-TS-13	BH-1057	5.6	5.6
4	IVT-MB-TS-23	DWRB-2307	6.8	6.8
5	IVT-MB-TS-11	DWRB-2308	5.4	5.4
6	IVT-MB-TS-5	DWRB-2309	5.5	5.5
7	IVT-MB-TS-15	DWRB-2310	5.7	5.7
8	IVT-MB-TS-8	DWRB-2311	5.4	5.4
9	IVT-MB-TS-17	DWRB-2312	7.1	7.1
10	IVT-MB-TS-9	PL-957	6.5	6.5
11	IVT-MB-TS-19	PL-958	5.5	5.5
12	IVT-MB-TS-1	PL-959	4.8	4.8
13	IVT-MB-TS-21	RD-3084	4.0	4.0
14	IVT-MB-TS-10	RD-3085	5.5	5.5
15	IVT-MB-TS-22	RD-3086	6.0	6.0
16	IVT-MB-TS-6	RD-3087	5.2	5.2
17	IVT-MB-TS-3	RD-3105	3.8	3.8
18	IVT-MB-TS-16	RD-3106	5.5	5.5
19	IVT-MB-TS-18	RD-3107	5.1	5.1
20	IVT-MB-TS-24	UPB-1124	5.5	5.5
21	IVT-MB-TS-25	UPB-1125	7.3	7.3
22	IVT-MB-TS-7	DWRUB-52 ©	5.3	5.3
23	IVT-MB-TS-4	DWRB-137 ©*	4.7	4.7
24	IVT-MB-TS-2	DWRB-182 ©	4.2	4.2
25	IVT-MB-TS-20	RD-2849 ©	4.3	4.3
Average			5.5	5.5

**Six row*

MALT PARAMETERS

Table 5.3.11. Malt yield (%) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	87.6	90.1	87.0	88.2
2	IVT-MB-TS-12	BH-1056	88.9	90.1	86.7	88.6
3	IVT-MB-TS-13	BH-1057	87.9	88.3	86.6	87.6
4	IVT-MB-TS-23	DWRB-2307	88.8	89.8	87.6	88.7
5	IVT-MB-TS-11	DWRB-2308	86.4	89.4	86.1	87.3
6	IVT-MB-TS-5	DWRB-2309	89.1	88.8	85.0	87.7
7	IVT-MB-TS-15	DWRB-2310	88.4	89.3	87.0	88.2
8	IVT-MB-TS-8	DWRB-2311	88.7	91.0	87.7	89.2
9	IVT-MB-TS-17	DWRB-2312	87.9	88.8	86.0	87.6
10	IVT-MB-TS-9	PL-957	87.5	89.1	85.7	87.4
11	IVT-MB-TS-19	PL-958	87.4	88.7	86.5	87.6
12	IVT-MB-TS-1	PL-959	87.8	87.8	85.1	86.9
13	IVT-MB-TS-21	RD-3084	87.5	89.2	84.8	87.2
14	IVT-MB-TS-10	RD-3085	86.1	87.9	84.8	86.3
15	IVT-MB-TS-22	RD-3086	87.1	88.8	86.8	87.5
16	IVT-MB-TS-6	RD-3087	88.9	85.8	86.4	87.0
17	IVT-MB-TS-3	RD-3105	87.1	89.2	84.9	87.1
18	IVT-MB-TS-16	RD-3106	88.8	89.1	85.1	87.7
19	IVT-MB-TS-18	RD-3107	89.0	88.0	85.9	87.6
20	IVT-MB-TS-24	UPB-1124	86.3	88.7	86.5	87.2
21	IVT-MB-TS-25	UPB-1125	87.7	89.4	87.1	88.0
22	IVT-MB-TS-7	DWRUB-52 ©	87.9	90.3	86.7	88.3
23	IVT-MB-TS-4	DWRB-137 ©*	88.6	88.7	89.1	88.8
24	IVT-MB-TS-2	DWRB-182 ©	88.0	88.4	85.9	87.4
25	IVT-MB-TS-20	RD-2849 ©	87.9	89.8	86.8	88.2
Average			87.9	89.0	86.3	87.7

**Six row*

Table 5.3.12. Malt friability (%) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	36.8	39.0	46.3	40.7
2	IVT-MB-TS-12	BH-1056	46.0	47.9	45.0	46.3
3	IVT-MB-TS-13	BH-1057	52.6	57.0	55.7	55.1
4	IVT-MB-TS-23	DWRB-2307	41.0	53.7	48.4	47.7
5	IVT-MB-TS-11	DWRB-2308	51.2	56.3	62.1	56.5
6	IVT-MB-TS-5	DWRB-2309	52.2	55.4	57.3	55.0
7	IVT-MB-TS-15	DWRB-2310	42.9	48.3	39.9	43.7
8	IVT-MB-TS-8	DWRB-2311	50.9	43.3	54.9	49.7
9	IVT-MB-TS-17	DWRB-2312	48.1	65.9	64.8	59.6
10	IVT-MB-TS-9	PL-957	46.8	48.9	60.5	52.1
11	IVT-MB-TS-19	PL-958	56.3	56.1	65.7	59.4
12	IVT-MB-TS-1	PL-959	52.3	67.5	73.7	64.5
13	IVT-MB-TS-21	RD-3084	64.1	56.5	63.8	61.5
14	IVT-MB-TS-10	RD-3085	61.5	64.1	66.7	64.1
15	IVT-MB-TS-22	RD-3086	48.1	46.6	52.2	49.0
16	IVT-MB-TS-6	RD-3087	54.1	61.3	59.7	58.3
17	IVT-MB-TS-3	RD-3105	72.7	63.8	78.5	71.7
18	IVT-MB-TS-16	RD-3106	49.9	43.5	54.1	49.2
19	IVT-MB-TS-18	RD-3107	50.3	62.2	61.7	58.1
20	IVT-MB-TS-24	UPB-1124	51.6	58.7	58.6	56.3
21	IVT-MB-TS-25	UPB-1125	38.5	37.0	46.7	40.7
22	IVT-MB-TS-7	DWRUB-52 ©	54.7	47.3	59.9	54.0
23	IVT-MB-TS-4	DWRB-137 ©*	46.9	59.1	34.2	46.7
24	IVT-MB-TS-2	DWRB-182 ©	60.5	57.9	59.4	59.3
25	IVT-MB-TS-20	RD-2849 ©	48.6	53.0	59.8	53.8
Average			51.1	54.0	57.2	54.1

**Six row*

Table 5.3.13. Malt homogeneity (%) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	59.0	65.8	74.6	66.5
2	IVT-MB-TS-12	BH-1056	79.5	78.8	78.7	79.0
3	IVT-MB-TS-13	BH-1057	92.6	96.8	94.4	94.6
4	IVT-MB-TS-23	DWRB-2307	84.7	94.0	89.2	89.3
5	IVT-MB-TS-11	DWRB-2308	94.3	98.3	98.3	96.9
6	IVT-MB-TS-5	DWRB-2309	93.9	95.8	91.3	93.7
7	IVT-MB-TS-15	DWRB-2310	85.3	88.4	85.4	86.4
8	IVT-MB-TS-8	DWRB-2311	87.3	85.1	90.3	87.6
9	IVT-MB-TS-17	DWRB-2312	91.1	97.7	98.7	95.8
10	IVT-MB-TS-9	PL-957	92.9	89.0	91.3	91.1
11	IVT-MB-TS-19	PL-958	94.4	95.6	96.7	95.6
12	IVT-MB-TS-1	PL-959	87.4	99.4	98.7	95.2
13	IVT-MB-TS-21	RD-3084	98.8	99.1	99.2	99.1
14	IVT-MB-TS-10	RD-3085	96.5	99.5	95.2	97.1
15	IVT-MB-TS-22	RD-3086	70.0	67.3	76.3	71.2
16	IVT-MB-TS-6	RD-3087	84.3	95.5	97.3	92.4
17	IVT-MB-TS-3	RD-3105	99.4	99.7	99.6	99.5
18	IVT-MB-TS-16	RD-3106	88.3	88.4	94.0	90.2
19	IVT-MB-TS-18	RD-3107	93.0	99.2	97.3	96.5
20	IVT-MB-TS-24	UPB-1124	87.7	94.5	93.0	91.7
21	IVT-MB-TS-25	UPB-1125	67.9	69.8	83.1	73.6
22	IVT-MB-TS-7	DWRUB-52 ©	93.1	97.2	97.9	96.1
23	IVT-MB-TS-4	DWRB-137 ©*	71.8	91.0	54.7	72.5
24	IVT-MB-TS-2	DWRB-182 ©	89.3	82.5	88.9	86.9
25	IVT-MB-TS-20	RD-2849 ©	91.7	97.1	96.9	95.2
Average			87.0	90.6	90.4	89.3

**Six row*

Table 5.3.14. Hot water extract (% fgdb) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	68.8	72.3	73.1	71.4
2	IVT-MB-TS-12	BH-1056	80.3	72.9	74.0	75.7
3	IVT-MB-TS-13	BH-1057	74.4	71.8	74.7	73.6
4	IVT-MB-TS-23	DWRB-2307	72.9	73.4	74.9	73.7
5	IVT-MB-TS-11	DWRB-2308	73.4	81.3	75.7	76.8
6	IVT-MB-TS-5	DWRB-2309	73.3	76.0	69.6	73.0
7	IVT-MB-TS-15	DWRB-2310	71.1	74.3	72.6	72.7
8	IVT-MB-TS-8	DWRB-2311	74.8	77.0	75.2	75.6
9	IVT-MB-TS-17	DWRB-2312	74.1	81.2	76.8	77.4
10	IVT-MB-TS-9	PL-957	70.3	75.0	73.9	73.1
11	IVT-MB-TS-19	PL-958	72.0	74.9	76.3	74.4
12	IVT-MB-TS-1	PL-959	76.1	79.5	76.7	77.4
13	IVT-MB-TS-21	RD-3084	76.2	71.0	81.8	76.3
14	IVT-MB-TS-10	RD-3085	72.9	78.2	72.1	74.4
15	IVT-MB-TS-22	RD-3086	70.1	67.5	74.6	70.7
16	IVT-MB-TS-6	RD-3087	69.0	69.9	71.1	70.0
17	IVT-MB-TS-3	RD-3105	72.8	71.2	76.2	73.4
18	IVT-MB-TS-16	RD-3106	73.5	73.0	72.2	72.9
19	IVT-MB-TS-18	RD-3107	73.1	75.0	73.1	73.7
20	IVT-MB-TS-24	UPB-1124	74.4	74.2	74.6	74.4
21	IVT-MB-TS-25	UPB-1125	71.4	68.1	74.6	71.4
22	IVT-MB-TS-7	DWRUB-52 ©	72.0	75.4	71.6	73.0
23	IVT-MB-TS-4	DWRB-137 © *	72.5	67.6	71.6	70.6
24	IVT-MB-TS-2	DWRB-182 ©	72.2	77.1	66.2	71.9
25	IVT-MB-TS-20	RD-2849 ©	70.7	75.2	78.7	74.9
Average			72.9	74.1	74.1	73.7

**Six row*

Table 5.3.15. Wort filtration rate (ml/hr.) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	195.0	140.0	180.0	171.7
2	IVT-MB-TS-12	BH-1056	205.0	180.0	205.0	196.7
3	IVT-MB-TS-13	BH-1057	190.0	145.0	210.0	181.7
4	IVT-MB-TS-23	DWRB-2307	225.0	135.0	200.0	186.7
5	IVT-MB-TS-11	DWRB-2308	175.0	130.0	255.0	186.7
6	IVT-MB-TS-5	DWRB-2309	165.0	120.0	280.0	188.3
7	IVT-MB-TS-15	DWRB-2310	175.0	165.0	160.0	166.7
8	IVT-MB-TS-8	DWRB-2311	185.0	190.0	265.0	213.3
9	IVT-MB-TS-17	DWRB-2312	215.0	175.0	195.0	195.0
10	IVT-MB-TS-9	PL-957	160.0	210.0	220.0	196.7
11	IVT-MB-TS-19	PL-958	205.0	165.0	180.0	183.3
12	IVT-MB-TS-1	PL-959	190.0	145.0	205.0	180.0
13	IVT-MB-TS-21	RD-3084	200.0	125.0	160.0	161.7
14	IVT-MB-TS-10	RD-3085	210.0	135.0	220.0	188.3
15	IVT-MB-TS-22	RD-3086	210.0	175.0	140.0	175.0
16	IVT-MB-TS-6	RD-3087	235.0	225.0	205.0	221.7
17	IVT-MB-TS-3	RD-3105	285.0	185.0	235.0	235.0
18	IVT-MB-TS-16	RD-3106	175.0	115.0	100.0	130.0
19	IVT-MB-TS-18	RD-3107	235.0	195.0	185.0	205.0
20	IVT-MB-TS-24	UPB-1124	175.0	165.0	175.0	171.7
21	IVT-MB-TS-25	UPB-1125	115.0	75.0	120.0	103.3
22	IVT-MB-TS-7	DWRUB-52 ©	175.0	115.0	225.0	171.7
23	IVT-MB-TS-4	DWRB-137 ©*	215.0	180.0	185.0	193.3
24	IVT-MB-TS-2	DWRB-182 ©	240.0	230.0	255.0	241.7
25	IVT-MB-TS-20	RD-2849 ©	175.0	105.0	210.0	163.3
Average			197.2	157.0	198.8	184.3

**Six row*

Table 5.3.16. Diastatic power (^{0}L) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	113.6	96.2	116.3	108.7
2	IVT-MB-TS-12	BH-1056	102.0	108.7	119.0	109.9
3	IVT-MB-TS-13	BH-1057	116.3	75.8	111.1	101.0
4	IVT-MB-TS-23	DWRB-2307	100.0	119.0	122.0	113.7
5	IVT-MB-TS-11	DWRB-2308	122.0	62.1	119.0	101.0
6	IVT-MB-TS-5	DWRB-2309	106.4	111.1	119.0	112.2
7	IVT-MB-TS-15	DWRB-2310	102.0	82.0	116.3	100.1
8	IVT-MB-TS-8	DWRB-2311	98.0	98.0	100.0	98.7
9	IVT-MB-TS-17	DWRB-2312	98.0	98.0	116.3	104.1
10	IVT-MB-TS-9	PL-957	106.4	87.7	108.7	100.9
11	IVT-MB-TS-19	PL-958	98.0	86.2	108.7	97.6
12	IVT-MB-TS-1	PL-959	108.7	111.1	108.7	109.5
13	IVT-MB-TS-21	RD-3084	116.3	98.0	106.4	106.9
14	IVT-MB-TS-10	RD-3085	119.0	94.3	119.0	110.8
15	IVT-MB-TS-22	RD-3086	83.3	116.3	116.3	105.3
16	IVT-MB-TS-6	RD-3087	111.1	111.1	108.7	110.3
17	IVT-MB-TS-3	RD-3105	96.2	96.2	122.0	104.8
18	IVT-MB-TS-16	RD-3106	98.0	101.0	116.3	105.1
19	IVT-MB-TS-18	RD-3107	100.0	108.7	122.0	110.2
20	IVT-MB-TS-24	UPB-1124	89.3	106.4	116.3	104.0
21	IVT-MB-TS-25	UPB-1125	100.0	104.2	106.4	103.5
22	IVT-MB-TS-7	DWRUB-52 ©	104.2	108.7	106.4	106.4
23	IVT-MB-TS-4	DWRB-137 ©*	108.7	98.0	108.7	105.1
24	IVT-MB-TS-2	DWRB-182 ©	122.0	108.7	122.0	117.5
25	IVT-MB-TS-20	RD-2849 ©	111.1	74.6	108.7	98.1
Average			105.2	98.5	113.8	105.8

**Six row*

Table 5.3.17. Saccharification rate (minutes) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	5.0	5.0	5.0	5.0
2	IVT-MB-TS-12	BH-1056	5.0	5.0	5.0	5.0
3	IVT-MB-TS-13	BH-1057	5.0	5.0	10.0	6.7
4	IVT-MB-TS-23	DWRB-2307	5.0	5.0	5.0	5.0
5	IVT-MB-TS-11	DWRB-2308	5.0	10.0	5.0	6.7
6	IVT-MB-TS-5	DWRB-2309	5.0	5.0	10.0	6.7
7	IVT-MB-TS-15	DWRB-2310	10.0	10.0	10.0	10.0
8	IVT-MB-TS-8	DWRB-2311	5.0	5.0	10.0	6.7
9	IVT-MB-TS-17	DWRB-2312	5.0	5.0	10.0	6.7
10	IVT-MB-TS-9	PL-957	5.0	5.0	10.0	6.7
11	IVT-MB-TS-19	PL-958	5.0	5.0	10.0	6.7
12	IVT-MB-TS-1	PL-959	10.0	5.0	10.0	8.3
13	IVT-MB-TS-21	RD-3084	10.0	10.0	5.0	8.3
14	IVT-MB-TS-10	RD-3085	10.0	10.0	5.0	8.3
15	IVT-MB-TS-22	RD-3086	5.0	5.0	5.0	5.0
16	IVT-MB-TS-6	RD-3087	10.0	10.0	5.0	8.3
17	IVT-MB-TS-3	RD-3105	5.0	5.0	5.0	5.0
18	IVT-MB-TS-16	RD-3106	5.0	5.0	5.0	5.0
19	IVT-MB-TS-18	RD-3107	10.0	5.0	5.0	6.7
20	IVT-MB-TS-24	UPB-1124	5.0	5.0	5.0	5.0
21	IVT-MB-TS-25	UPB-1125	10.0	5.0	5.0	6.7
22	IVT-MB-TS-7	DWRUB-52 ©	5.0	5.0	5.0	5.0
23	IVT-MB-TS-4	DWRB-137 ©*	5.0	5.0	10.0	6.7
24	IVT-MB-TS-2	DWRB-182 ©	5.0	5.0	5.0	5.0
25	IVT-MB-TS-20	RD-2849 ©	10.0	10.0	5.0	8.3
Average			6.6	6.2	6.8	6.5

**Six row*

Table 5.3.18. Wort pH of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	5.9	5.8	5.6	5.7
2	IVT-MB-TS-12	BH-1056	5.8	5.7	5.7	5.7
3	IVT-MB-TS-13	BH-1057	5.8	5.7	5.6	5.7
4	IVT-MB-TS-23	DWRB-2307	5.9	5.8	5.6	5.8
5	IVT-MB-TS-11	DWRB-2308	5.7	5.8	5.6	5.7
6	IVT-MB-TS-5	DWRB-2309	5.8	5.8	5.6	5.7
7	IVT-MB-TS-15	DWRB-2310	5.8	5.8	5.6	5.7
8	IVT-MB-TS-8	DWRB-2311	5.8	5.7	5.6	5.7
9	IVT-MB-TS-17	DWRB-2312	5.8	5.8	5.6	5.7
10	IVT-MB-TS-9	PL-957	5.8	5.8	5.6	5.8
11	IVT-MB-TS-19	PL-958	5.8	5.8	5.6	5.7
12	IVT-MB-TS-1	PL-959	5.9	5.9	5.7	5.8
13	IVT-MB-TS-21	RD-3084	5.8	5.6	5.6	5.6
14	IVT-MB-TS-10	RD-3085	5.8	5.8	5.6	5.7
15	IVT-MB-TS-22	RD-3086	5.9	5.8	5.7	5.8
16	IVT-MB-TS-6	RD-3087	5.9	5.8	5.6	5.7
17	IVT-MB-TS-3	RD-3105	5.9	5.7	5.6	5.7
18	IVT-MB-TS-16	RD-3106	5.8	5.7	5.4	5.6
19	IVT-MB-TS-18	RD-3107	5.9	5.8	5.6	5.8
20	IVT-MB-TS-24	UPB-1124	5.8	5.7	5.6	5.7
21	IVT-MB-TS-25	UPB-1125	5.7	5.8	5.6	5.7
22	IVT-MB-TS-7	DWRUB-52 ©	5.8	5.7	5.6	5.7
23	IVT-MB-TS-4	DWRB-137 © *	6.0	5.9	5.8	5.9
24	IVT-MB-TS-2	DWRB-182 ©	5.9	5.9	5.7	5.8
25	IVT-MB-TS-20	RD-2849 ©	5.7	5.7	5.6	5.6
Average			5.8	5.8	5.6	5.7

**Six row*

Table 5.3.19. Wort FAN content (ppm) of IVT entries from different locations.

S.N	Code	Entry	Karnal	Durgapura	Ludhiana	Mean
1	IVT-MB-TS-14	BH-1055	116	162	208	161.9
2	IVT-MB-TS-12	BH-1056	156	162	189	168.9
3	IVT-MB-TS-13	BH-1057	191	159	159	169.7
4	IVT-MB-TS-23	DWRB-2307	138	180	171	162.8
5	IVT-MB-TS-11	DWRB-2308	191	143	138	157.4
6	IVT-MB-TS-5	DWRB-2309	191	155	189	178.3
7	IVT-MB-TS-15	DWRB-2310	169	164	206	179.5
8	IVT-MB-TS-8	DWRB-2311	165	171	201	179.0
9	IVT-MB-TS-17	DWRB-2312	166	133	171	156.8
10	IVT-MB-TS-9	PL-957	180	158	152	163.5
11	IVT-MB-TS-19	PL-958	166	181	205	184.1
12	IVT-MB-TS-1	PL-959	160	152	170	160.7
13	IVT-MB-TS-21	RD-3084	175	134	119	142.8
14	IVT-MB-TS-10	RD-3085	190	179	197	188.9
15	IVT-MB-TS-22	RD-3086	138	164	205	168.8
16	IVT-MB-TS-6	RD-3087	160	165	162	162.1
17	IVT-MB-TS-3	RD-3105	193	123	147	154.3
18	IVT-MB-TS-16	RD-3106	138	170	159	156.0
19	IVT-MB-TS-18	RD-3107	111	155	172	146.0
20	IVT-MB-TS-24	UPB-1124	129	140	187	152.0
21	IVT-MB-TS-25	UPB-1125	207	172	166	181.6
22	IVT-MB-TS-7	DWRUB-52 ©	172	139	158	156.4
23	IVT-MB-TS-4	DWRB-137 ©*	145	153	189	162.5
24	IVT-MB-TS-2	DWRB-182 ©	153	123	161	145.9
25	IVT-MB-TS-20	RD-2849 ©	179	174	200	184.5
Average			163.1	156.5	175.3	165.0

**Six row*

Table 5.3.20. Wort β--Glucan Content (ppm) of IVT entries at one location.

S.N	Code	Entry	Karnal	Mean
1	IVT-MB-TS-14	BH-1055	1188	1188
2	IVT-MB-TS-12	BH-1056	916	916
3	IVT-MB-TS-13	BH-1057	741	741
4	IVT-MB-TS-23	DWRB-2307	756	756
5	IVT-MB-TS-11	DWRB-2308	803	803
6	IVT-MB-TS-5	DWRB-2309	680	680
7	IVT-MB-TS-15	DWRB-2310	904	904
8	IVT-MB-TS-8	DWRB-2311	617	617
9	IVT-MB-TS-17	DWRB-2312	813	813
10	IVT-MB-TS-9	PL-957	1037	1037
11	IVT-MB-TS-19	PL-958	764	764
12	IVT-MB-TS-1	PL-959	627	627
13	IVT-MB-TS-21	RD-3084	359	359
14	IVT-MB-TS-10	RD-3085	526	526
15	IVT-MB-TS-22	RD-3086	945	945
16	IVT-MB-TS-6	RD-3087	364	364
17	IVT-MB-TS-3	RD-3105	94	94
18	IVT-MB-TS-16	RD-3106	972	972
19	IVT-MB-TS-18	RD-3107	908	908
20	IVT-MB-TS-24	UPB-1124	840	840
21	IVT-MB-TS-25	UPB-1125	1472	1472
22	IVT-MB-TS-7	DWRUB-52 ©	604	604
23	IVT-MB-TS-4	DWRB-137 ©*	429	429
24	IVT-MB-TS-2	DWRB-182 ©	516	516
25	IVT-MB-TS-20	RD-2849 ©	1069	1069
Average			757.8	757.8

**Six row*

BARLEY QUALITY SCREENING NURSERY (BQSN)

The *Barley Quality Screening Nursery* (BQSN) was conducted for finding better sources of hulless and malt barley for different quality traits. The Nursery was conducted at six locations i.e., Hisar, Durgapura, Karnal, Ludhiana, Pantnagar, and Kanpur. The nursery was sent under three categories i.e., high alpha amylase (BQSN 1), High antioxidant, Fe and Zn (Naked/hulless barley) (BQSN 2), and Low beta glucan and high protein (BQSN 3) comprising 23, 19 and 12 entries, respectively. BQSN 1 entries were evaluated for grain parameters (thousand grain weight, hectoliter weight, bold grain, thin grain, germinative energy, protein content, moisture, starch) and malt parameters (alpha amylase). For assaying alpha amylase, grains were germinated at 18^0C for 72 hr followed by drying at 55^0C for 48hr in micro-malting machine. The dried samples were assayed for total alpha amylase activity using alpha amylase kit (Ceralpha method) procured from Megazyme. The activity of alpha amylase was expressed as CU/g (Ceralpha Unit/g). All BQSN 2 entries were evaluated for total antioxidant activity using DPPH method and scavenging activity was expressed as percentage discoloration of DPPH. Approximate Fe ad Zn was estimated using XRF machine. All the BQSN 3 entries were evaluated for all the grain parameters as mentioned above while selected entries were evaluated for malting parameters (malt yield, malt friability, malt homogeneity, hot water extraction, wort filtration rate, diastatic power, saccharification rate, wort pH, wort FAN, and wort beta glucan). The promising genotypes from the all the nurseries are given in following tables

BQSN 1: (High Alpha Amylase Genotypes)

Table 5.4.1. Promising sources for different traits*.

Traits	Promising entries
High Alpha amylase activity	BCU5955, BCU5958, BCU5958, BCU5960, BCU5961, BK316, BK323,
Bold Grain Percentage	BK 303, BK 306, BK311, BK 312, BK315
Protein	BCU5954, BCU5955, BCU5958, BCU5960, BK303, BK315

**At par or better than best check*

BQSN 2: Antioxidant, Fe and Zn (Hulless/Naked Genotypes)

Table 5.4.2. Promising sources for different traits*.

Traits	Promising entries
High Antioxidant	DWRB-189 ©
High Fe	DWRB-189 ©
High Zn	IC532985, IC0438103, IC0532979, EC0578267, HLR-322, HLR-196, HLR-136, HLR-64, HLR-34 HLR-24

**At par or better than best check*

BQSN 3: Low Beta-Glucan and High Protein

Table 5.4.3. Promising sources for different traits*.

Traits	Promising entries
High Protein	RMB2307
Low Beta-glucan	DWRB182 ©

**At par or better than best check*

BQSN 1: (High alpha amylase genotypes suitable for malt quality)-Grain Parameters

Table 5.4.4. Thousand grain weight in different genotypes at different locations.

Code	Entry	Hisar	D. Pura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	45.6	55.3	51.8	47.1	53.3	45.8	**49.8**
AA-2	BCU5955	45.8	54.8	51.4	43.2	55.4	47.0	**49.6**
AA-3	BCU5958	50.1	56.6	54.7	47.2	55.3	50.0	**52.3**
AA-4	BCU5959	43.4	60.9	52.0	45.4	54.6	50.2	**51.1**
AA-5	BCU5960	44.6	57.5	54.0	47.4	56.6	50.3	**51.7**
AA-6	BCU5961	44.0	55.8	50.3	43.4	53.4	39.5	**47.7**
AA-7	BK 303	54.3	65.4	62.6	52.0	65.6	55.0	**59.1**
AA-8	BK-306	57.2	64.6	62.2	54.0	63.4	55.4	**59.5**
AA-9	BK-311	56.7	64.5	61.0	50.2	62.5	58.8	**59.0**
AA-10	BK-312	54.7	63.7	57.8	50.6	62.5	57.2	**57.8**
AA-11	BK-315	41.3	58.2	54.1	45.2	54.6	48.9	**50.4**
AA-12	BK-316	41.9	43.1	46.1	38.8	45.1	40.0	**42.5**
AA-13	BK-323	44.2	51.4	52.7	41.5	49.6	41.1	**46.7**
AA-14	BCU6263	44.5	53.4	51.8	44.5	49.6	43.2	**47.9**
AA-15	DWRBLK-2023-1	52.1	63.8	56.5	47.0	63.4	56.7	**56.6**
AA-16	DWRBLK-2023-2	34.5	61.3	59.8	48.4	59.9	55.8	**53.3**
AA-17	MBST-2022/6	40.4	50.8	52.8	44.1	53.0	44.8	**47.6**
AA-18	DWRB174 ©	-	44.3	35.0	36.2	46.7	39.6	**40.4**
AA-19	BK1127 ©	49.3	60.9	56.3	45.8	57.4	50.3	**53.3**
AA-20	DWRUB 52 ©	46.7	51.9	49.8	41.0	50.9	43.2	**47.3**
AA-21	DWRB 101 ©	46.5	53.6	49.8	43.0	52.3	47.0	**48.7**
AA-22	DWRB 123 ©	51.9	58.3	56.6	48.1	56.5	50.0	**53.6**
AA-23	DWRB 182 ©	48.9	53.9	53.9	47.6	57.2	46.2	**51.3**
Average		**46.9**	**56.9**	**53.6**	**45.7**	**55.6**	**48.6**	**51.2**

Table 5.4.5. Hectoliter weight (Test weight in kg/hl) of genotypes from different locations.

Code	Entry	Hisar	D. Pura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	58.9	68.9	66.1	62.6	66.5	63.9	**64.5**
AA-2	BCU5955	53.6	70.4	68.1	62.7	67.0	64.9	**64.5**
AA-3	BCU5958	57.6	70.9	69.3	67.8	70.5	65.9	**67.0**
AA-4	BCU5959	57.3	69.6	67.5	64.3	68.0	64.8	**65.3**
AA-5	BCU5960	57.6	73.5	68.1	65.9	68.5	65.3	**66.5**
AA-6	BCU5961	-	72.3	69.3	65.2	69.4	60.8	**67.4**
AA-7	BK 303	55.4	68.7	67.1	63.1	67.7	62.6	**64.1**
AA-8	BK-306	57.1	68.3	66.8	64.0	66.8	62.4	**64.3**
AA-9	BK-311	58.4	70.8	68.7	64.4	67.0	65.9	**65.9**
AA-10	BK-312	59.0	71.6	68.7	65.1	67.9	65.4	**66.3**
AA-11	BK-315	-	69.7	65.6	63.7	66.3	64.0	**65.9**
AA-12	BK-316	-	69.1	66.4	66.7	67.6	64.3	**66.8**
AA-13	BK-323	58.4	71.6	67.9	67.9	69.1	65.4	**66.7**
AA-14	BCU6263	59.4	71.1	67.6	66.3	67.7	65.4	**66.2**
AA-15	DWRBLK-2023-1	56.5	68.4	64.2	60.2	64.7	63.1	**62.9**
AA-16	DWRBLK-2023-2	-	66.9	66.3	62.6	66.1	61.9	**64.8**
AA-17	MBST-2022/6	-	67.6	66.1	63.7	67.2	65.0	**65.9**
AA-18	DWRB174 ©	-	63.3	-	56.0	60.1	-	**59.8**
AA-19	BK1127 ©	58.8	69.3	65.7	64.6	64.4	64.8	**64.6**
AA-20	DWRUB 52 ©	58.4	72.3	71.5	67.7	68.3	66.1	**67.4**
AA-21	DWRB 101 ©	60.53	72.23	69.53	67.21	68.7	64.67	**67.1**
AA-22	DWRB 123 ©	60.96	71.12	68.95	66.82	67.17	64.43	**66.6**
AA-23	DWRB 182 ©	56.25	68.51	67.24	64.26	67.63	63.8	**64.6**
Average		**57.6**	**69.7**	**67.4**	**64.2**	**67.0**	**64.3**	**65.0**

Table 5.4.6. Bold grain percentage of genotypes from different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	91.7	90.3	93.6	88.1	97.5	91.8	**92.2**
AA-2	BCU5955	89.4	93.1	90.1	73.4	97.0	86.3	**88.2**
AA-3	BCU5958	86.4	85.6	89.8	90.5	94.8	90.1	**89.5**
AA-4	BCU5959	72.8	97.7	92.2	88.6	98.4	89.4	**89.8**
AA-5	BCU5960	87.1	94.7	92.6	88.8	95.0	90.8	**91.5**
AA-6	BCU5961	-	96.2	91.9	82.9	97.9	71.9	**88.2**
AA-7	BK 303	96.0	97.8	99.0	96.2	99.6	98.1	**97.8**
AA-8	BK-306	96.9	98.1	98.8	96.3	99.1	98.4	**97.9**
AA-9	BK-311	94.7	95.8	97.7	94.0	97.5	97.1	**96.1**
AA-10	BK-312	95.7	99.4	97.7	92.8	99.5	99.2	**97.4**
AA-11	BK-315	-	98.1	98.2	93.8	98.9	96.9	**97.2**
AA-12	BK-316	-	91.3	90.2	84.5	94.0	77.8	**87.5**
AA-13	BK-323	80.1	90.3	95.3	82.1	94.1	64.5	**84.4**
AA-14	BCU6263	57.4	76.3	73.9	55.9	74.8	36.5	**62.5**
AA-15	DWRBLK-2023-1	89.2	98.3	92.4	89.0	98.8	94.4	**93.7**
AA-16	DWRBLK-2023-2	-	98.1	98.7	97.0	97.7	97.3	**97.8**
AA-17	MBST-2022/6	-	94.1	97.9	93.6	96.3	-	**95.5**
AA-18	DWRB174 ©	-	77.1	-	63.5	83.2	-	**74.6**
AA-19	BK1127 ©	91.9	97.9	97.3	95.6	97.9	93.5	**95.7**
AA-20	DWRUB 52 ©	83.5	92.3	90.1	79.0	93.7	78.1	**86.1**
AA-21	DWRB 101 ©	83.4	92.12	89.9	80.74	94.43	87.34	**88.0**
AA-22	DWRB 123 ©	95.8	97.2	96	88.31	96.01	91.51	**94.1**
AA-23	DWRB 182 ©	95.01	95.98	97.24	95.76	99.45	91.85	**95.9**
Average		**86.6**	**93.1**	**93.5**	**86.3**	**95.3**	**86.2**	**90.2**

Table 5.4.7. Thin grain percentage of genotypes from different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	2.4	3.3	0.7	2.9	0.9	1.0	**1.9**
AA-2	BCU5955	1.7	1.4	1.0	6.0	0.5	2.4	**2.1**
AA-3	BCU5958	2.1	1.9	1.0	2.3	0.8	1.5	**1.6**
AA-4	BCU5959	5.8	0.4	0.5	2.4	0.4	1.4	**1.8**
AA-5	BCU5960	1.7	0.7	0.9	2.4	1.1	1.0	**1.3**
AA-6	BCU5961	-	0.5	0.4	2.9	0.4	6.8	**2.2**
AA-7	BK 303	1.1	0.3	0.2	0.7	0.1	0.1	**0.4**
AA-8	BK-306	0.4	0.3	0.2	0.6	0.5	0.3	**0.4**
AA-9	BK-311	1.4	0.6	0.2	1.7	0.3	0.6	**0.8**
AA-10	BK-312	0.9	0.1	0.2	2.2	0.2	0.2	**0.6**
AA-11	BK-315	-	0.2	0.1	1.2	0.2	0.5	**0.4**
AA-12	BK-316	-	1.6	1.1	2.1	1.0	3.8	**1.9**
AA-13	BK-323	3.9	1.6	0.4	2.9	0.7	8.0	**2.9**
AA-14	BCU6263	5.4	3.1	1.9	6.7	1.2	10.1	**4.7**
AA-15	DWRBLK-2023-1	1.6	0.2	0.9	3.9	0.3	0.5	**1.2**
AA-16	DWRBLK-2023-2	-	0.2	0.1	1.2	0.7	0.5	**0.5**
AA-17	MBST-2022/6	-	1.5	0.6	1.1	0.7	-	**1.0**
AA-18	DWRB174 ©	-	3.4	-	8.7	2.0	-	**4.7**
AA-19	BK1127 ©	1.8	0.4	0.1	0.5	0.5	1.1	**0.7**
AA-20	DWRUB 52 ©	1.7	1.3	0.6	2.6	0.6	2.5	**1.5**
AA-21	DWRB 101 ©	1.5	1.72	69	2.92	0.55	0.59	**12.7**
AA-22	DWRB 123 ©	0.67	0.61	0.56	2.41	0.69	1.43	**1.1**
AA-23	DWRB 182 ©	0.68	0.41	0.11	0.4	0.21	1.13	**0.5**
Average		**2.3**	**1.1**	**0.6**	**2.7**	**0.6**	**2.3**	**1.6**

Table 5.4.8. Protein content (% dwb) in different genotypes at different locations.

Code	Entry	Durgapura	Karnal	Ludhiana	Pantnagar	Mean
AA-1	BCU5954	13.0	16.2	14.5	10.4	**13.5**
AA-2	BCU5955	11.4	15.6	12.9	10.5	**12.6**
AA-3	BCU5958	12.2	15.5	13.5	10.7	**13.0**
AA-4	BCU5959	11.4	14.0	12.8	9.5	**11.9**
AA-5	BCU5960	11.8	15.4	12.4	11.5	**12.8**
AA-6	BCU5961	10.0	13.8	11.6	10.2	**11.4**
AA-7	BK 303	10.9	14.9	12.9	13.2	**13.0**
AA-8	BK-306	10.6	14.6	13.3	13.5	**13.0**
AA-9	BK-311	10.9	13.3	11.6	10.7	**11.6**
AA-10	BK-312	10.5	13.2	11.4	10.0	**11.3**
AA-11	BK-315	12.6	16.6	13.0	11.6	**13.5**
AA-12	BK-316	10.9	13.7	10.0	9.6	**11.1**
AA-13	BK-323	10.4	14.4	9.9	8.9	**10.9**
AA-14	BCU6263	10.9	13.1	11.1	10.1	**11.3**
AA-15	DWRBLK-2023-1	14.7	15.5	15.4	12.5	**14.5**
AA-16	DWRBLK-2023-2	14.3	15.9	15.2	14.1	**14.9**
AA-17	MBST-2022/6	14.5	15.8	12.8	13.5	**14.2**
AA-18	DWRB174 ©	15.4	-	13.9	13.0	**14.1**
AA-19	BK1127 ©	13.5	14.2	10.5	10.2	**12.1**
AA-20	DWRUB 52 ©	10.3	12.1	9.7	9.5	**10.4**
AA-21	DWRB 101 ©	10.3	13	10.6	10.0	**11.0**
AA-22	DWRB 123 ©	10.9	13.1	11.7	10.5	**11.6**
AA-23	DWRB 182 ©	11.3	13.0	10.8	9.3	**11.1**
Average		**12.0**	**14.6**	**12.4**	**11.2**	**12.5**

Table 5.4.9. Moisture content in grains (%) of genotypes from different locations*.

Code	Entry	D. Pura	Karnal	Ludhiana	Pantnagar	Mean
AA-1	BCU5954	8.1	9.4	9.4	9.9	**9.2**
AA-2	BCU5955	7.9	9.2	9.6	10.4	**9.3**
AA-3	BCU5958	7.8	9.0	9.2	9.7	**8.9**
AA-4	BCU5959	7.9	9.9	9.2	9.8	**9.2**
AA-5	BCU5960	7.9	10.0	9.0	9.7	**9.2**
AA-6	BCU5961	8.0	9.2	9.3	9.7	**9.1**
AA-7	BK 303	8.4	9.7	9.3	10.2	**9.4**
AA-8	BK-306	7.7	9.3	9.2	10.0	**9.1**
AA-9	BK-311	7.8	10.3	10.3	9.6	**9.5**
AA-10	BK-312	8.2	9.8	9.2	9.8	**9.3**
AA-11	BK-315	8.2	9.6	9.5	9.8	**9.3**
AA-12	BK-316	8.0	9.7	9.3	9.8	**9.2**
AA-13	BK-323	7.6	9.3	9.0	9.4	**8.8**
AA-14	BCU6263	7.7	9.2	10.8	10.0	**9.4**
AA-15	DWRBLK-2023-1	8.2	10.3	9.5	10.0	**9.5**
AA-16	DWRBLK-2023-2	10.3	9.9	9.7	9.9	**10.0**
AA-17	MBST-2022/6	8.1	9.4	11.3	9.9	**9.7**
AA-18	DWRB174 ©	8.2	9.8	10.4	10.3	**9.6**
AA-19	BK1127 ©	8.2	9.5	9.4	9.8	**9.2**
AA-20	DWRUB 52 ©	7.8	9.6	9.0	9.9	**9.1**
AA-21	DWRB 101 ©	7.9	9.6	9.3	9.5	**9.1**
AA-22	DWRB 123 ©	8.2	9.5	9.3	9.8	**9.2**
AA-23	DWRB 182 ©	8.6	9.2	9.3	10	**9.5**
	Average	**8.1**	**9.6**	**9.6**	**9.9**	**9.3**

Table 5.4.10. Starch content in grains (%dwt basis) in different entry at different locations.

Code	Entry	Durgapura	Karnal	Ludhiana	Pantnagar	Mean
AA-1	BCU5954	62.7	60.1	60.6	62.2	**61.4**
AA-2	BCU5955	63.7	60.3	61.0	62.0	**61.8**
AA-3	BCU5958	63.8	60.9	61.4	63.8	**62.5**
AA-4	BCU5959	63.6	61.4	61.4	63.7	**62.5**
AA-5	BCU5960	64.5	60.6	62.1	62.9	**62.5**
AA-6	BCU5961	65.1	62.6	62.8	65.1	**63.9**
AA-7	BK 303	63.0	61.2	61.5	62.2	**62.0**
AA-8	BK-306	64.4	61.3	61.5	61.6	**62.2**
AA-9	BK-311	64.6	60.3	61.1	63.2	**62.3**
AA-10	BK-312	64.3	61.8	62.2	63.3	**62.9**
AA-11	BK-315	61.6	59.4	61.1	62.1	**61.1**
AA-12	BK-316	65.4	62.0	63.9	65.0	**64.1**
AA-13	BK-323	65.0	61.4	64.1	64.6	**63.8**
AA-14	BCU6263	64.8	62.2	62.1	62.8	**63.0**
AA-15	DWRBLK-2023-1	61.6	60.0	59.8	61.5	**60.7**
AA-16	DWRBLK-2023-2	60.3	58.6	58.9	60.6	**59.6**
AA-17	MBST-2022/6	60.7	59.5	61.1	60.7	**60.5**
AA-18	DWRB174 ©	59.7		58.8	60.0	**59.5**
AA-19	BK1127 ©	62.7	61.4	62.9	63.4	**62.6**
AA-20	DWRUB 52 ©	65.5	63.5	64.2	63.9	**64.3**
AA-21	DWRB 101 ©	64.9	62.8	63	63.8	**63.6**
AA-22	DWRB 123 ©	63.9	62.5	62.4	62.8	**62.9**
AA-23	DWRB 182 ©	63.1	61.9	62.4	63.4	**62.7**
Average		**63.4**	**61.0**	**61.6**	**62.7**	**62.2**

Table 5.4.11. Alpha amylase activity (Ceralpha Unit, CU/g) in different genotypes at different locations.

Code	Entry	Hisar	D. Pura	Karnal	Ludhiana	Mean
AA-1	BCU5954	113.6	169.1	181.3	179.4	**160.9**
AA-2	BCU5955	99.6	154.2	250.0	187.9	**172.9**
AA-3	BCU5958	81.8	237.5	192.2	214.4	**181.5**
AA-4	BCU5959	102.7	150.1	130.4	175.4	**139.7**
AA-5	BCU5960	86.1	132.9	319.9	160.1	**174.8**
AA-6	BCU5961	112.7	154.2	285.6	186.6	**184.8**
AA-7	BK 303	37.8	109.9	64.3	171.0	**95.7**
AA-8	BK-306	48.4	83.0	68.3	151.7	**87.9**
AA-9	BK-311	47.1	108.9	140.7	113.3	**102.5**
AA-10	BK-312	54.3	109.9	202.5	144.8	**127.9**
AA-11	BK-315	122.3	176.0	127.6	188.2	**153.5**
AA-12	BK-316	163.5	276.2	246.5	346.1	**258.1**
AA-13	BK-323	176.6	223.4	280.6	183.5	**216.0**
AA-14	BCU6263	198.2	156.4	21.8	206.0	**145.6**
AA-20	DWRUB 52 ©	38.7	126.7	121.1	174.5	**115.2**
AA-21	DWRB 101 ©	57.1	115.5	128.6	162.6	**115.9**
AA-22	DWRB 123 ©	33.1	106.7	105.8	73.3	**79.7**
AA-23	DWRB 182 ©	42.4	209.7	229.4	190.1	**167.9**
Average		**89.8**	**155.6**	**172.0**	**178.3**	**148.9**

Agronomic Parameters

Table 5.4.12. Days to heading (75%) in different genotypes at different locations.

Code	Entry	Hisar	D. Pura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	89	65	98	110	90	72	**87**
AA-2	BCU5955	95	76	110	112	93	78	**94**
AA-3	BCU5958	94	75	98	112	94	77	**92**
AA-4	BCU5959	91	67	99	98	92	78	**88**
AA-5	BCU5960	95	73	102	111	90	78	**92**
AA-6	BCU5961	95	67	98	111	93	74	**90**
AA-7	BK 303	88	64	93	98	90	72	**84**
AA-8	BK-306	90	64	98	104	92	73	**87**
AA-9	BK-311	93	80	98	109	95	73	**91**
AA-10	BK-312	94	79	98	109	93	75	**91**
AA-11	BK-315	88	70	98	98	92	72	**86**
AA-12	BK-316	99	84	110	112	95	80	**97**
AA-13	BK-323	97	81	102	109	94	79	**94**
AA-14	BCU6263	94	83	102	108	95	79	**94**
AA-15	DWRBLK-2023-1	94	80	102	112	91	77	**93**
AA-16	DWRBLK-2023-2	87	60	93	105	84	74	**84**
AA-17	MBST-2022/6	61	43	42	57	53	68	**54**
AA-18	DWRB174 ©	61	37	45	51	57	69	**53**
AA-19	BK1127 ©	93	64	98	98	90	80	**87**
AA-20	DWRUB 52 ©	92	71	98	109	95	77	**90**
AA-21	DWRB 101 ©	92	69	98	109	91	76	**89**
AA-22	DWRB 123 ©	92	72	98	98	91	78	**88**
AA-23	DWRB 182 ©	94	80	98	112	95	77	**93**
Average		**90**	**69**	**94**	**102**	**88**	**75**	**86**

Table 5.4.13. Days to maturity (75%) in different genotypes at different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	133	123	146	153	140	119	**136**
AA-2	BCU5955	133	124	154	153	140	122	**138**
AA-3	BCU5958	134	121	141	152	139	121	**135**
AA-4	BCU5959	134	120	147	152	138	123	**136**
AA-5	BCU5960	136	118	146	154	137	123	**136**
AA-6	BCU5961	137	122	145	155	141	122	**137**
AA-7	BK 303	136	123	146	155	142	123	**138**
AA-8	BK-306	137	123	150	156	142	123	**138**
AA-9	BK-311	138	125	145	156	141	123	**138**
AA-10	BK-312	137	124	145	156	145	124	**139**
AA-11	BK-315	131	119	147	148	143	124	**135**
AA-12	BK-316	138	123	152	152	144	122	**138**
AA-13	BK-323	133	125	145	154	140	124	**137**
AA-14	BCU6263	127	127	144	151	141	123	**136**
AA-15	DWRBLK-2023-1	137	122	147	156	142	123	**138**
AA-16	DWRBLK-2023-2	135	115	144	153	141	123	**135**
AA-17	MBST-2022/6	115	106	108	115	114	111	**112**
AA-18	DWRB174 ©	118	110	113	119	119	115	**116**
AA-19	BK1127 ©	133	119	146	151	140	122	**135**
AA-20	DWRUB 52 ©	134	123	144	155	142	122	**137**
AA-21	DWRB 101 ©	135	124	146	154	141	122	**137**
AA-22	DWRB 123 ©	133	124	147	155	141	124	**137**
AA-23	DWRB 182 ©	137	125	143	155	143	124	**138**
Average		**133**	**121**	**143**	**150**	**139**	**122**	**134**

Table 5.4.14. Plant height (cm) in different genotypes at different locations.

Code	Entry	Hisar	D. Pura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
AA-1	BCU5954	98	101	83	82	107	73	**90.6**
AA-2	BCU5955	97	100	106	81	92	78	**92.3**
AA-3	BCU5958	105	92	111	80	89	93	**94.8**
AA-4	BCU5959	106	104	108	78	94	102	**98.6**
AA-5	BCU5960	108	100	100	77	107	82	**95.5**
AA-6	BCU5961	112	97	94	91	106	82	**97.0**
AA-7	BK 303	103	103	102	89	109	82	**97.9**
AA-8	BK-306	115	91	107	103	98	82	**99.3**
AA-9	BK-311	104	89	114	92	98	90	**97.9**
AA-10	BK-312	109	92	106	75	100	83	**94.2**
AA-11	BK-315	99	87	95	81	98	83	**90.5**
AA-12	BK-316	109	105	117	82	104	91	**101.2**
AA-13	BK-323	118	87	113	76	113	89	**99.3**
AA-14	BCU6263	123	108	114	88	114	83	**105.0**
AA-15	DWRBLK-2023-1	116	86	91	86	101	66	**91.1**
AA-16	DWRBLK-2023-2	117	73	95	69	98	69	**86.9**
AA-17	MBST-2022/6	70	62	65	57	89	52	**65.8**
AA-18	DWRB174 ©	53	64	43	46	64	56	**54.3**
AA-19	BK1127 ©	102	96	98	78	98	86	**93.0**
AA-20	DWRUB 52 ©	112	91	104	83	85	80	**92.5**
AA-21	DWRB 101 ©	97	95	94	76	101	72	**89.1**
AA-22	DWRB 123 ©	96	96	95	84	106	87	**93.9**
AA-23	DWRB 182 ©	98	93	93	88	93	78	**90.3**
Average		**103.8**	**91.4**	**98.1**	**79.7**	**98.2**	**80.2**	**91.9**

BQSN 2: (Hulless Landrace/Lines) -High antioxidant, Fe and Zn Parameters

Table 5.4.15. Antioxidant activity (% discoloration) using DPPH assay in different entry at different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
NB-1	HLR-10	44.5	69.1	50.0	36.6	51.0	49.6	**50.1**
NB-2	HLR-24	48.3	78.1	41.3	49.1	45.5	46.3	**51.4**
NB-3	HLR-34	45.4	82.9	43.6	54.5	55.5	39.1	**53.5**
NB-4	HLR-64	44.3	81.8	46.4	50.3	47.1	45.9	**52.6**
NB-5	HLR-125	33.9	71.8	31.1	43.7	36.3	41.8	**43.1**
NB-6	HLR-136	34.5	68.6	37.2	37.5	29.2	37.6	**40.8**
NB-7	HLR-153	36.7	71.8	38.3	50.5	44.5	42.1	**47.3**
NB-8	HLR-196	41.6	80.8	42.4	58.8	55.1	47.6	**54.4**
NB-9	HLR-310	37.8	79.8	41.1	46.2	43.5	46.3	**49.1**
NB-10	HLR-322	37.3	73.7	47.0	40.1	47.1	45.1	**48.4**
NB-11	HLR-355	35.2	73.3	39.9	43.4	43.4	47.5	**47.1**
NB-12	EC0578267	31.3	81.0	42.0	42.8	40.2	47.9	**47.5**
NB-13	IC0532979	33.2	77.3	44.5	39.7	42.2	39.9	**46.1**
NB-14	IC0438103	32.5	78.6	37.2	37.4	41.6	41.8	**44.9**
NB-15	IC532985	30.4	75.4	42.1	39.0	37.4	36.8	**43.5**
NB-16	DWRB-191 ©	40.2	88.9	50.1	51.9	47.4	42.2	**53.4**
NB-17	DWRB-192 ©	40.5	88.9	47.3	51.1	38.9	46.1	**52.1**
NB-18	KASOTA ©	37.5	76.9	41.0	40.5	35.8	61.1	**48.8**
NB-19	DWRB-189 ©	53.9	93.6	79.5	60.6	59.7	42.3	**64.9**
Average		**38.9**	**78.5**	**44.3**	**46.0**	**44.3**	**44.6**	**49.4**

Table 5.4.16. Approximate Fe content (ppm) in different genotypes at different locations .

Code	Entry	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
NB-1	HLR-10	29.9	30.9	30.7	31.4	32.2	**31.0**
NB-2	HLR-24	39.0	42.5	38.5	40.3	46.6	**41.4**
NB-3	HLR-34	39.3	39.3	31.5	38.1	43.5	**38.3**
NB-4	HLR-64	38.1	44.9	34.3	41.4	47.4	**41.2**
NB-5	HLR-125	29.9	34.7	30.8	31.5	39.3	**33.2**
NB-6	HLR-136	40.7	38.1	37.5	40.7	46.2	**40.6**
NB-7	HLR-153	38.5	33.1	31.0	29.2	43.1	**35.0**
NB-8	HLR-196	31.7	32.4	28.0	35.2	33.6	**32.2**
NB-9	HLR-310	31.4	37.1	30.4	35.7	41.3	**35.2**
NB-10	HLR-322	35.2	37.8	34.4	34.2	38.3	**36.0**
NB-11	HLR-355	29.9	34.9	30.0	30.9	37.7	**32.7**
NB-12	EC0578267	34.0	37.9	31.5	31.5	36.9	**34.4**
NB-13	IC0532979	35.8	39.4	37.3	39.3	37.6	**37.9**
NB-14	IC0438103	34.1	36.6	33.4	30.5	35.3	**34.0**
NB-15	IC532985	42.3	37.6	44.1	44.6	42.4	**42.2**
NB-16	DWRB-191 ©	44.3	41.9	34.3	43.6	39.6	**40.7**
NB-17	DWRB-192 ©	41.1	46.7	36.6	52.1	39.6	**43.2**
NB-18	KASOTA ©	39.9	34.0	27.4	39.0	41.1	**36.3**
NB-19	DWRB-189 ©	38.9	33.1	33.1	33.6	34.2	**34.6**
Average		**36.5**	**37.5**	**33.4**	**37.0**	**39.8**	**36.8**

Table 5.4.17: Approximate Zn content (ppm) in different genotypes at different locations .

Code	Entry	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
NB-1	HLR-10	26.0	31.1	32.5	26.5	28.2	**28.9**
NB-2	HLR-24	27.4	41.9	35.3	36.0	35.1	**35.1**
NB-3	HLR-34	28.8	39.4	29.8	35.7	29.1	**32.6**
NB-4	HLR-64	33.9	43.2	34.2	34.8	29.1	**35.0**
NB-5	HLR-125	22.3	36.7	30.0	30.9	34.4	**30.9**
NB-6	HLR-136	34.1	42.2	35.3	37.6	40.6	**38.0**
NB-7	HLR-153	22.8	31.0	22.4	22.3	27.2	**25.1**
NB-8	HLR-196	32.2	36.2	29.0	35.3	31.4	**32.8**
NB-9	HLR-310	25.2	37.4	27.1	28.3	30.9	**29.8**
NB-10	HLR-322	28.7	37.0	33.8	30.9	34.3	**32.9**
NB-11	HLR-355	22.2	35.3	30.8	25.6	32.9	**29.4**
NB-12	EC0578267	36.3	42.0	38.2	38.0	41.7	**39.2**
NB-13	IC0532979	38.9	43.2	37.7	36.8	41.0	**39.5**
NB-14	IC0438103	35.6	39.1	35.3	40.2	38.1	**37.7**
NB-15	IC532985	33.5	36.3	34.5	39.3	37.2	**36.2**
NB-16	DWRB-191 ©	26.4	36.6	30.4	28.4	33.6	**31.1**
NB-17	DWRB-192 ©	31.1	41.3	28.2	39.7	33.6	**34.8**
NB-18	KASOTA ©	25.1	28.9	23.4	32.6	25.8	**27.2**
NB-19	DWRB-189 ©	19.8	31.0	21.9	24.5	55.9	**30.6**
Average		**29.0**	**37.4**	**31.0**	**32.8**	**34.7**	**33.0**

BQSN 3: High Protein and low beta glucan -Grain Parameters

Table 5.4.18. Thousand grain weight (g) in different genotypes at different locations*.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301	57.3	69.3	64.9	54.5	60.6	47.4	**59.0**
MB-2	RMB2302	46.1	53.6	54.8	42.2	51.3	35.0	**47.2**
MB-3	RMB2303	47.0	49.7	54.4	42.7	50.4	34.5	**46.5**
MB-4	RMB2304	48.0	56.7	54.9	43.2	50.3	37.7	**48.5**
MB-5	RMB2305	51.1	63.1	60.2	51.2	59.2	47.1	**55.3**
MB-6	RMB2306	57.5	68.4	64.1	57.6	65.8	56.6	**61.7**
MB-7	RMB2307	54.1	67.0	64.2	56.8	57.6	56.0	**59.3**
MB-8	RMB2308	54.9	61.2	58.2	47.5	57.9	48.0	**54.6**
MB-16	BK306 ©	47.8	52.1	54.6	43.4	54.1	41.0	**48.9**
MB-17	BK1127 ©	60.3	70.8	71.2	60.6	70.0	63.4	**66.0**
MB-18	DWRB136 ©	46.1	48.0	48.8	38.9	48.4	38.0	**44.7**
MB-19	DWRB182 ©	45.5	52.9	52.8	40.4	49.7	34.8	**46.0**
Average		**51.3**	**59.4**	**58.6**	**48.3**	**56.3**	**44.9**	**53.1**

Table 5.4.19. Hectoliter weight (Test weight in kg/hl) of genotypes from different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301	58.6	67.0	66.8	66.2	67.2	64.7	**65.1**
MB-2	RMB2302	55.6	72.4	70.1	64.1	68.4	-	**66.1**
MB-3	RMB2303	56.0	68.7	66.0	63.2	67.8	-	**64.3**
MB-4	RMB2304	57.7	70.3	66.2	63.7	67.0	62.5	**64.6**
MB-5	RMB2305	59.0	71.1	67.6	65.6	68.2	65.2	**66.1**
MB-6	RMB2306	55.1	68.7	64.8	65.4	66.2	67.3	**64.6**
MB-7	RMB2307	54.0	67.7	65.1	63.5	63.6	65.8	**63.3**
MB-8	RMB2308	58.2	70.6	67.4	63.5	67.7	68.3	**66.0**
MB-16	BK306 ©	57.6	71.7	68.8	67.2	70.9	70.8	**67.8**
MB-17	BK1127 ©	59.3	69.3	67.3	65.3	66.2	66.9	**65.7**
MB-18	DWRB136 ©	55.6	64.9	60.9	59.2	62.3	56.8	**59.9**
MB-19	DWRB182 ©	55.2	68.4	67.0	66.5	66.4	63.5	**64.5**
Average		**56.8**	**69.2**	**66.5**	**64.5**	**66.8**	**65.2**	**64.8**

Table 5.4.20. Bold grain percentage of genotypes from different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301	94.9	93.6	99.2	95.2	98.5	86.0	**94.6**
MB-2	RMB2302	84.1	91.0	96.5	79.9	96.2	-	**89.5**
MB-3	RMB2303	82.5	80.8	95.5	77.6	96.4	-	**86.6**
MB-4	RMB2304	83.8	93.3	91.7	75.5	91.5	45.2	**80.2**
MB-5	RMB2305	92.7	95.9	98.1	89.7	95.5	76.6	**91.4**
MB-6	RMB2306	92.0	96.3	97.7	69.5	98.3	86.6	**90.1**
MB-7	RMB2307	89.5	95.0	96.9	95.5	96.5	95.2	**94.8**
MB-8	RMB2308	93.3	92.2	94.8	85.0	97.3	87.9	**91.8**
MB-16	BK306 ©	87.1	92.6	96.0	82.5	93.4	69.1	**86.8**
MB-17	BK1127 ©	95.1	96.1	98.9	97.2	99.0	96.3	**97.1**
MB-18	DWRB136 ©	89.8	93.2	90.9	78.4	92.7	74.9	**86.6**
MB-19	DWRB182 ©	80.8	92.2	95.1	86.9	92.7	42.0	**81.6**
Average		**88.8**	**92.7**	**95.9**	**84.4**	**95.7**	**76.0**	**88.9**

Table 5.4.21. Thin grain percentage of genotypes from different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301	0.61	1.67	0.01	0.95	0.54	2.44	**1.0**
MB-2	RMB2302	1.65	1.27	0.18	3.41	0.40	-	**1.4**
MB-3	RMB2303	1.98	2.84	0.08	2.91	0.44	-	**1.7**
MB-4	RMB2304	2.74	1.02	0.18	3.98	1.11	12.29	**3.6**
MB-5	RMB2305	0.94	0.77	0.12	1.03	0.94	3.60	**1.2**
MB-6	RMB2306	0.92	0.77	0.13	0.94	0.40	1.68	**0.8**
MB-7	RMB2307	1.51	1.02	0.14	1.04	1.39	0.87	**1.0**
MB-8	RMB2308	0.96	1.59	0.40	2.56	0.57	0.57	**1.1**
MB-16	BK306 ©	1.33	0.96	0.32	1.82	1.08	3.59	**1.5**
MB-17	BK1127 ©	0.51	1.14	0.24	0.57	0.42	0.61	**0.6**
MB-18	DWRB136 ©	2.17	1.04	0.99	5.01	1.54	5.17	**2.7**
MB-19	DWRB182 ©	4.11	1.23	0.66	1.12	0.48	14.24	**3.6**
Average		**1.6**	**1.3**	**0.3**	**2.1**	**0.8**	**4.5**	**1.8**

Table 5.4.22. Protein content (% dwb) in different genotypes at different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301		13.0	14.7	11.9	11.0		**12.7**
MB-2	RMB2302		10.7	13.6	11.3	9.2		**11.2**
MB-3	RMB2303		11.2	12.6	10.0	8.7		**10.6**
MB-4	RMB2304		10.5	13.2	11.2	9.9		**11.2**
MB-5	RMB2305		12.5	14.7	11.8	12.9		**13.0**
MB-6	RMB2306		12.8	15.5	12.0	13.2		**13.4**
MB-7	RMB2307		13.8	16.6	12.9	14.6		**14.5**
MB-8	RMB2308		11.7	14.4	11.5	12.1		**12.4**
MB-16	BK306 ©		10.7	13.3	10.2	10.2		**11.1**
MB-17	BK1127 ©		13.4	15.8	12.1	14.7		**14.0**
MB-18	DWRB136 ©		9.3	12.3	8.6	9.2		**9.9**
MB-19	DWRB182 ©		10.7	14.2	8.4	8.0		**10.3**
Average			**11.7**	**14.2**	**11.0**	**11.1**		**12.0**

Table 5.4.23. Moisture content in grains (%) of genotypes from different locations*.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301		8.3	10.1	9.4	10.7		**9.6**
MB-2	RMB2302		7.9	10.1	9.5	9.8		**9.3**
MB-3	RMB2303		7.9	10.5	9.1	9.9		**9.4**
MB-4	RMB2304		8.0	9.8	9.2	9.9		**9.2**
MB-5	RMB2305		8.1	10.0	9.4	9.5		**9.3**
MB-6	RMB2306		8.2	10.6	9.6	10.2		**9.7**
MB-7	RMB2307		8.3	9.6	9.2	10.7		**9.5**
MB-8	RMB2308		8.6	9.5	9.3	10.4		**9.5**
MB-16	BK306 ©		7.7	9.7	9.5	10.1		**9.3**
MB-17	BK1127 ©		8.2	9.6	9.3	10.3		**9.4**
MB-18	DWRB136 ©		8.3	10.6	9.5	10.6		**9.8**
MB-19	DWRB182 ©		8.1	9.0	9.0	10.4		**9.1**
Average			**8.1**	**9.9**	**9.3**	**10.2**		**9.4**

Table 5.4.24. Starch content in grains (%dwt basis) in different genotypes at different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301		62.3	60.7	62.4	62.6		**62.0**
MB-2	RMB2302		64.7	61.5	62.2	64.2		**63.2**
MB-3	RMB2303		64.1	61.8	62.9	64.7		**63.4**
MB-4	RMB2304		64.3	61.5	62.5	63.4		**62.9**
MB-5	RMB2305		62.8	60.8	61.6	61.7		**61.7**
MB-6	RMB2306		62.6	60.2	61.2	61.3		**61.3**
MB-7	RMB2307		61.1	59.2	60.8	59.8		**60.2**
MB-8	RMB2308		62.2	60.7	61.7	61.6		**61.6**
MB-16	BK306 ©		62.5	62.3	63.0	64.4		**63.1**
MB-17	BK1127 ©		62.3	59.8	61.9	60.7		**61.2**
MB-18	DWRB136 ©		64.0	60.4	62.5	62.5		**62.4**
MB-19	DWRB182 ©		63.8	62.1	65.2	64.0		**63.8**
Average			**63.1**	**60.9**	**62.3**	**62.6**		**62.2**

Table 5.4.25. Germination % in different genotypes at different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301	96	100	98	96	92	89	**95.1**
MB-2	RMB2302	90	98	96	98	94	-	**95.2**
MB-3	RMB2303	94	100	100	92	98	-	**96.8**
MB-4	RMB2304	96	100	100	90	100	89	**95.8**
MB-18	DWRB136 ©	97	100	100	91	98	87	**95.4**
MB-19	DWRB182 ©	95	98	100	94	100	88	**95.8**
Average		**94.7**	**99.3**	**99.0**	**93.5**	**97.0**	**87.9**	**95.2**

Table 5.4.26: β--glucan content (% dwb) of different entries from different locations.

Code	Entry	Hisar	Durgapura	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
MB-1	RMB2301	5.4	5.2	5.8	5.1	5.6	5.3	**5.4**
MB-2	RMB2302	4.5	5.2	5.5	5.4	5.1	5.6	**5.2**
MB-3	RMB2303	5.2	5.8	5.1	4.0	4.2	4.9	**4.9**
MB-4	RMB2304	5.5	4.6	4.3	5.5	5.7	4.2	**5.0**
MB-18	DWRB136 ©	4.8	4.2	4.7	5.0	6.5	5.5	**5.1**
MB-19	DWRB182 ©	4.5	4.8	4.9	3.9	4.9	4.6	**4.6**
Average		**5.0**	**5.0**	**5.1**	**4.8**	**5.3**	**5.1**	**5.0**

MALT PARAMETERS

Table 5.4.27. Malt yield (%) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	90.3	89.2	91.3	87.2	89.1	88.7	89.3
MB-2	RMB2302	91.5	90.6	88.0	87.3	88.5	-	89.2
MB-3	RMB2303	90.0	89.8	89.7	86.5	87.6	-	88.7
MB-4	RMB2304	89.8	90.3	89.9	88.1	87.9	88.8	89.1
MB-18	DWRB136 ©	89.7	89.4	87.6	88.5	87.2	86.5	88.2
MB-19	DWRB182 ©	88.0	90.3	89.9	86.9	87.1	87.7	88.3
Average		**89.9**	**89.9**	**89.4**	**87.4**	**87.9**	**87.9**	**88.7**

Table 5.4.28. Malt friability (%) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	55.9	58.2	56.8	66.1	63.4	60.2	**60.1**
MB-2	RMB2302	47.6	52.3	52.4	67.5	60.4	-	**56.0**
MB-3	RMB2303	57.0	62.2	59.7	78.2	70.6	-	**65.5**
MB-4	RMB2304	53.2	57.7	60.3	71.2	62.9	27.0	**55.4**
MB-18	DWRB136 ©	41.0	51.7	46.0	63.5	61.8	58.4	**53.7**
MB-19	DWRB182 ©	53.0	47.1	51.1	77.2	77.2	48.7	**59.1**
Average		**51.3**	**54.9**	**54.4**	**70.6**	**66.1**	**48.6**	**57.6**

Table 5.4.29. Malt homogeneity (%) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	96.9	94.6	94.8	98.4	99.2	91.0	**95.8**
MB-2	RMB2302	93.5	92.5	95.7	98.7	98.3	-	**95.7**
MB-3	RMB2303	96.8	95.1	94.7	99.5	98.4	-	**96.9**
MB-4	RMB2304	95.8	94.9	96.3	98.7	96.2	95.8	**96.3**
MB-18	DWRB136 ©	69.1	83.0	75.4	88.8	86.1	91.5	**82.3**
MB-19	DWRB182 ©	84.7	73.5	78.5	98.5	98.5	72.4	**84.3**
Average		**89.5**	**88.9**	**89.2**	**97.1**	**96.1**	**87.7**	**91.4**

Table 5.4.30. Hot water extract (% fgdb) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	71.8	76.8	79.7	79.1	74.2	77.7	**76.6**
MB-2	RMB2302	66.8	81.0	79.3	77.7	75.6	-	**76.1**
MB-3	RMB2303	78.6	78.3	74.6	75.4	80.4	-	**77.5**
MB-4	RMB2304	68.5	81.5	73.1	74.3	75.1	75.5	**74.7**
MB-18	DWRB136 ©	76.2	77.9	74.1	75.2	78.2	78.5	**76.7**
MB-19	DWRB182 ©	74.4	73.6	78.9	82.1	81.0	80.9	**78.5**
Average		**72.7**	**78.2**	**76.6**	**77.3**	**77.4**	**78.2**	**76.7**

Table 5.4.31. Wort filtration rate (ml/hr) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	265.0	175.0	195.0	230.0	165.0	210.0	**206.7**
MB-2	RMB2302	315.0	265.0	295.0	255.0	305.0	-	**287.0**
MB-3	RMB2303	290.0	290.0	295.0	280.0	285.0	-	**288.0**
MB-4	RMB2304	295.0	315.0	325.0	310.0	320.0	210.0	**295.8**
MB-18	DWRB136 ©	280.0	245.0	225.0	275.0	200.0	260.0	**247.5**
MB-19	DWRB182 ©	310.0	315.0	320.0	320.0	305.0	295.0	**310.8**
Average		**292.5**	**267.5**	**275.8**	**278.3**	**263.3**	**243.8**	**270.2**

Table 5.4.32. Diastatic power (^{0}L) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	108.7	119.0	111.1	108.7	116.3	116.3	**113.4**
MB-2	RMB2302	98.0	62.5	87.7	98.0	75.8	-	**84.4**
MB-3	RMB2303	111.1	106.4	106.4	108.7	89.3	-	**104.4**
MB-4	RMB2304	108.7	104.2	113.6	111.1	106.4	108.7	**108.8**
MB-18	DWRB136 ©	108.7	116.3	122.0	108.7	111.1	116.3	**113.8**
MB-19	DWRB182 ©	106.4	108.7	116.3	108.7	108.7	113.6	**110.4**
Average		**106.9**	**102.8**	**109.5**	**107.3**	**101.3**	**113.7**	**106.9**

Table 5.4.33. Saccharification rate (minutes) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	10.0	5.0	10.0	5.0	5.0	10.0	**7.5**
MB-2	RMB2302	5.0	5.0	10.0	5.0	5.0	-	**6.0**
MB-3	RMB2303	5.0	5.0	5.0	10.0	10.0	-	**7.0**
MB-4	RMB2304	10.0	5.0	5.0	10.0	5.0	5.0	**6.7**
MB-18	DWRB136 ©	5.0	5.0	10.0	5.0	5.0	10.0	**6.7**
MB-19	DWRB182 ©	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Average		**6.7**	**5.0**	**7.5**	**6.7**	**5.8**	**7.5**	**6.5**

Table 5.4.34. Wort pH of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	5.7	5.7	5.7	5.6	5.7	5.8	**5.7**
MB-2	RMB2302	5.6	5.7	5.7	5.7	5.8	-	**5.7**
MB-3	RMB2303	5.7	5.8	5.7	5.6	5.8	-	**5.7**
MB-4	RMB2304	5.6	5.8	5.7	5.8	5.9	5.8	**5.8**
MB-18	DWRB136 ©	5.9	5.9	5.9	5.9	5.9	5.9	**5.9**
MB-19	DWRB182 ©	5.8	5.8	5.7	5.9	5.9	5.9	**5.8**
Average		**5.7**	**5.8**	**5.7**	**5.7**	**5.8**	**5.8**	**5.8**

Table 5. 4.35. Wort FAN content (ppm) of AVT entries from different locations.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	191.2	193.2	169.2	141.9	186.3	165.8	**174.6**
MB-2	RMB2302	175.0	179.5	182.3	233.3	186.3	-	**191.3**
MB-3	RMB2303	172.7	172.6	156.9	181.2	174.8	-	**171.6**
MB-4	RMB2304	174.6	161.5	169.6	214.1	177.4	159.6	**176.1**
MB-18	DWRB136 ©	127.7	148.7	162.3	213.7	166.7	153.1	**162.0**
MB-19	DWRB182 ©	131.5	146.6	138.5	177.8	156.4	142.7	**148.9**
Average		**162.1**	**167.0**	**163.1**	**193.7**	**174.6**	**155.3**	**169.3**

Table 5.4.36. Wort β--Glucan Content (ppm) of AVT entries at one location.

Code	Entry	Hisar	Karnal	Ludhiana	Pantnagar	Durgapura	Bawal	Mean
MB-1	RMB2301	902.9	652.3	1259.2	941.0	880.3	571.5	**867.9**
MB-2	RMB2302	1029.3	659.8	1097.2	530.5	681.2	-	**799.6**
MB-3	RMB2303	798.2	461.5	835.8	316.1	531.4	-	**588.6**
MB-4	RMB2304	765.7	602.1	687.3	187.6	525.1	735.3	**583.9**
MB-18	DWRB136 ©	996.9	626.4	703.2	381.0	599.6	482.6	**631.6**
MB-19	DWRB182 ©	727.1	795.8	870.6	373.3	658.6	459.6	**647.5**
Average		**870.0**	**633.0**	**908.9**	**454.9**	**646.0**	**562.3**	**679.2**

FEED AND FOOD BARLEY QUALITY EVALUATION

The feed and food grain samples from various trials grown at different locations were analyzed for physical parameters and protein content. Each centre was requested to provide a grain sample of 250 g. The details of samples received are as under:

Table 5.5.1: Details of grain samples analyzed for quality.

Trial	Zone	Locations	Total No. of Samples
Food/Hulless Barley			
AVT-IR-TS	NWPZ/CZ	Karnal, Durgapura, Ludhiana, Pantnagar, Hisar, Vijapur, Udaipur	5 (entry) x 7 (location) = 35
		TOTAL	**35**

Hectoliter weight (test weight) was measured with ICAR-IIWBR Hectoliter Weight instrument. The crude protein content was estimated using FOSS NIR system and has been given on dry weight basis. The quality data has been presented trial wise (Annexure 1). The entries having highest thousand grain weight, protein content and hectoliter weight have been listed in table no. 5.5.2.

Table 5.5.2: Entries having highest thousand grain weight, protein content, hectoliter weight, grain beta-glucan content, Fe and Zn in respective trials.

Trial	Zone	TGW (g)	PC (%)	HW (kg/hl)	G-BG (%)*	Fe (ppm)	Zn (ppm)
Food/Hulless Barley							
AVT-IR-TS	NWPZ/CZ	DWRB 244, DWRB 223	DWRB 244, DWRB223	DWRB 223, DWRB 244	DWRB 244	K1149©	DWRB223

**G-BG: Grain Beta Glucan at two locations only*

Hulless Barley/Naked Barley-NWPZ

Table 5.5.3. Thousand grain weight (g) of different entries in NWPZ.

Code	Entry	Karnal	Durgapura	Ludhiana	Pantnagar	Hisar	Mean
AVT-IRTS-NB-4	DWRB223**	36.9	36.0	37.2	39.5	36.6	**37.2**
AVT-IRTS-NB-1	DWRB244*	39.1	35.4	37.6	39.2	37.3	**37.7**
AVT-IRTS-NB-5	Karan16©	40.8	30.4	32.9	37.6	32.2	**34.8**
AVT-IRTS-NB-3	K1149©	26.1	31.0	34.7	34.4	32.6	**31.8**
AVT-IRTS-NB-2	PL891©	45.5	46.5	47.3	41.2	48.0	**45.7**
Average		**37.7**	**35.9**	**37.9**	**38.4**	**37.3**	**37.4**

**=AVT (I) **=AVT (II)*

Table 5.5.4: Protein content (% dwb) of different entries in NWPZ.

Code	Entry	Karnal	Durgapura	Ludhiana	Pantnagar	Hisar	Mean
AVT-IRTS-NB-4	DWRB223**	14.6	13.6	12.0	9.1	11.2	**12.1**
AVT-IRTS-NB-1	DWRB244*	13.3	13.6	13.0	10.1	14.0	**12.8**
AVT-IRTS-NB-5	Karan16©	13.9	12.1	11.3	9.6	12.4	**11.9**
AVT-IRTS-NB-3	K1149©	16.1	12.6	12.0	9.6	12.1	**12.5**
AVT-IRTS-NB-2	PL891©	13.7	13.3	11.5	9.6	11.5	**11.9**
Average		**14.3**	**13.0**	**12.0**	**9.6**	**12.2**	**12.2**

**=AVT (I) **=AVT (II)*

Table 5.5.5. Hectoliter weight (kg/hl) of different entries in NWPZ.

Code	Entry	Karnal	Durgapura	Ludhiana	Pantnagar	Hisar	Mean
AVT-IRTS-NB-4	DWRB223**	78.6	80.6	78.3	80.1	71.2	**77.8**
AVT-IRTS-NB-1	DWRB244*	78.7	76.7	77.2	79.3	60.7	**74.5**
AVT-IRTS-NB-5	Karan16©	79.8	77.8	76.4	78.0	68.5	**76.1**
AVT-IRTS-NB-3	K1149©	75.5	79.5	75.3	75.8	69.3	**75.0**
AVT-IRTS-NB-2	PL891©	77.7	78.8	76.2	77.4	63.4	**74.7**
Average		**78.1**	**78.7**	**76.7**	**78.1**	**66.6**	**75.6**

**=AVT (I) **=AVT (II)*

Table 5.5.6. Plump grain percentage (>2.5 mm) of different entries in NWPZ.

Code	Entry	Karnal	Durgapura	Ludhiana	Pantnagar	Hisar	Mean
AVT-IRTS-NB-4	DWRB223**	69.5	47.1	70.2	50.1	52.3	**57.8**
AVT-IRTS-NB-1	DWRB244*	27.7	17.1	30.3	33.6	32.2	**28.2**
AVT-IRTS-NB-5	Karan16©	52.3	14.3	32.9	33.8	24.0	**31.4**
AVT-IRTS-NB-3	K1149©	15.8	6.5	35.0	22.5	11.7	**18.3**
AVT-IRTS-NB-2	PL891©	63.4	70.3	83.2	43.4	65.6	**65.2**
Average		**45.7**	**31.1**	**50.3**	**36.7**	**37.1**	**40.2**

**=AVT (I) **=AVT (II)*

Table 5.5.7. β--glucan content (% dwb), Fe (ppm) and Zn (ppm) of different entries from different locations in NWPZ. # indicates Karnal location only.

Code	Entry	Karnal	Durgapura	Mean	Fe$^{\#}$	Zn$^{\#}$
AVT-IRTS-NB-4	DWRB223**	6.2	5.8	**6.0**	43.7	47.8
AVT-IRTS-NB-1	DWRB244*	8.3	7.3	**7.8**	43.3	38.2
AVT-IRTS-NB-3	K1149©	5.5	4.9	**5.2**	44.4	42.0
AVT-IRTS-NB-5	Karan16©	4.7	5.3	**5.0**	42.7	30.4
AVT-IRTS-NB-2	PL891©	6.5	6.1	**6.3**	40.3	36.6
Average		**6.3**	**5.9**	**6.1**	**42.9**	**39.0**

**=AVT (I) **=AVT (II)*

Hulless Barley/Naked Barley-CZ

Table 5.5.8. Thousand grain weight (g) of different entries in CZ.

Code	Entry	Vijapur	Udaipur	Mean CZ
AVT-IR-NB-CZ-5	DWRB223**	34.9	20.2	**27.6**
AVT-IR-NB-CZ-4	DWRB244*	38.1	18.5	**28.3**
AVT-IR-NB-CZ-3	Karan16©	34.3	18.6	**26.5**
AVT-IR-NB-CZ-1	K1149©	35.2	20.6	**27.9**
AVT-IR-NB-CZ-2	PL891©	36.7	23.8	**30.3**
Average		**35.8**	**20.4**	**28.1**

**=AVT (I) **=AVT (II)*

Table 5.5.9. Protein content (% dwb) of different entries in CZ.

Code	Entry	Vijapur	Udaipur	Mean CZ
AVT-IR-NB-CZ-5	DWRB223**	16.0	12.4	**14.2**
AVT-IR-NB-CZ-4	DWRB244*	15.8	13.7	**14.8**
AVT-IR-NB-CZ-3	Karan16©	14.0	11.3	**12.6**
AVT-IR-NB-CZ-1	K1149©	10.5	12.5	**11.5**
AVT-IR-NB-CZ-2	PL891©	14.3	12.4	**13.4**
Average		**14.1**	**12.5**	**13.3**

**=AVT (I) **=AVT (II)*

Table 5.5.10. Hectoliter weight (kg/hl) of different entries in CZ.

Code	Entry	Vijapur	Udaipur	Mean CZ
AVT-IR-NB-CZ-5	DWRB223**	75.3	78.9	**77.1**
AVT-IR-NB-CZ-4	DWRB244*	73.8	78.0	**75.9**
AVT-IR-NB-CZ-3	Karan16©	72.9	77.9	**75.4**
AVT-IR-NB-CZ-1	K1149©	70.5	78.6	**74.6**
AVT-IR-NB-CZ-2	PL891©	70.6	77.6	**74.1**
Average		**72.6**	**78.2**	**75.4**

**=AVT (I) **=AVT (II)*

Table 5.5.11. Plump grain percentage (>2.5 mm) of different entries in CZ.

Code	Entry	Vijapur	Udaipur	Mean CZ
AVT-IR-NB-CZ-5	DWRB223**	41.2	76.8	**59.0**
AVT-IR-NB-CZ-4	DWRB244*	28.5	27.4	**28.0**
AVT-IR-NB-CZ-3	Karan16©	21.0	25.5	**23.2**
AVT-IR-NB-CZ-1	K1149©	30.1	45.3	**37.7**
AVT-IR-NB-CZ-2	PL891©	31.3	59.4	**45.4**
Average		**30.4**	**46.9**	**38.7**

**=AVT (I) **=AVT (II)*

Table 5.5.12. Zonal mean of test entries for all grain parameters.

Genotype	Zonal Mean				
	TGW (g)	PC (%)	HW (kg/hl)	Plump grain (%)	Beta-glucan (%) (NWPZ)
DWRB223**	**32.41**	**13.16**	**77.42**	**58.42**	**6.0**
DWRB244*	**33.00**	**13.78**	**75.20**	**28.07**	**7.8**
Karan16©	**30.62**	**12.25**	**75.75**	**27.34**	**5.2**
K1149©	**29.82**	**11.99**	**74.80**	**27.98**	**5.0**
PL891©	**37.98**	**12.63**	**74.39**	**55.27**	**6.3**
Average	**32.77**	**12.76**	**75.51**	**39.42**	**6.1**

**=AVT (I) **=AVT (II); HW: Hectoliter Weight; PC: Protein content; (TGW: Thousand Grain Weight)*

Barley Frontline Demonstrations (2023-24)

During the *rabi* crop season 2023-24, 140 hectares Barley Frontline Demonstrations (BFLDs) were allotted to 40 cooperating centers all over India in eight states/UT namely, Himachal Pradesh, Uttar Pradesh, Bihar, Jammu & Kashmir, Punjab, Haryana, Rajasthan and Madhya Pradesh. Out of these, 135.2 BFLDs were conducted by 39 centers, covering 138.4 hectares area of 420 farmers (Table 6.1). Improved barley varieties with complete package of practices (irrigation management, nutrient management, weed control, seed treatment *etc.*) were demonstrated.

Table 6.1. Centre wise distribution of Barley FLDs during rabi *2023*-24 (in hectares) .

S.No.	Zone and Centre	BFLDs allotted	BFLDs conducted	Area sown (hectares)	No. of farmers/ locations
Northern Hills Zone (NHZ)					
1.	CSKHPKV, HAREC, Bajaura , District Kullu (HP)	4.8	Not conducted	-	-
2.	IARI, Regional Station, Amartara Cottage, Shimla (HP)	2	2	2.0	10
North Eastern Plains Zone (NEPZ)					
3.	ANDUA&T, Narendranagar, Kumarganj, Ayodhya (UP)	4	4	4.0	10
4.	Head, KVK (IAS- BHU), Barkachha, Mirzapur (UP)	4	4	4.0	10
5.	CSAUA&T, Kanpur (UP)	4	4	4.0	12
6.	KVK (NDUA&T), Kallipur, Mirzamurad, Varanasi (UP)	4.8	4.8	4.8	12
7.	Mahayogi Gorakhnath KVK, Gorakhpur-2, (GGSS), Chauk Mafi (Peppeganj), Jangal Kaudiya, Gorakhpur (UP)	4	4	4.0	10
8.	KVK (NDUA&T) Basti, Post-Katiya, Banjariaya Farm, Basti (UP)	4	4	4.0	20
9.	KVK (Dr. RPCAU), Begusarai (Bihar)	2	2	2.0	8
10.	KVK (BAU Bhagalpur), Agwanpur, Barh, Patna (Bihar)	2	2	2.0	6
11.	KVK, Samastipur-1 (Dr. RPCAU), Birauli, Samastipur (Bihar)	2	2	2.0	17
12.	KVK, Samastipur-2 (Dr. RPCAU), Lada, Singhia, Samastipur (Bihar)	2	2	2.0	5
North Western Plains Zone (NWPZ)					
13.	KVK (SKUAST-Jammu), Rajhani, Kathua (J&K)	4	4	4.0	36
14.	PAU, Ludhiana (Punjab)	3.2	3.2	3.2	8
15.	KVK (PAU), Khokhar Khurd, Tehsil & District-Mansa (Punjab)	4	4	5.2	13
16.	KVK (PAU), Kheri, Patran Road, Sangrur (Punjab)-148001	4	4	4.0	10
17.	KVK (PAU), Goneana, Mukatsar (Punjab)	4	4	4.8	12
18.	KVK (PAU), Dabwali Road, Near Kheti Bhawan, Bathinda (Punjab)	4	4	4.0	10
19.	COA, CCSHAU, Hisar (Haryana)	4	4	4.0	10
20.	KVK (Shri B.B. Ashram), Rampura, Rewari (Haryana)	3.2	3.2	3.2	8
21.	KVK (CCSHAU), Opposite Bhim Stadium, Bhiwani (Haryana)	3.2	3.2	4.4	11
22.	PI (Social Sciences), ICAR-IIWBR, Karnal (Haryana)	2.4	2.4	2.4	6
23.	Dean, FoAS, SGT University, NCR, Gurugram (Haryana)	2	2	2.0	5
24.	RARI (SKNAU), Durgapura, Jaipur (Rajasthan)– 302018	4	4	4.0	10
25.	KVK (Pragati Trust), Tankarda, Chomu, Jaipur (Rajasthan)	3.2	3.2	3.2	10
26.	KVK (AU-Kota), Akorashi, Hindauncity, Karauli (Rajasthan)	4	4	4.0	14
27.	KVK, Alwar-1 (SKNAU-Jobner), Navgaon, Alwar (Rajasthan)	2	2	2	5
28.	ACES, AUUP, J-1 Block, LGF, Amity Uni Campus, Noida (UP)	4	4	4.0	10
29.	KVK (SVPUA&T, Modipuram, Meerut), RRS, Nagina, Bijnor (UP)	2	2	2.0	5
Central Zone (CZ)					
30.	RCOA, MPUA&T, Udaipur (Rajasthan)	4.8	4.8	4.8	12
31.	KVK (MPUA&T), Dhoinda, Rajasmand (Rajasthan)	4.8	4.8	4.8	12
32.	KVK (JNKVV), Rewa, CoA, Kuthulia Farm, Rewa (MP)	4.8	4.8	4.8	12
33.	KVK (JNKVV), Purushottampur, Panna (MP)	4.8	4.8	4.8	12
34.	KVK (JNKVV), Kundeshwar Road,Tikamgarh (MP)	4.8	4.8	4.8	12
35.	KVK (RVSKVV), Rajgarh, Biaora, Kothi Bagh, Rajgarh (MP)	2.8	2.8	2.8	12
36.	Dean, CoA (JNKVV), Ganj Basoda, District-Vidisha (MP)	4.8	4.8	4.8	16
37.	Director Extension Services, RVSKVV, Gwalior (MP)	2	2	2.0	5
38.	KVK (BUA&T-Banda), Govt Agri Farm, Khiria Misra, Bamourikala, Devgarh Road, Lalitpur (UP)	4.8	4.8	4.8	12
39.	KVK (BUA&T-Banda), Bharari, Bhojla, Jhansi (UP)	2.8	2.8	2.8	7
40.	Director Extension Education, RLBCAU, Jhansi (UP)	2	2	2.0	5
	TOTAL	**140**	**135.2**	**138.4***	**420**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

Table 6.2. State wise yield gain during *Rabi* 2023-24.

State	BFLDs mean yield (q/ha)	Check mean yield (q/ha)	Gain (in %)
HP	29.25	21.75	34.48**
Eastern UP	35.58	25.68	38.56***
Central UP	34.78	24.40	42.52***
Western UP	61.25	49.53	23.67***
Bihar	38.28	31.03	23.37***
All UP	37.78	27.60	36.87***
J&K	33.05	20.98	57.57***
Punjab	47.50	41.50	14.46***
Haryana	43.60	40.18	08.53*
Rajasthan (NWPZ)	57.90	51.78	11.83***
Rajasthan (CZ)	40.78	32.45	25.65***
All Rajasthan	51.38	44.43	15.64***
MP	40.40	29.88	35.23***
All India	42.05	33.83	24.32***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level*

The highest gain in barley yield was recorded in UT of J&K (57.57%) followed by Central UP (42.52%), Eastern UP (38.56%), All UP (36.87%), MP (35.23%), HP (34.48%), Rajasthan-CZ (25.65%). The lowest gain in yield was reported in Haryana (8.53%) (Table 6.2).

Table 6.3. Zone wise productivity over check during Rabi 2023-24.

Zone	BFLDs mean yield (q/ha)	Check mean yield (q/ha)	Gain (%)
NHZ	29.25	21.75	34.48**
NEPZ	36.15	26.83	34.76***
NWPZ	47.15	40.43	16.64***
CZ	39.25	29.25	34.19***

**** Significant at 1 per cent level, ** Significant at 5 per cent level*

The yield gain due to improved varieties over check was highest in NEPZ (34.76%) followed by NHZ (34.48%), CZ (34.19%) and NWPZ (16.64%) (Table 6.3). Therefore, efforts should be made to increase barley yield in the NEPZ, CZ and NHZ by promoting recent barley production technologies in collaboration with the state department of agriculture.

Centre wise data analysis revealed that the yield gain under barley FLD was highest at center Basti (81.47%) followed by Kanpur (40.59%) in NEPZ; Rewa (64.92%) followed by RLBCAU Jhansi (62.65%) and Lalitpur (45.55%) in CZ; Shimla (34.48%) in NHZ; and Kathua (57.57%) followed by Mansa (34.53%) in NWPZ. The yield gain was lowest at Muktsar (04.58%) in NWPZ.

Table 6.4. Variety wise performance of improved barley varieties during *Rabi* 2023-24.

Zone and Centre	Improved variety	Average yield (q/ha)	Check variety	Average yield (q/ha)	Yield gain Over check (%)
NHZ					
Shimla	BHS 400	29.25	Local	21.75	34.48**
NEPZ					
Ayodhya	DWRB 137	35.33	Local	25.78	37.05***
Ayodhya	DWRB 137	34.38	Narender Jau 2	26.25	30.95 NS
Ayodha	RD 2907	35.00	Local	26.25	33.33 NS
Ayodhya	RD 2907	35.20	Narender Jau 2	27.08	30.01***
Mirzapur	DWRB 137	30.00	K 71 Amber	22.50	33.33 NS
Mirzapur	RD 2907	25.63	K 71 Amber	22.50	13.89 NS
Kanpur	DWRB 137	35.00	K 226	24.55	42.57***
Kanpur	DWRB 137	37.45	K 508	27.13	38.06***
Kanpur	DWRB 137	38.00	NB-1	34.33	10.71***
Kanpur	RD 2907	32.83	Narender Jau 2	29.33	11.94***
Kallipur Varanasi	DWRB 137	38.00	NB-1	34.33	10.71***
Kallipur Varanasi	RD 2907	32.83	NB-1	29.33	11.94***
Gorkhpur-2	DWRB 137	42.40	RD 2660	32.50	30.46***
Gorkhpur-2	RD 2907	44.50	RD 2660	32.30	37.77***
Basti	RD 2907	35.90	K 287	21.15	69.74***
Basti	RD 2907	33.20	Narender Jau 2	20.70	60.39***
Basti	DWRB 137	35.30	K 287	18.45	91.33***
Begusarai	DWRB 137	39.88	BR 32	35.25	13.12***
Barh Patna	DWRB 137	43.48	Local	31.70	37.15***
Lada Samstipur-2	DWRB 137	29.20	Local	22.55	29.49***
NWPZ					
Kathua	DWRB 137	33.28	Local	21.08	57.89***
Kathua	RD 2907	32.78	Local	20.85	57.19***
Ludhiana	DWRB 137	50.52	PL 807	45.95	14.25*
Mansa	DWRB 137	38.28	Local	28.45	34.53***
Sangrur	DWRB 137	58.25	PL 126	48.75	19.49***
Sangrur	DWRB 137	57.00	PL 807	51.25	11.22*
Sri Muktsar Sahib	DWRB 137	48.13	PL 426	45.88	4.90**
Sri Muktsar Sahib	DWRB 137	51.25	PL 807	49.18	4.22*
Bathinda	DWRB 137	42.75	Local	39.13	9.27*
Hisar	DWRB 137	49.13	BH 946	46.25	6.22 NS
Rewari	DWRB 137	50.30	BH 393	46.00	9.35***
Bhiwani	DWRB 137	31.25	BH 393	27.65	13.02***
Karnal	DWRB 137	48.05	DWRUB 52	45.30	6.07 NS
Durgapura	RD 2907	70.40	Local	49.28	42.87**
Durgapura	RD 2907	62.33	PL 426	54.05	15.31***
Durgapura	DWRB 137	52.03	Local	47.68	9.12*
Durgapura	DWRB 137	58.13	RD 2052	53.43	8.80 NS
Chomu Jaipur	RD 2907	55.93	PL 426	45.18	23.80 NS
Chomu Jaipur	RD 2907	59.58	RD 2035	51.01	16.79***
Chomu Jaipur	RD 2907	58.49	RD 2052	48.80	19.85***
Chomu Jaipur	DWRB 137	52.09	PL 426	46.39	12.29**
Chomu Jaipur	DWRB 137	49.88	RD 2035	47.38	5.28 NS
Karauli	DWRB 137	59.28	RD 2035	56.08	5.71***
Karauli	RD 2907	61.23	RD 2035	58.68	4.35**
Alwar	DWRB 137	52.43	RD 2552	45.25	15.86***
Alwar	RD 2907	51.75	RD 2552	42.63	21.41**
Amity Noida	DWRB 137	61.25	BH 393	49.53	23.67***
CZ					
Udaipur	DWRB 137	39.38	RD 2035	31.88	23.53*
Udaipur	DWRB 137	38.75	RD 2715	30.00	29.17**
Udaipur	DWRB 137	41.88	RD 2786	34.38	21.82**
Rajsamand	DWRB 137	37.63	Local	31.50	19.44 NS
Rajsamand	DWRB 137	42.60	RD 2786	32.90	29.48***
Rajsamand	RD 2899	37.50	Local	31.75	18.11 NS
Rajsamand	RD 2899	45.18	RD 2786	34.25	31.90***

Rewa	DWRB 137	36.65	JB 58	23.15	58.32***
Rewa	RD 2899	41.20	JB 58	23.73	73.66***
Panna	RD 2899	30.65	Local	24.15	26.92***
Panna	DWRB 137	30.43	JB 58	23.75	28.11***
Panna	DWRB 137	30.00	Local	23.75	26.32***
Tikamgarh	DWRB 137	38.43	JB 15	29.38	30.81***
Tikamgarh	RD 2899	38.05	JB 15	29.43	29.31***
Rajgarh	RD 2899	46.38	Local	32.13	44.36**
Rajgarh	DWRB 137	47.38	Local	35.88	32.06***
Vidisha	DWRB 137	46.85	Local	36.10	29.78***
Vidisha	RD 2899	46.43	Local	36.43	27.45***
Lalitpur	DWRB 137	37.23	K 560 Haritma	25.58	45.55***
KVK Jhansi	DWRB 137	31.35	Local Mundi	25.00	25.40***
RLBCAU Jhansi	DWRB 137	33.75	Local Parvati	20.75	62.65***

**** Significant at 1 per cent level ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

The varieties BHS 400 (29.25 q/ha) at Shimla centre in NHZ; RD 2907 (44.50 q/ha) at Gorakhpur in NEPZ; RD 2907 (70.40 q/ha) at Durgapura Jaipur in NWPZ and DWRB 137 (47.38 q/ha) at Rajgarh in CZ were the highest average yielding (Table 6.4). It is evident from table 6.6 that recent varieties outperformed check varieties at all the locations. The yield gain due to varietal intervention ranged from 4.22 % at Sri Muktsar Sahib center in Punjab to 91.33% at Basti center in UP.

Table 6.5. Highest grain yield of barley varieties in different zones during *Rabi* 2023-24.

Zone	Centre	Variety	Yield(q/ha)
NHZ	Shimla	BHS 400	33.75
NEPZ	Gorakhpur	RD 2907	46.25
NWPZ	Durgapura Jaipur	RD 2907	70.85
CZ	Vidisha	DWRB 137	49.40

It is evident from table 6.5 that varieties BHS 400 (33.75 q/ha), RD 2907 (46.25 q/ha), RD 2907 (70.85 q/ha) and DWRB 137 (49.40 q/ha) performed better than other varieties at Shimla, Gorakhpur, Durgapura Jaipur and Vidisha centres in the NHZ, NEPZ, NWPZ and CZ, respectively.

Table 6.6. Barley varieties grown in different zones during *Rabi* 2023-24.

Zone	Improved varieties	Check varieties	Popular varieties in the region
NHZ	BHS 400	Local	Local
NEPZ	DWRB 137, RD 2907	Local, Narendra Jau-2, Amber (K 71), K 226, K 508, NB-1, RD 2660, K 287, BR 32	Narendra Jau-2, Lakhan, Jyoti, Jagriti, Amber (K 71), K 125 (Azad), RD 2660, RD 2794, Local, Prakhar, Narendra Barley-4, DL 36, BR 32, Narendra Barley-7, HUB 113, K 226, K 287, K 329
NWPZ	DWRB 137, RD 2907	Local , PL 807, PL 426, BH 393, BH 946, DWRUB 52, RD 2035, RD 2052, RD 2552	RD 2907, PL 807, PL 426, PL 891, DWRUB 52, BH 393, BH 946, RD 2035, RD 2052, RD 2552, RD 2660, RD 2715, RD 2786, RD 2794, RD 2899, , RD 2907, Local
CZ	DWRB 137, RD 2899	RD 2035, RD 2715, RD 2786, Local, JB 58, JB 15, Haritma (K 560), Local Mundi, Local Parvati	RD 2035, RD 2552, RD 2715, RD 2899, JB 58, Mundi, Local, RD 2907, JB 15, JB 58, Haritma, Parvati, RD 2508, PL 419, DL 88, GRD 222

Major constraints impeding barley production in the country

Overall analysis of constraints in different zones clearly indicated that decline in water table, high cost of inputs, *Phalaris minor*, small land holding, non-availability of labour, low price of grain, poor participation in exposure visits arranged by various departments, lack of facility of canal irrigation water, untimely rain and poor quality of herbicides/pesticides were the major constraints affecting barley production and productivity in the country. Farmers need to be educated and upskilled on recent barley production technologies, complete package of practices and soil health management. There is a need of government intervention to ensure supply of quality seed and inputs to the farmers. Farmers need to be updated on impact of climate change on barley cultivation and adaptation strategies for mitigation. To ensure better price, farmers have to go for quality barley production. There is a need to register barley growers on e-NAM platform for selling of barley.

Zonal Monitoring Reports (2023-24)

The teams constituted for monitoring of Barley Yield Trials & Nurseries in Central zone, NWP and NEP Zone, visited different locations at the most appropriate stage of the crop and recorded observations about the varietal performance, conduct of trials, disease/ pest incidence and genetic purity of the test entries. On the spot decisions were taken about the rejection of trials and purity of test entries. The proceedings of these team meetings have been circulated for necessary action by concerned breeders and other scientists and copies of the same is appended in the report for record.

Table. 7.1. Zonal monitoring visits of the barley teams.

Zone	Date	Centres visited	Team Members
NEPZ Team I	Feb. 27-March 1, 2024	Sabour, Pusa, Samastipur	Drs. Lokendrra Kumar, Anil Khippal and S.S Vaish
NEPZ Team II	March 6-10, 2024	Kanpur, Dalipnagar, Kumarganj, Saini, & Varanasi	Drs. Om Vir Singh and Dr. Vijay Yadav
CZ	Feb. 13-16, 2024	Dholpur, Morena, Gwalior, Tikamgarh and Banda	Drs. Jogendra Singh, S.S. Rajput, P.S. Shekhawat and Sudhanshu Jain
NWPZ & CZ	March 4-8, 2024	Bawal, Navgaon, Durgapura, Tabiji, Udaipur, Vijapur	Drs. Lokendra Kumar, S.S> Punia, R.S. Beniwal
NWPZ	March 11-12, 2024	CCSHAU., Hisar, Bhatinda Ludhiana, IIWBR, Hisar	Drs. S.K Bishnoi, Jaspal Kaur, Bhagat Singh, Simarjit Kaur
NWPZ	March 15-16, 2024	Modipuram and Pantnagar	Drs. Lokendra Kumar and Jogendra Singh
NHZ	April 14-17, 2024	Malan, Bijaura and Shimla	Drs. Jogendra Singh, D.P. Walia and P.L. Kashyap
NHZ	April 15-17, 2024	Majhera, Almora and Gaja	Drs. Charan Singh, Pramod Prasad and Navin Chander Gahtyari

Monitoring reports are attached

Zonal Monitoring Report (2023-24)
Zone: NEPZ-Team-II

Period of visit: 27 Feb-01 March 2024

Name of team members	Centres visited
Dr Lokendra Kumar, Dr Anil Khippal, Dr. S.S. Vaish	Sabour, RPCAU-Pusa, BISA Samastipur

Summary of breeding trials allocated & monitored:

Centre	Trial (s) Allotted	Trials not conducted/ Rejected	Remarks
Sabour	AVT-IR-FB-NEPZ	Conducted successfully	Trial failed due to severe infection of leaf blight in all the entries.
	IVT-IR-FB-NEPZ	Conducted successfully	Except entry No. 1 & 2, all the entries were damaged due to severe infection of leaf blight
	IVT-RF-NEPZ	Conducted successfully	Trial failed due to severe infection of leaf blight in all the entries.
RPCAU-Pusa	AVT-IR-FB-NEPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-FB-NEPZ	Conducted successfully	Very good & satisfactory
	IVT-RF-NEPZ	Conducted successfully	Very good & satisfactory
BISA Samastipur	AVT-IR-FB-NEPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-FB-NEPZ	Conducted successfully	Very good & satisfactory

- Evaluate trials as very good, good, average and poor on the basis of conduction.

Entries showing promising performance in breeding trial across centres

Trial	Entry (s)	Remarks
AVT-IR-FB-NEPZ	AVT-IR-FB- 1 & 5	Observations were based on phenotypic appearance and plant stand etc.
IVT-IR-FB-NEPZ	IVT-IR-FB-11,15 &24	
IVT-RF-NEPZ	IVT-RF-7	

Entries recommended for purification.

Trial	Entry (s)	Remarks
AVT-IR-FB-NEPZ	AVT-IR-FB-1,2 &5	Nil
IVT-IR-FB-NEPZ	IVT-IR-FB- 5,6,13,20 & 25	
IVT-RF-NEPZ	IVT-RF-2 & 7	

Entries recommended to be dropped from further testing.

Trial	Entry (s)	Remarks
AVT-IR-FB-NEPZ	Nil	
IVT-IR-FB-NEPZ	IVT-IR-FB- 7,8,12	Problem of genetic segregation
IVT-RF-NEPZ	IVT-RF-6	Problem of genetic segregation.

Entries exhibiting higher incidence of disease /insect infestation.

Sabour :

Trial	Entry (s)	Remarks
AVT-IR-FB-NEPZ	AVT-IR-FB- 3,4 &5	Nil
IVT-IR-FB-NEPZ	IVT-IR-FB- All entries	
IVT-RF-NEPZ	IVT-RF- All entries	

RPCAU-Pusa:

Trial	Entry (s)	Remarks
AVT-IR-FB-NEPZ	AVT-IR-FB- 4	Nil
IVT-IR-FB-NEPZ	IVT-IR-FB- 3,5,6,10,12,16,17 & 19	
IVT-RF-NEPZ	IVT-RF- 1,4,5,8	

BISA Samastipur:

Trial	Entry (s)	Remarks
AVT-IR-FB-NEPZ	AVT-IR-FB- 4	Nil
IVT-IR-FB-NEPZ	IVT-IR-FB-1,2,3,5,6,8,10,11,12,13,16,17,18,19,20	

Special comments, if any (2-3 bullet points only): On the basis of 2 years (2022-23 & 2023-24) performance of rainfed trial, it was observed that Sabour center did not find suitable for conducting of the rainfed trial of Barley due to high severity of leaf blight irrespective of the entries.

Signatures:

29/2/2024 29/12/24 29/12/2024

(Dr.Lokendra Kumar) **(Dr. Anil Kumar Khippal)** **(Prof. S.S. Vaish)**

Zonal Monitoring Report (2023-24)
Zone: NEPZ
Team -II

Period of visit: March 6-10, 2024

Name of team Members	Centres visited
Drs. Om Vir Singh and Dr. Vijay Yadav	Kanpur, Dalipnagar, Kumarganj, Saini & Varanasi

1. Summary of breeding trials allocated & monitored:

Centre	Trial (s) Allotted	Trials not Conducted/ Rejected	Remarks
Kanpur	AVT-FB,IVT-FB,IVT-RF,IVT-NK,IVT-DP	NIL	There was lodging in AVT-FB
Ayodhya	AVT-FB,IVT-FB,IVT-RF,IVT-NK,IVT-DP, IVT/AVT-SST	Nil	Plants stand was not upto mark in IVT-NK and in some replications there was rats damages.
Varansi	AVT-FB,IVT-FB,IVT-RF,IVT-NK,IVT-DP	nil	Leaf blight damage was there in all trials
Saini	IVT-RF-NEPZ	NIL	****
Dilipnagar	IVT/AVT-SST	nil	****

(Om Vir Singh) (V.K. Yadav)

Barley Network (AICW&BIP)

Monitoring Report of Central Zone

Duration: 13-16 February, 2024

Location visited: Dholpur, Morena, Gwalior, Tikamgarh and Banda

Team Members

- Dr. Jogendra Singh, Barley Breeder, ICAR-IIWBR, Karnal
- Dr. Syam Singh Rajput, Barley Breeder, RARI, Durgapura (Raj.)
- Dr. Pradeep Singh Shekhawat, Plant Pathologist, RARI, Durgapura (Raj)
- Dr. Sudhanshu Jain, Plant Breeder, Department of Genetics and Plant Breeding, RVSKVV, Gwalior.

The team constituted by the Director, IIWBR, Karnal for monitoring of Barley trials in Central Zone, assembled at Agra on 13th February, 2024 and visited the different centres as per schedule.

(i) BREEDING TRIALS:

A. Location wise observations:

Dholpur

Three barley trials (IVT-IRTS-MB, IVT-IRTS-FB and IVT-DP) were monitored on 13th February, 2024 at the centre. All the experiments were found in good condition. Lodging was not observed in any entry. There was no incidence of rusts. However, minor incidence of covered and loose smut was observed in few entries.

Morena

Four barley coordinated trials (IVT-IRTS-FB, IVT-DP, IVT-IRTS-NB and AVT-IRTS-NB) were monitored on 13th February, 2024 at the centre. All the experiments were found in good condition although trails were sown delayed. Hence trials were at booting stage. None of the disease was observed in the trials.

Gwalior

Four barley coordinated trials (IVT-IRTS-FB, IVT-DP, IVT-IRTS-NB and AVT-IRTS-NB) were monitored on 13th February, 2024 at the centre. All experiments were found in good condition. But, in IVT-DP trial cutting was not done for green forage as per technical program. All the entries were free from rusts and other diseases. However, minor incidence of covered and loose smuts was observed in few entries.

Tikamgarh

Four barley coordinated trials (IVT-IRTS-FB, IVT-DP, IVT-IRTS-NB and AVT-IRTS-NB) were monitored on 14th February, 2024 at the Centre. All the experiments were found in very good condition. In case of IVT-DP, cutting for green forage was done in all the

replications. There was no incidence of rusts in all entries. However, minor incidence of covered and loose smuts was observed in few entries.

Banda

One breeding trial viz., IVT-IR**TS**-FB**, was** monitored at **Banda** on 15th February, 2024. The trial **was** planted as per technical programme and found in excellent condition. None of the rust was observed in the trial. However, incidence of smuts and leaf spot was observed in few entries.

B. Disease / pest incidence:

All the barley trials were free from rusts. However, incidence of leaf blight was observed in two entries namely, IVT-FB-10 (56) and IVT-FB-17 (35) in IVT-IRTS-FB trial at Gwalior, Tikamgarh and Banda centres. Incidence of covered smut (2-3%) was noted in one entry namely, IVT-NB-7 of IVT-IRTS-NB at all the locations.

C: Entries observed as segregating/mixtures:

No entries were noticed to have significant amount of segregation/mixture in all the trials. However, few entries were showing off type plants (<5 plants).

Trial Name	Entries with	
	Segregation/ mixtures	Off types
IVT-IRTS-FB	Nil	IVT-IR-FB-1, IVT-IR-FB-6, IVT-IR-FB-8, IVT-IR-FB-11 and IVT-IR-FB-18
IVT-IRTS-NB	Nil	IVT-NB-7
AVT-IRTS-NB	Nil	AVT-NB-2 and AVT-NB-5
IVT-DP	Nil	IVT-DP-9

(ii) AGRONOMY TRIAL:

At Gwalior centre, one agronomy trial on weed management and date of sowing was monitored and was conducted in proper way and found in good condition.

(Dr. Sudhanshu Jain)
Plant Breeder
Plant Breeding & Genetics,
RVSKVV, Gwalior (MP)

(Dr. S.S. Rajput)
Barley Breeder
AICW&BIP, RARI,
Durgapura, Jaipur (Raj).

(Dr. P.S. Shekhawat)
Wheat and Barley Pathologist
AICW&BIP, RARI,
Durgapura, Jaipur (Raj).

15/02/2024

(Dr. Jogendra Singh)
Barley Breeder
ICAR-IIWBR
Karnal (Haryana)

Zonal Monitoring Report (2023-24)
Zone: NWPZ-Team-I & CZ

Period of visit: 04--08 March 2024

Name of team members	Centres visited
Drs. Lokendra Kumar, SS Punia , RS Beniwal	Bawal, Navgaon, Durgapura, Tabijji, Udaipur, Vijapur

Summary of breeding trials allocated & monitored:

Centre	Trial (s) Allotted	Trials not conducted/ Rejected	Remarks
Bawal	AVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
Navgaon	AVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
Durgapura	AVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
	AVT-NB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-NB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-FB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-DP-NWPZ	Conducted successfully	Very good & satisfactory
Tabiji	AVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-FB-NWPZ	Conducted successfully	Very good & satisfactory
Udaipur	AVT-NB-CZ	Conducted successfully	Very good & satisfactory
	IVT-NB-CZ	Conducted successfully	Very good & satisfactory
	IVT-FB-CZ	Conducted successfully	Very good & satisfactory
	IVT-DP-CZ	Conducted successfully	Very good & satisfactory
Vijapur	AVT-NB-CZ	Conducted successfully	Very good & satisfactory
	IVT-NB-CZ	Conducted successfully	Very good & satisfactory
	IVT-FB-CZ	Conducted successfully	Very good & satisfactory
	IVT-DP-CZ	Conducted successfully	Very good & satisfactory

Entries showing promising performance in breeding trial across centres:

Trial	Entry (s)	Remarks
AVT-MB	AVT-MB-4, 5 and 6	Observations are based on phenotypic appearance and plant stand etc.
IVT-MB	IVT-MB-3 and 17	
AVT-NB	AVT-NB-1 and 4	
IVT-NB	IVT-NB-3, 9 and 11	
IVT-FB	IVT-FB-3,11,17 and 20	
IVT-DP	IVT-DP-9,11 and 14	

Entries recommended for purification:

Trial	Entry (s)	Remarks
AVT-MB	Nil	NA
IVT-MB	IVT-MB-9, 12,14,,22 and 23	Waxy and non-waxy, two-row and six-row
AVT-NB	AVT-NB-3 and 5	Variable plant Height
IVT-NB	Nil	NA
IVT-FB	IVT-FB-1 and 9	Variable plant Height and different ear types
IVT-DP	IVT-DP-1 and 6	Variable plant Height

Entries recommended to be dropped from further testing:

Trial	Entry (s)	Remarks
AVT-MB	Nil	NA
IVT-MB	Nil	NA
AVT-NB	Nil	NA
IVT-NB	Nil	NA
IVT-FB	IVT-FB-14	A mixture of drooping and non-drooping
IVT-DP	IVT-DP-4 and 5	A mixture of different plant types

Entries exhibiting a higher incidence of disease /insect infestation:

Trial	Entry (s)	Remarks
AVT-MB	Nil	NA
IVT-MB	NIL	NA
AVT-NB	AVT-NB-3 (covered smut)	Only at Vijapur
IVT-NB	IVT-NB-1, 3,5, 6, 7, 9, 10 and 11	Net blotch and leaf blight (more than 57) were observed only at Vijapur
IVT-FB	In all entries except IVT-FB-1, 2, 13 ,14, 19 and 24	Net blotch and leaf blight (more than 57) were observed only at Vijapur
IVT-DP	IVT-DP-8	Powdery mildew(6), Net blotch and leaf blight (more than 57) were observed only at udaipur

Report on pathological nurseries:

Centre	Nurseries	Remarks
Durgapura	IBDSN, NBDSN and EBDSN	All nurseries were conducted nicely

Special comments, if any (2-3 bullet points only):
Expression of all trials of barley at Tabiji was excellent

Signatures:

8/3/24

(Lokendra Kumar) **(S S Punia)** **(RS Beniwal)** 8/3/24

Barley Network (AICW&BIP)
Monitoring Report of NWPZ

Duration: 11-12 March, 2024
Location visited: PAU, Ludhiana, ARS Bathinda, CCSHAU, Hisar and ICAR-IIWBR, Hisar

Team Members

Dr Santosh Kumar Bishnoi, Senior Scientist, ICAR-IIWBR, RS Hisar
Dr Simarjit Kaur, PAU, Ludhiana
Dr. Jaspal Kaur, PAU, Ludhiana
Dr Bhagat Singh, Senior Agronomist, CCS-HAU, Hisar

The team constituted by the Director, IIWBR, Karnal for monitoring of Barley Network Trials & Nurseries in NWPZ, assembled at PAU, Ludhiana on 11th March, 2024 and visited the different locations as per schedule.

A: Location wise observations

Ludhiana

Six trials viz. AVT-MB-NWPZ (2023-24), IVT-MB-NWPZ (2023-24), IVT-FB-NWPZ (2023-24), AVT-NB-CZ+NWPZ (2023-24), IVT-NB-NWPZ (2023-24) and IVT-DP-TS-NWPZ were monitored at PAU, Ludhiana and were found in excellent condition.

Bathinda

Two trials viz. AVT-MB-NWPZ (2023-24) and IVT-MB-NWPZ (2023-24) were monitored at Bathinda. Both the trials were in good condition and planted as per the technical programme.

Hisar (CCSHAU)

Six trials viz. AVT-MB-NWPZ (2023-24), IVT-MB-NWPZ (2023-24), IVT-FB-NWPZ (2023-24), AVT-NB-CZ+NWPZ (2023-24), IVT-NB-NWPZ (2023-24) and IVT-DP-TS-NWPZ were monitored at CCSHAU, Hisar and were found in excellent condition.

Hisar (ICAR-IIWBR)

Two trials viz. IVT Salinity (2023-24)-I and IVT Salinity (2023-24)-II were monitored at ICAR-IIWBR, Seed and Research Farm, Hisar. One trial was good, however another trial was rejected due to very poor plant stand due to high salinity.

B: Trials rejected: One IVT Salinity (2023-24)-II at ICAR-IIWBR, Hisar

C: Entries showing promising performance in breeding trials across centres

Trial	Entry	Remarks
AVT-MB	AVT-MB-1, 3, 4, 6, 7	Observations are based on phenotypic appearance and plant stand etc.
IVT-MB	IVT-MB-6, 8, 9, 18, 19, 23	
IVT-FB	IVT-FB-3, 5, 6, 13, 14, 18, 20, 25	
AVT-NB	AVT-NB-1, 2, 4	
IVT-NB	IVT-NB-1, 4, 13	
AVT/IVT-SST-ALK	AVT/IVT-SST-ALK-2, 3, 7, 8,	

	9, 10,12 13, 14, 15, 17, 18.	
IVT-DP	IVT-DP-6, 9, 13,14	

D: Entries recommended for purification

Trial	Entry (s)	Remarks
AVT-MB	Nil	NA
IVT-MB	IVT-MB-2, IVT-MB- 4, IVT-MB-11, E-23, IVT-MB-14,	E-2: off types of rough spikes E-4: 2 row off types E-11, E-23: 6 row off types E-14: spike deformity
IVT-FB	IVT-FB-8, 17	2 row off types
AVT-NB	Nil	NA
IVT-NB	Nil	NA
AVT/IVT-SST-ALK	Nil	NA
IVT-DP	IVT-DP-4, IVT-DP-5, IVT-DP-10	E-4:Tall and pigmented off types E:5 Tall off types E: 10 hooded off types

E: Entries recommended to be dropped from further testing

Trial	Entry (s)	Remarks
AVT-MB	Nil	NA
IVT-MB	IVT-MB-13 IVT-MB-24	E-13: Spike segregating for rudimentary and non-rudimentary type E-24: Spike deformity, waxy/non waxy and two types of spike angle.
IVT-FB	Nil	NA
AVT-NB	Nil	NA
IVT-NB	Nil	NA
AVT/IVT-SST-ALK	Nil	NA
IVT-DP	Nil	NA

F: Entries exhibiting a higher incidence of disease/insect infestation

Trial	Entry (s)	Remarks
AVT-MB	AVT-MB-3, 6	Covered smut At Hisar (CCSHAU) and Bathinda.
IVT-MB	IVT-MB-E1, E-4, -5, -7, -15 E-24, E-2, -21, -23 E-10 E-13, .	(CS) at Bathinda (CS) at Hisar and Ludhiana, Aphid at Ludhiana, loose smut at Ludhiana
IVT-FB	Nil	NA
AVT-NB	AVT NB- 3 AVT NB- 5	CS 25% CS 50%
IVT-NB	IVT-NB-7	50% (CS) at Bathinda, Ludhiana, Hisar

AVT/IVT-SST-ALK	Nil	NA
IVT-DP	Nil	NA

G. Nurseries:
EIBGN, NBGSN, BQCSN, ICARDA nurseries, IBDSN, NBDSN and EBDSN were grown at Ludhiana station and were in good condition. EIBGN, NBGSN, IBON and BQCSN were grown at CCSHAU, Hisar and were in good condition.

H. Agronomy Trials

Name of Centre	Trial Allotted	Trial Conducted	Remarks
PAU, Ludhiana	IR-TS-HL-DOS, SLP-6	IR-TS-HL-DOS, SLP-6	All the trials were properly conducted and excellently managed
CCSHAU, Hisar	IR-SL-LON, SPL-5, SLP-6	IR-SL-LON, SPL-5, SLP-6	All the trials were properly conducted and managed excellently managed
IIWBR, Hisar	IR-SL-LON	IR-SL-LON	Trial was properly conducted and well managed

(Santosh Kumar Bishnoi) **(Simarjit Kaur)** **(Jaspal Kaur)**

(Bhagat Singh)

Zonal Monitoring Report (2023-24)
Zone: NWPZ-Team-III

Period of visit: 15-16 March 2024

Name of team members	Centres visited
Dr Lokendra Kumar, Dr Jogendra Singh	Modipuram, Pantnagar

Summary of breeding trials allocated & monitored:

Centre	Trial (s) Allotted	Trials status	Remarks
Modipuram	IVT-IR-FB-NWPZ	Conducted successfully	Very good & satisfactory
	AVT-IR-NB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-NB-NWPZ	Conducted successfully	Very good & satisfactory
	AVT-IR-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-DP-NWPZ	Conducted successfully	Very good & satisfactory
Pantnagar	IVT-IR-FB-NWPZ	Conducted successfully	Very good & satisfactory
	AVT-IR-NB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-NB-NWPZ	Conducted successfully	Very good & satisfactory
	AVT-IR-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-MB-NWPZ	Conducted successfully	Very good & satisfactory
	IVT-IR-DP-NWPZ	Conducted successfully	Very good & satisfactory

- Evaluate trials as very good, good, average and poor on the basis of conduction

Entries showing promising performance in breeding trial across centres

Trial	Entry (s)	Remarks
IVT-IR-FB-NWPZ	IVT-FB-7, 16, 20	Observations are based on phenotypic appearance and plant stand etc.
AVT-IR-NB-NWPZ	AVT-NB-1 and 4	
IVT-IR-NB-NWPZ	IVT-NB-3	
AVT-IR-MB-NWPZ	AVT-MB-3, 5 and 6	
IVT-IR-MB-NWPZ	IVT-MB-3, 8, 15, 17,21, 23	
IVT-IR-DP-NWPZ	IVT-DP-9,11,14	

Entries recommended for purification

Trial	Entry (s)	Remarks
IVT-IR-FB-NWPZ	IVT-FB-1 and 9	Few plants are off types
AVT-IR-NB-NWPZ	AVT-NB-1 and 4	Few plants are off types
IVT-IR-NB-NWPZ	Nil	Nil
AVT-IR-MB-NWPZ	Nil	Nil
IVT-IR-MB-NWPZ	IVT-MB-1, 9, 12, 14 and 23	Few plants are off types
IVT-IR-DP-NWPZ	IVT-DP-1, 10	Few plants are off types

Entries recommended to be dropped from further testing

Trial	Entry (s)	Remarks
IVT-IR-FB-NWPZ	IVT-FB-14	Mixture of drooping and normal ears
AVT-IR-NB-NWPZ	Nil	Nil
IVT-IR-NB-NWPZ	Nil	Nil
AVT-IR-MB-NWPZ	Nil	Nil
IVT-IR-MB-NWPZ	Nil	Nil
IVT-IR-DP-NWPZ	IVT-DP-4 and 5	Mixture of different plant types

Entries exhibiting higher incidence of disease /insect infestation

Trial	Entry (s)	Remarks
IVT-IR-FB-NWPZ	IVT-FB-10	high incidence (79) of foliar blight
AVT-IR-NB-NWPZ	Nil	Nil
IVT-IR-NB-NWPZ	Nil	Nil
AVT-IR-MB-NWPZ	Nil	Nil
IVT-IR-MB-NWPZ	Nil	Nil
IVT-IR-DP-NWPZ	IVT-DP-8	high incidence (58) of foliar blight

Report on pathological nurseries:

Centre	Nurseries	Remarks
Pantnagar	IBDSN, NBDSN, EBDSN	Nurseries were conducted nicely

Special comments, if any (2-3 bullet points only): Nil

Signatures:

26/3/24

(Lokendra Kumar)

26/3/2024

(Jogendra Singh)

Zonal Monitoring Report 2023-24

Zone: NHZ – Team 1
Period of visit: 14.04.2024 to 17.04.2024

Name of team members	Centres visited
Drs. Jogendra Singh, Prem Lal Kashyap (IIWBR, Karnal), Dharam Pal (IARI RS, Shimla)	Malan, Bajaura and Shimla

Summary of barley breeding trials allocated& monitored:

Centre	Trial(s) Allotted	Trials Not Conducted / Rejected	Reason/Remark*
Malan	AVT/IVT-RF-NHZ	Trial conducted.	Very Good & Satisfactory
Bajaura	AVT/IVT-RF-NHZ	Trial conducted.	Very Good & Satisfactory
Shimla	AVT/IVT-RF-NHZ	Trial conducted.	Very Good & Satisfactory

**Trials as very good, good, average and poor based on conduction*

Entries showing promising performance in breeding trials across centres:

Trial	Entry	Remarks
AVT/IVT-RF-NHZ	IVT-RF-3, IVT-RF-4, IVT-RF-23	Observations are based on appearance of the genotype and plant stand.

Entries recommended for purification:

Trial	Entry	Remark
AVT/IVT-RF-NHZ	IVT-RF-9, IVT-RF-12, IVT-RF-13	Variation for row type, ear shape and plant height was observed and it was presumed that these entries can be purified by roughing off these few plants. Hence recommended for purification.

Entries recommended to be dropped from further testing:

Trial	Entry	Remark
AVT/IVT-RF-NHZ	IVT-RF-16	Genotype was 2-rowed but 6-rowed types were observed in large number. Hence recommended for rejection.

Entries exhibiting higher diseases incidence /insect infestation: Nil

Report on Agronomical Trials:

Centre	Trial	Trials Not Conducted / Rejected	Remark
Malan	SPL-5	Conducted successfully	Treatment effects were visible among treatments

Report on Pathological/Elite Nurseries:

Centre	Nursery	Remark
Bajaura	IBDSN, EBDSN, NBDSN, EIBGSN, NBGSN	• Nurseries were conducted satisfactorily.
Shimla	EIBGSN, NBGSN	• Nurseries were conducted satisfactorily.

Special comments, if any (2-3 bullet points only): Nil

Signature(s):

17/4/2024
(Jogendra Singh)

17.4.24
(PL Kashyap)

(Dharam Pal)

Proforma for Zonal Monitoring Report 2023-24

Zone: North Hill Zone (NHZ)

Team-II

Period	Team	Centres Visited
15-17th April 2024	Drs. Charan Singh, Pramod Prasad and Navin Chander Gahtyari	Majhera, Almora, Gaja (Ranichauri)

Breeding trials allocated & monitored:

Centre	Trial(s) Allotted	Reason/Remark
Majhera	AVT/IVT-RF-NHZ	Good
Almora	AVT/IVT-RF-NHZ	Good
Gaja	AVT/IVT-RF-NHZ	Good

Entries showing promising performance in breeding trials:

Trial		Entry
AVT/IVT-RF-NHZ	Non-Cut	IVT-RF-2, IVT-RF-3, IVT-RF-8, IVT-RF-17, IVT-RF-21, IVT-RF-22
	Cut	IVT-RF-3, IVT-RF-7, IVT-RF-10, IVT-RF-17,

Entries recommended for purification:

Trial	Entry	Remark
AVT/IVT-RF	IVR-RF-13, IVT-RF-20, IVT-RF-24	Few off-type plants showing height and maturity variation.

Entries recommended to be dropped from further testing: Nil

Entries exhibiting higher diseases incidence /insect infestation:
There was no incidence of rusts observed in any trial at all the locations namely Majhera, Almora and Gaja.

Special comments, if any (2-3 bullet points only)

1. Since wheat and barley trials phonological stages are different, separate monitoring teams should be constituted for each crop.
2. No cut in AVT/IVT-RF trial was performed at Gaja (Ranichauri) centre.

Signature(s)

(Charan Singh) (Pramod Prasad) (Navin Chander Gahtyari)

Table. List of AICRP Centres of Barley Rabi *2023-24*

S.N.	Location	Name	Designation	AICRP Centres address
1.	Almora	Dr. Navin Gahtyari	Senior Scientist	ICAR-VPKAS, Almora – 263 601 (U.K) Mob: 9358044714
2.	Bajaura	Dr. Neha Sharma	Asstt. Plant Breeder	CSKHPKV, HAREC, Bajaura Kullu -175 125 (H.P.). Mob: 9736909876
3.	Banda	Dr. Mukul Kumar	Prof. & Head	Division of Plant Breeding and Genetics Banda University of Agriculture and Technology, BANDA, U.P.-210001
4.	Bhatinda	Dr. Vineet Kumar	Plant Breeder	PAU, Regional Research Station Dabwali Road, Bathinda-151005 (Punjab) Mobile No: 9411159840 Emil: vineet2906@pau.edu
5.	Bawal	Dr. Ankit Yadav	Plant Breeder	CCSHAU, Regional Research Station Bawal, District-Rewari PIN-123501(Haryana) Mobile No: 8901151570 Email: yadavankitgpb@gmail.com
6.	Chyanki	Dr. D.N. Singh	Associate Director	Birsa Agri University, Zonal Research Station Chiyanki-822102, Palamu (Jharkhand) Mobile No:9430362061 Email: dnsingh_baurnchi@gmail.com
7.	Dholpur	Dr. Ashish Sheera	Assistant Professor	SKNAU , College of Agriculture, Basedi (Dholpur) Email: sheeraashish.pbg@sknau.ac.in
8.	Durgapura	Dr. S.S. Rajput	Barley Breeder	RARI, Durgapura, Jaipur City-302018 (Rajasthan) Mobile No: 8302035321 Email: ssrajput.skncoa@sknau.ac.in
9.	Gwalior	Dr. Sushma Tiwari	Scientist	AICRP- Wheat &Barley, College of Agriculture, RVRSUA&T, GWALIOR -474002 (M.P.)
10.	Hisar	Dr. Y. K. Gulia	Barley Breeder	Deptt. of Plant Breeding College of Agriculture CCSHAU., Hisar- 125004 (Haryana) Mobile No: 9416320888 Email: yogendergulia@gmil.com
11.	Kangra	Dr. Vijaya Rana	Professor	Wheat Breeding CSKHPKV, Rice & Wheat Research Centre, Malan, Kangra -176 047, (HP) Mob: 9418457124
12.	Kanpur	Dr. Vijay Yadav	Barley Breeder	Section of Economic Botany CSAUA&T, Kanpur-208002 (UP) Mobile No: 7408339333 Email: vkyadav@gmail.com
13.	Khudwani	Dr. S.H. Wani	Associate Director of Research	SKUAST-K, Khudwani, Anantnag, 192102 (J&K) Mob: 77006907220
14.	Kumarganj	Dr. Vinod Singh	Wheat Breeder	Deptt. of Plant Breeding N.D. University of Agri & Tech. Kumarganj – 224001 (U.P.) Mobile No: 9450882524 Email: singhv.1959@gmail.com
15.	Ludhiana	Dr. Simarjit Kaur	Barley Breeder	Deptt. of Plant Breeding, College of Agriculture P.A.U., Ludhiana - 141004 (Punjab) Mobile No: 8198050999 Email: simarjit13sept@yahoo.co.in
16.	Majhera	Dr. Anjuli Agarwal	Joint Director	Zonal Agricultural Research Station GBPUA&T. Majhera Nainital- 263 135, (U.K) Mob: 7500241431
17.	Modipuram	Dr. Lokesh Gangwar	Prof. & Head	Div. of Genetics & Plant Breeding SVBPUA&T. , Meerut-250110 (UP)

				Mobile No: 7704014035 Email: gangwarlk@gmail.com
18.	Morena	Dr. Jagendra Singh	Scientist	RVSKVV, Zonal Agriculture Research Station, A.B. Road, MORENA - 476001 (M.P.)
19.	Navgaon	Dr. Indu Bala	Asstt. Professor	College of Agriculture Navgaon-301025, Alwar (Rajasthan) Mobile no: 9027997764 Email: ibsethi.agro@sknau.ac.in
20.	Pantnagar	Dr. J.P. Jaiswal	Professor	Deptt. Of Genetics & Plant Breeding GBPUA&T., Pantnagar-263145 (UK) Mobile No: 9411159751 Email: jpj.gbpu@gmil.com
21	Pusa	Dr. S.K. Singh	Associate Professor	Deptt.of Genetics & Plant Breeding Rajendra Prasad Central Agri University PUSA, Samastipur- - 848125 (Bihar) Mobile No: 7250209227 Email: satish.singh@rpcau.ac.in
22.	Ranchi	Dr. Surya Prakash	Asstt. Professor	Genetics & Plant Breeding Birsa Agri University, Kanke, Patratu Road Ranchi- 843006, (Jharkhand) Mobile No: 9430393412 Email: suryapbg@gmail.com
23.	Ranichauri	Dr. Ajay	Dean/Director Research	College of Forestry and Hill Agriculture Ranichauri -249199,Teri Garwal (U.K) Mob – 9430393412 Email:pardeep.patho@gmail.com
24.	Sabour	Dr. D.K. Barnwal	Barley Breeder	Deptt.of Genetics & Plant Breeding Bihar Agriculture University, Sabour- 813210, Bhagalpur (Bihar) Mobile No: 9006828656 Email:dkbbhu@gmail.com
25.	Saini	Dr. V.K. Yadav	Director (Seeds)	CSAUA&T, Kanpur-208002 (UP) Mobile No: Email:
26.	Samastipur	Mr. Manish Kumar	Plant Breeders	Borlaug Institute for South Asia (BISA), New Farm Area, PUSA, SAMASTIPUR, Bihar-848125
27.	Shimla	Dr. D.P. Walia	Principal Scientist & Head	IARI, Regional station, Tutikandi, Shimla - 171 004, (HP) Mob: 9817163305
28.	Srigangana gar	Dr. Pradeep Kumar	Asstt. Professor	Agriculture Research Station Karni Marg, Surendra Dental College Road, Sri Ganganagar-335001(Raj.) Mobile No: 9414537801 Email: pradeep.patho@gmail.com
29.	Tabiji	Dr. Dinesh Kumar	Asstt. Professor	SKNAU, Agricultural Research Sub-Station Tabiji-305206, Ajmer (Rajasthan) Mobile No: 9460089702 Email: inchrge.arss.tabiji@sknau.ac.in
30.	Tikamgarh	Dr. Rudrasen Singh	Plant Breeder	College of Agriculture (JNKVV), Madhuban Colony, Kudeshwar Road TIKAMGARH (MP)- 472001
31.	Udaipur	Dr. Abhay Dashora	Asstt. Prof.	Deptt. Of Plant Breeding Rajasthan College of Agriculture (MPUA&T), UDAIPUR-313001(Rajasthan)
32.	Varanasi	Dr. Sandeep Sharma	Barley Breeder	Department of Plant Breeding Institute of Agriculture Sciences BHU., Varanasi - 221005 (U.P.)
33.	Vijapur	Dr. A.M. Patel	Scientist	Wheat Research Station S. D. Agricultural University VIJAPUR-382 870 Distt.: Mehsana (Gujarat)
34.	Wadura	Dr. Reyazul Rouf Mir	Associate Professor	Division of Genetics and Plant Breeding, SKUAST, Kashmir, Wadura Campus, Sopore, - 193201 (J&K) Mob: 9622152829

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