प्रगति प्रतिवेदन
PROGRESS REPORT
2021-22

जौ सुधार
BARLEY IMPROVEMENT

Azadi Ka Amrit Mahotsav

अखिल भारतीय समन्वित गेहूँ एवं जौ अनुसंधान परियोजना

AICRP on Wheat and Barley

भा.कृ.अनु.प.-भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल

ICAR-Indian Institute of Wheat and Barley Research, Karnal

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All India Coordinated Research Project on Wheat and Barley

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BARLEY IMPROVEMENT

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Correct Citation:

ICAR-IIWBR 2022. Progress Report of AICRP on Wheat & Barley 2021-22: Barley Improvement. Eds: RPS Verma, OV Singh, AS Kharub, D Kumar, C Lal, J Singh, R Malik, L Kumar, SK Bishnoi, S Kumar, SC Bhardwaj, P Jasrotia, OP Gangwar, A Verma, A K Sharma, C Singh, S Singh and GP Singh. ICAR-Indian Institute of Wheat and Barley Research, Karnal, India. P. 257.

Issued on the occasion of 61st All India Wheat & Barley Research Workers' Meet hosted by RVS Krishi Vishwa Vidyalaya, Gwalior (Madhya Pradesh), India during August, 29-31, 2022.

ACKNOWLEDGEMENTS

It gives me great pleasure to record my deep sense of gratitude to Dr. G.P. Singh, Director, ICAR-IIWBR, Karnal for his able guidance, keen interest and facilitation towards barley coordination activities under the AICRP on wheat and barley as well as during preparation of this document.

The cooperation received from all funded and voluntary centres of AICRP on wheat and barley as well as other testing centres for the successful conduct of barley trials and nurseries during the crop season is sincerely acknowledged.

I record my sincere acknowledgements for the useful help provided by my colleagues Drs. OV Singh, AS Kharub, Dinesh Kumar, Chuni Lal, Lokendra Kumar, Jogendra Singh, Rekha Malik, SK Bishnoi, AK Sharma Charan Singh, Sudheer Kumar, Poonam Jasrotia, and Satyavir Singh in compilation and editing of this report as well as in coordinating research activities in their respective disciplines. Special thanks are due to Dr. SC Bhardwaj, and his team at Flowerdale Shimla, for seedling studies, beginning of gene postulation and making inocula available for all the rusts to breeders on demand.

The useful help rendered by Sh. Ravindra Kumar, Sh. Rampal and Sh. Deepak in the laboratory for analytic work, field experimentation and data compilation is gratefully acknowledged.

The help extended by Dr. Ajay Verma, in analyzing the voluminous data well in time deserve my special thanks.

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61st All India Wheat and Barley Workers Meet (29-31 August 2022)

RESEARCH HIGHLIGHTS OF BARLEY IMPROVEMENT

The crop season 2021-22 started well for barley and initially looking good for barley production as the crop growth conditions were very good, however, the heat stress experienced late February onwards during the grain filling/ development process adversely affected the production in NWP Zone. Third Advance Estimates of Production of Food grains for 2021-22 has indicated that 15.87 thousand tones production of barley in country against the target of 22.00 thousand tones in country. This is nearly 4.2% less production over the previous year. According to 3rd advance estimates for Rabi 2021-22, nearly 1587 thousand tons of barley has been produced in 542 thousand ha area with a productivity of 29.30 q/ha. Rajasthan continues to be the largest state having >49.0 % in area and >58.0 % production followed by Uttar Pradesh Uttarakhand and Himachal Pradesh (Table 1.1). In case of Rajasthan there is not much change in area and production over last year. Maharashtra has an increasing trend for barley area in recent three years, but declined around five folds in the year i.e., 16.40 in 2021-22 against 62.95 in 2020-21. The states of U.P., Himachal Pradesh and Uttarakhand have indicated stable trends and in other states only minor fluctuations are there for barley area/ production.

Table 1.1: Recent estimates of barley area, production and productivity in major barley growing states.

State/ Country	2020-21 (Final Estimates)			2021-22 (3rd Estimates)		
	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)
Bihar	7.56	14.38	1903	9.76	17.12	1754
Chhattisgarh	1.43	0.99	694	0.71	0.58	820
Haryana	9.26	30.96	3343	9.02	32.91	3649
Himachal Pradesh	20.43	32.14	1573	20.11	36.40	1810
Madhya Pradesh	25.00	47.98	1919	16.00	30.74	1921
Maharashtra	62.95	48.09	764	16.40	3.26	199
Punjab	5.90	22.28	3777	7.00	22.93	3275
Rajasthan	269.75	935.75	3469	268.53	920.25	3427
Uttar Pradesh	157.00	488.11	3109	165.00	490.88	2975
Uttarakhand	22.00	27.98	1272	20.00	24.16	1208
West Bengal	0.25	0.54	2139	0.50	1.05	2100
Others	1.82	1.19	1232.83	8.76	7.14	815
INDIA	592.47	1656.34	2796	541.78	1587.41	2930

Source: DES, MoA & FW, India.

There is always a concern expressed at various platforms for barley area decline in India (Fig. 1a), however, in recent years, the area has more or less stabilized and there has been gain in productivity resulting in higher production (Fig. 1b). The possible reasons for the non-preference by farmers for barley could be the difficulties or lack of profit in selling the produce as per convenience. Though the MSP of barley is announced (much lower than wheat), but there is no procurement by government agencies, which makes it non assured procurement of the crop and farmers are not willing to take such risk except in cases where there are no better options are available. Sometimes industry is taking care of limited procurement on premium price for malt barley either directly or through or market people based in important mandis. A few of such industries had also followed "contract farming" with malt type varieties to ensure regular supply of the raw material for their units.

This has given much needed impetuous to the barley cultivation under well managed conditions with rise in productivity levels at small holder farmers. ***However, the crop year 2021-22, for barley has been a unique year where against the declared MSP of Rs. 1635/q, the market prices in most of mandis of Rajasthan and Haryana ranged from Rs. 2550 to 3600/q during most of the procurement period from March to May 2022, allowing the farmers to raise their income from this crop to the tune of 150 to 200% or even more in some cases.***

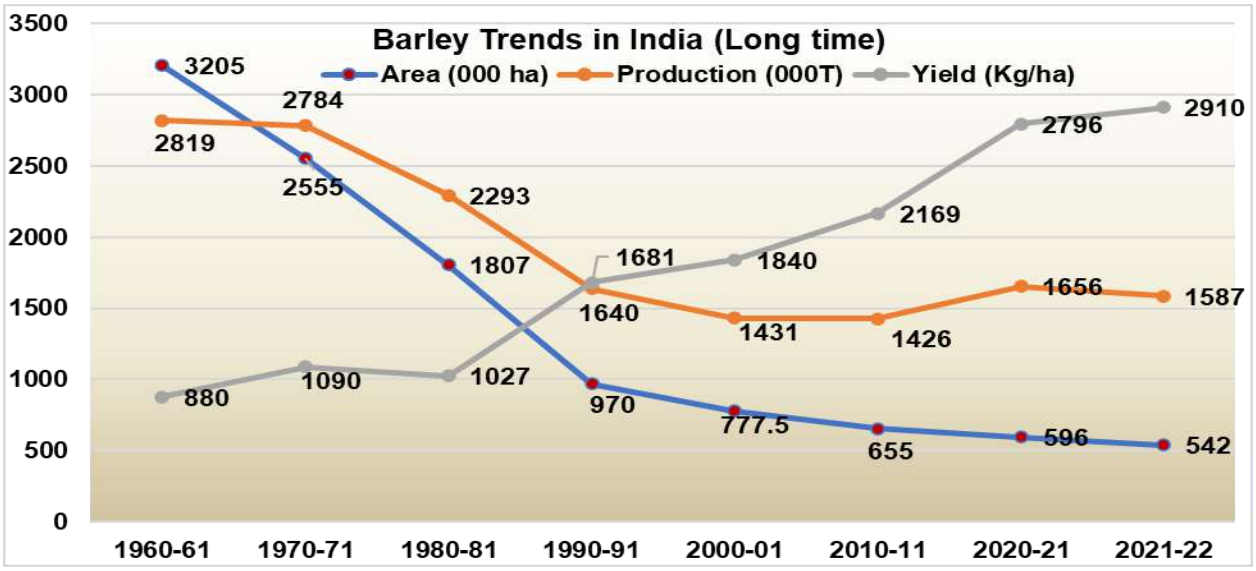


Fig. 1a: Long term trends of barley area, production and productivity in India (Source: DES, MoA &FW, India).

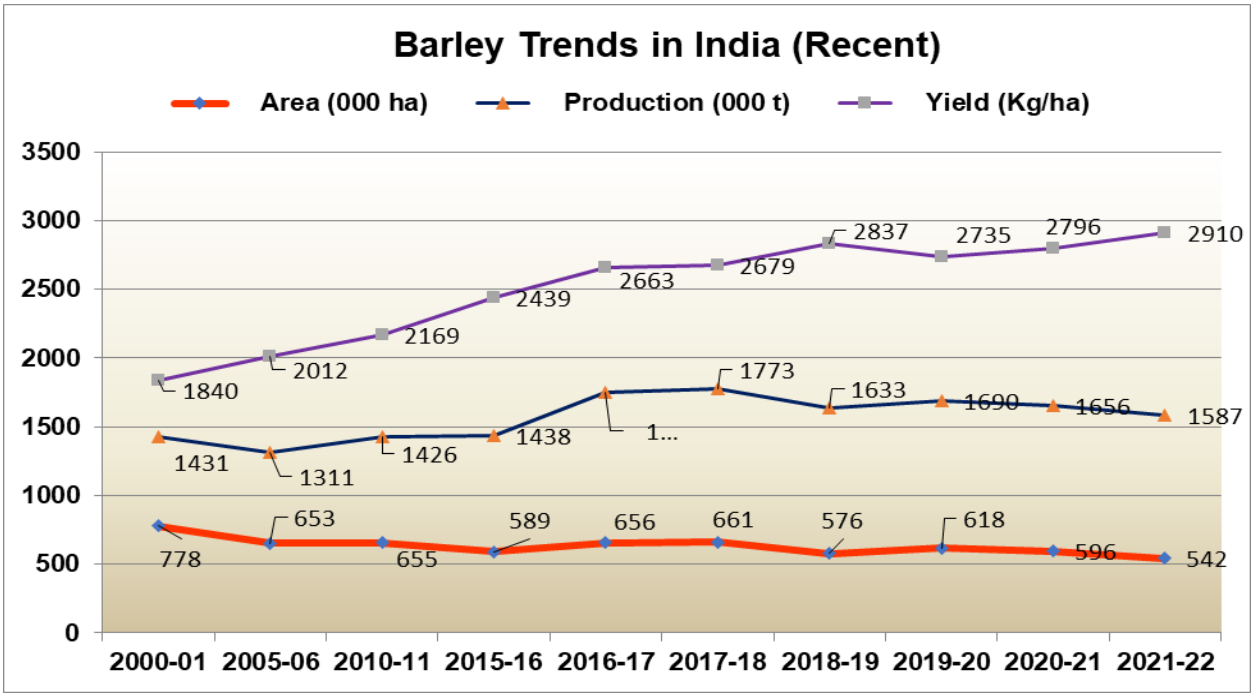


Fig. 1b: Short term trends of barley area, production and productivity in India (Source: DES, MoA &FW, India).

The predicted shortage of the grain for barley industry in country as well as risky international supply from Ukraine and other countries in the region might have contributed in the

sudden price rise. This may help the cause of stabilizing/ increasing the area under barley in country in addition of the heat wave experienced during the year coupled with the water availability in central India, especially in states like Madhya Pradesh.

Despite this one-time development, there is a need of regular support in terms of assured procurement and higher MSP for barley from government side also to support its production. Also, imposing the import duty on barley will also support indigenous production and procurement for good quality malting barley varieties, available in country. Another extremely important factor is the need for regular breeder seed indenting by the different states, private and public sector agencies, to assure the availability of quality seed for farmers, averting, an unplanned sudden demand from industry for huge seed quantity, which cannot be met because of non-prior indenting. The recent trends of decreasing breeder seed indenting is a cause of great concern to the cultivation of the crop and availability of good quality seed to willing farmers.

During the year some damage/losses in quantity and quality of the grain were observed due to heat wave observed in different areas in timely sown crop. The crop was adversely affected at grain development stage in northern plains especially north western regions, which is indicated in physical grain quality analysis for parameters like 1000 gw, proportion of bold and thin grains, which were recorded in negative side over long term observations from AICRP Barley evaluation centers. The phenomena were more visible in northern Haryana, Punjab, and Western UP, where the location means were poorer than others in Rajasthan, Southern Haryana and adjoining regions, where the crop escaped the stage of grain filling from severe heat wave. The monitoring teams during the surveys in the major barley growing areas during the season, observed that the crop season was by and large a rust-free year in major barley growing areas, with some incidence of aphids in the plains and more incidence of spot blotch in NEP Zone. The smuts (mainly covered) were common in trials as well as in farmers' fields where the seed was not treated with correct fungicides.

Release of new barley varieties

Fig.1: DWRB137, six row barley variety which is now recommended for all three plains zones in India.

The variety DWRB137, a six row-feed barley variety has been approved for area extension in North Western Plains Zone (Punjab, Haryana, Western U.P., Rajasthan during 2021-22 by CVRC. This variety was earlier released for NEPZ and CZ, and currently leading the breeder seed production indents in country. On account of its superiority in yield and other traits, in no time, this variety became very popular among barley growers of India as indicated by its first rank in national breeder seed indent and production programme. Keeping in view its popularity, a systematic plan was chalked out to explore the possibility of extending its availability for farmers of NWPZ also. Thus, the farmers of NWPZ will also be benefitted from this variety and will harness its potential in the region. Another barley variety KB1425 has been released for saline-alkaline soils of Uttar Pradesh under irrigated timely sown conditions (Table 1.2).

Table 1.2: Barley varieties released by CVRC/SVRC during 2021-22.

SN	Variety	Parentage	Zone	Av. yield (q/ha)	Pot. Yield (q/ha)	Developed at	Production condition
1.	DWRB137	DWRB28/ DWRUB64	NWPZ	52.2	80.0	IIWBR, Karnal	Timely sown irrigated conditions
			NEPZ	37.9	53.6		
			CZ	42.5	67.4		
2.	KB1425	K508/ NDB1295	Uttar Pradesh	33.1	47.3	CSAUA&T Kanpur	Irrigated timely sown, in saline-sodic soils

Registration of new barley genetic stocks

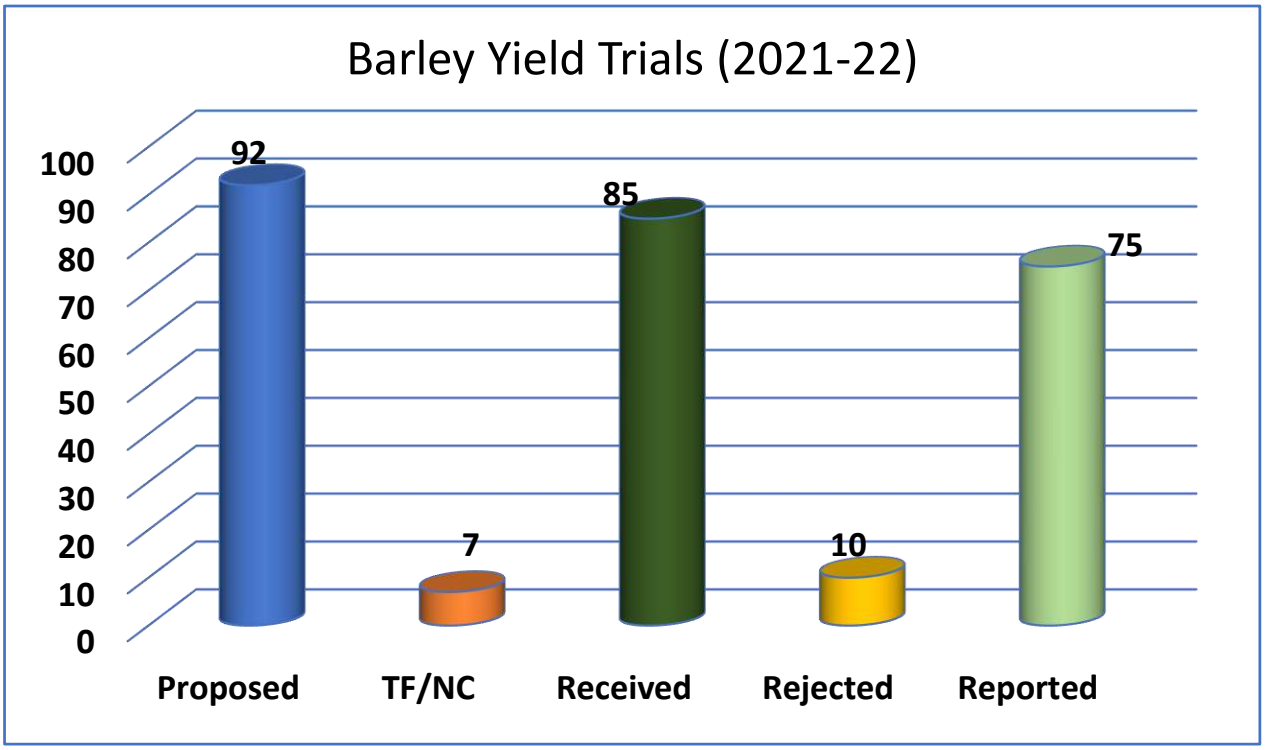
Nine genetic stocks namely DWRB206, BHS478, BCLA3, BCLA11-6, DWRBG1, DWERBG3, DWRBG4, DWRBG5 and DWRBG6 (Table 1.3) have been registered with ICAR-NBPGR for their unique traits during the year 2020 and 2021. Two of them are unique for resistance to corn leaf aphid for the first time in country. These genotypes have been discovered with specific traits through their evaluation under the AICRP Wheat and Barley multilocation disease/ pest (NBDSN) or quality (BQSN) screening nurseries.

Table 1.3: Genetic stocks registered with NBPGR New Delhi during 2021-22.

SN	**Name**	**INGRN**	**Parentage**	**Trait(s)**	**Institute**
1.	DWRB 206	21100	Zigzig/4/Tocte//Higo/ Lino/3/Petunia1	Resistant to stripe rust at APR under artificial inoculation	IIWBR, Karnal
2	BCLA 3	21102	EB921/ Alfa93	Corn leaf aphid resistance in two-row back ground	IIWBR, Karnal
3	BCLA11-6	21101	BCU390 /Alfa93	Corn leaf aphid resistance in six-row back ground	IIWBR, Karnal
4	BHS 478	21202	BHS385/BHS369	Seedling resistance against all races of leaf and stripe rust. Adult plant resistance to yellow rust, leaf rust and stem rust.	IARI, RS, Shimla
5	DWRBG 1	21204	Legacy/4/Tocte//Gob/ Humai10/3/Atah92/Aleli /5/Arupo /K8755 /Mora	Barley genotype with a combination of low grain beta glucan (3.8%) and higher grain protein contents (13%).	IIWBR, Karnal
6	DWRBG 3	21205	J09049 F3 10/030552	Barley genotype with combination of low grain beta glucan content (3.88%) and desirable thousand grain weight (45g).	IIWBR, Karnal
7	DWRBG 4	21203	DWR30/ Shebac	Combination of high beta and high protein.	IIWBR, Karnal
8	DWRBG 5	21206	W260/BCU8	Huskless barley genotype with high thousand grain (43.5g) weight, in combination of bold grain percentage (63.2%) and protein content (14.7%).	IIWBR, Karnal
9	DWRBG 6	21207	Petunia2/M112	Huskless barley resistant for stripe rust at APR and for new pathotypes 6S0 and 7S0 at SRT and also having higher starch content.	IIWBR, Karnal

CROP IMPROVEMENT

Coordinated Yield Evaluation Trials



- In all 90 test entries contributed by 11 centres, were evaluated against 19 checks in the coordinated yield trials under rainfed (plains and hills), Irrigated (plains) and saline soils conditions. The new barley entries include malt, feed or dual purposes types and mostly were hulled type with a few hull-less types in northern hills and plains.
- These trials were conducted at 11 main centres and 32 additional testing centres (including ICAR, SAUs and State Department of Agriculture) during Rabi 2021-22.
- Out of 92 yield evaluation trials proposed 90 trials were conducted as Gwalior center did not conduct two trials. Five trials failed at Kumarganj due to poor management. The data were received in time for 85 trials. Out of this data received number, four trials were rejected by the monitoring teams (2 trials at Navgaon and one each at SG Nagar and Bhilwara due to faulty lay outs). After the analysis, only 75 trials (81.5% of proposed, 89.3% of received) were found good for reporting. This rejection includes the five trials failed at Kumarganj, which is funded center because of extremely poor crop stand and improper care during the conduct of trials.

Promising entries in AVT/IVTs during 2021-22

Based upon the multilocation evaluation under different trials series, 20 new entries were found promising (Table1.4), with significant superiority for the yield over the best check in the trial. Another set of 39 entries was numerically superior to the best check in different trials/ zones, however, based on the CD values these were at par. The promotion/ retention in the AICRP trials for next year will depend on the promotion criteria i.e. significantly superior or better than check with additional trait(s), monitoring reports for purity, disease/pest reactions and the quality traits (as applicable).

Table 1.4: Promising entries in different trials during 2021-22

SN	Trial name	Zone	Significantly superior	Superior (numerically)
1	AVT-IR-MB	NWPZ	DWRB219	-
2	IVT-IR-MB	NWPZ	-	-
3	AVT-IR-FB	NEPZ	-	NDB1756, RD3034
4	IVT-FB	NWPZ	UPB1106, KB2004	BH1044, KB2031, DWRB226, PL939, NDB1793, RD3054, PL936, RD3051, RD3052 and UPB1105
		NEPZ	DWRB226	RD3053, UPB1106, BH1045, KB2004, UPB1105
		CZ	RD3053, KB2004, HUB281, PL937, RD3052, NDB1800, NDB1793, BH1045, DWRB225, KB2015	8 entries (check at Rk 20)
5	IVT-IRTS-NB	NWPZ	DWRB223	-
		NEPZ	-	-
		CZ	-	UPB1104, DWRB223,
6	AVT-SST	PLAINS	KB2031, DWRB228	RD3059, NDB1782, RD3062, RD3060
7	IVT-RF	NEPZ	-	NDB1785, NDB1784, DWRB225
8	AVT-RF- NC	NHZ	UPB1103, VLB175	-
9	AVT-RF- DP-GY-CUT	NHZ	VLB175, HBL876	HBL875, VLB177, UPB1102, VLB176
	AVT-RF- DP-FY- CUT	NHZ	-	HBL877, VLB175
	Total		20	39

Malt Barley Trials

AVT-MB-TS- NWP Zone:

- The Advanced Varietal Trial (IRTS) of malt barley was proposed at 11 locations in North Western Plains Zone (NWPZ) and was conducted at all locations. The trial at Navgaon centre was rejected by the monitoring team due to faulty layout and data from remaining ten locations were considered for location wise as well as zonal analysis.
- No serious disease/pest incidence was reported at any centre in the crop season except a mild incidence of spot blotch at Hisar and Pantnagar centre. Over all the condition of the trial was very good at all centres.
- In case of grain yield, the trials mean value ranged from 35.87 q/ha (Bawal) to 58.31 q/ha (Modipuram) with 45.30 q/ha over all mean of NWP Zone. Amongst the genotypes, the test entry DWRB219 (49.40 q/ha) was observed as significantly superior to rest of entries and checks.

IVT-MB-TS- NWP Zone:

- The IVT-MB-NWPZ was proposed at 11 locations and was conducted at all locations. The data from nine locations were considered for zonal mean analysis as Navgaon and SG Nagar trials were rejected by monitoring team because of layout issues.
- There were 25 genotypes in this trial including four checks.
- In case of disease/pest incidence, no major problem was reported at the any location except a mild incidence of spot blotch at Hisar and Pantnagar centre.

- Grain yield location mean values ranged from 34.98 q/ha (Hisar) to 58.01q/ha (Modipuram) with a zonal mean of 45.5 q /ha. In this trial the check variety DWRB182 (49.60) stood at first rank, hence no test entry could beat the best check.

Feed Barley Trials

AVT-IR-FB- NEPZ:

- The AVT was proposed at 7 locations in NEPZ with four entries and two checks (HUB113 and DWRB137). Entry PL917 was in final year of evaluation.
- The Zonal monitoring teams visited the trials at Kalyani, Ranchi, Sabour, Pusa, Kanpur, Kumarganj and Varanasi locations and rejected Kumarganj trial due to animal grazing.
- No incidence of disease and insect/ pest infestation was observed in any of the entry of the trial except leaf blights higher incidences at most of the centers.
- The data from Kalyani centre were not included in the pooled analysis because of late sowing (10.12.2021) and low location mean yield (25.28 q/ha). The results from rest of the five centers were included in zonal pooled analysis.
- The location means for grain yield ranged from 29.74 q/ha (~ 30q/ha) at Ranchi to (49.74 q/ha) at RPCAU, Pusa with 39.3 q/ha zonal mean across the centres in NEPZ. The test entry NDB1756 ranked 1st in the zone with mean grain yield 41.80 q/ha followed by entry RD3034 (41.3 q/ha) and check DWRB137 (40.80 q/ha) in the first non-significant group.

IVT-IR-FB- NWEPZ/ NEPZ and CZ:

- The IVT feed barley was proposed at 20 locations across NWPZ (8), NEPZ (7) and central zone (5) in northern plains region of the country. All the centers conducted the trial except Gwalior in Central Zone. The trial consisted of 21 test-entries and three checks, namely (BH946, HUB113 and DWRB137). To fit the trial in a 5 x 5 lattice design, one filler was also included.
- During the crop season the monitoring teams visited Hisar, Ludhiana, Durgapura, Tabiji centres of NWPZ and Kalyani, Ranchi, Sabour, RPCAU Pusa, Kanpur, Kumarganj (Ayodhya) and Varanasi locations of NEPZ. In central zone the Udaipur center was also monitored by the barley team, while at Vijapur center the wheat team took the notes.
- The results from all the eight locations were included for zonal pooled analysis in NWPZ. In NEPZ this trial was rejected at Kumarganj by the monitoring team and data from Kalyani location were not included in the zonal pooled analysis because of late sowing. The remaining five locations were considered for pooled zonal analysis of NEPZ. In the Central Zone, Gwalior centre has not conducted the trial and data from the remaining four locations were included in zonal pooled analysis.
- The location means for grain yield ranged from 34.43 q/ha (Ludhiana) to 57.07 q/ha (Durgapura) with 46.2 q/ha zonal mean in NWPZ. Entry UPB1106, ranked first with 50.8 q/ha grain yield in NWPZ and was followed by nine more entries in the 1st NSG, while DWRB137 was the best check and ranked 14th. Two test entries UPB1106 (50.8 q/ha) and KB2004 (49.9 q/ha) ranking 1 and 3, respectively gave significantly higher grain yields over the best check variety of this zone.
- In NEPZ, location means ranged from 35.60 q/ha (Varanasi) to 53.14 q/ha (Kanpur) with zonal mean 43.20 q/ha. The entry DWRB226 recorded significantly higher yield (50.90 q/ha) over the best check DWRB137, though there were six more entries (RD3053, UPB1106, BH1045, KB2004, UPB1105 and Filler) in the 1st NSG with numerically higher yield than best check.

- In case of central zone, the location mean ranged from 46.45 q/ha (Vijapur) to 59.90 q/ha (Tikamgarh) with 52.7 q/ha zonal mean. Entry RD3053 (59.1 q/ha) ranked first followed by KB2004 (58.4 q/ha), HUB281 (58.0 q/ha), PL937 (56.3 q/ha) and RD3052 (56.1 q/ha) in the first NSG. All the five entries were significantly superior than the best check DWRB137 (50.0 q/ha). In all there were six more entries with significant superiority to the check DWRB137.

IVT-RF-NEPZ:

- The trial was proposed at eight locations and was conducted by all centres. The trial consisted of 13 genotypes including 11 test entries and two checks, namely K603 and Lakhan.
- The trial at Kumarganj was rejected by the monitoring team dur to grazing and the data from Sabour center were rejected due to high CV and results from rest six centers were included in zonal pooled analysis.
- The location means for grain yield ranged from 20.68 q/ha (Varanasi) to 37.40 q/ha (Pusa) with 31.0 q/ha trial zonal mean across the centres. Entry NDB1785 ranked first with mean grain yield of 35.00 q/ha followed by NDB1784 (33.70 q/ha), DWRB225 (33.70 q/ha) and the best check variety K603 (33.40 q/ha) in the first significant group.

AVT-SST:

- This trial was proposed at 8 locations and was conducted by all centres. The trial consisted of 14 genotypes including three checks (NDB1173, RD2794 and RD2907) and 11 entries contributed by different centers.
- The Zonal Monitoring Teams visited the trials at Dalipnagar and Kumarganj in NEPZ and Fatehpur, CCSHAU, Hisar, IIWBR Hisar in NWPZ and Bhilwara in CZ during the crop season. The trials at Bhilwara (due to faulty layout) and Kumarganj (poor performance and animal grazing) centres were rejected by the teams. The data from rest of the six centers were included in zonal pooled analysis.
- The location means for grain yield ranged from 21.73 q/ha (CSSRI, Karnal) to 47.11 q/ha (IIWBR, Hisar) with 32.40 q/ha over all mean across the centres. Entry KB2031 ranked first with mean grain yield of 36.20 q/ha and followed by entries DWRB228 (35.70 q/ha), RD3059 (34.80 q/ha) and NDB1782 (34.50 q/ha) in the first NSG. However, only the first two were significantly superior to the best check RD2907.

IVT-IRTS-NB -NWPZ/NEPZ/CZ:

- In IVT-IRTS-NB a hulless barley trial was proposed at 14 locations comprising of NWPZ (6), NEPZ (3) and Central Zone (5) in northern plains. The results were received from 12 locations as the Gwalior center did not conduct the trial and the trial failed/rejected by monitoring team at Kumarganj.
- The trial consisted of 5 entries and 2 checks, namely Karan16 and PL891. The monitoring teams visited Hisar, Ludhiana, Durgapura, Modipuram and Pantnagar in NWPZ and Kanpur, Kumarganj and Varanasi in NEP zone. In entries DWRB 223, UPB1086 and UPB1104 off types were reported in NWP zone, while entry DWRB227 was reported as segregating/ mixture.
- The data from all the six locations were included for zonal pooled analysis in NWPZ, while data from Varanasi location were not included due to LSM in NEPZ. In case of CZ the results from the four locations were included for pooled analysis.
- The location means for grain yield ranged from 31.57 q/ha (Ludhiana) to 56.46 q/ha (Durgapura) with 40.15 q/ha zonal mean in NWPZ. Entry DWRB223 ranked 1st in the NWP zone and was significantly superior than rest of the entries and checks. In case of NEPZ, at

Kanpur location, check PL891 ranked first with 41.67 q/ha grain yield and was the only genotype in first non- significant group.

- In case of central zone, the location mean ranged from 29.52 q/ha (Vijapur) to 54.96 q/ha (Morena) with 43.0 q/ha zonal mean. The entry UPB1104 ranked first with mean grain yield 46.8 q/ha followed by DWRB223 (45.9 q/ha) and check Karan 16 with mean grain yield 44.9 q/ha, respectively in the first non-significant group.

Dual Purpose Barley Trials in NH Zone

AVT-RF-NHZ:

- The advanced varietal trial (Rainfed) for North Hills Zone was proposed, with two components merged for normal as well as dual purpose barley evaluation in one common trial. There were a total four replications proposed (two replications as normal for grain purpose and remaining two replications as dual purpose i.e., grain as well as green fodder) for evaluation under rainfed conditions of northern hills.
- The trial was proposed at 12 locations across Uttarakhand, Himachal Pradesh, and Jammu & Kashmir and was conducted by all centres. Wadura center did not exercise cut for green forage and all four replications were taken as normal grain crop.
- The trial consisted a total of 23 genotypes and out of which 18 were the test entries while the rest five were the check varieties for grain (BHS352, BHS400, HBL113 and VLB118) and BHS380 for dual purposes.

A. **Performance in grain (no cut) trial**

- The data from Katrain (LSM and HCV) and Majhera (LSM) centres were not considered for zonal mean analysis. The results from rest 10 centres were in accordance and included in zonal pooled analysis.
- The location means for grain yield ranged from 18.10 q/ha (Gaza) to 42.24 q/ha (Malan) with 30.2 q/ha zonal mean across the centres. Entry UPB1103 ranked first with mean grain yield of 35.0 q/ha and entry VLB175 ranked second with grain yield 34.8 q/ha in the first non-significant group. The check VLB118 (33.10 q/ha) was revealed as best check rank third.

B. **Performance in dual purpose (cut for green forage) trial**

I. Grain yield performance:

- Though the trial was proposed at 12 locations but Wadura centre did not implemented the cut treatment. After analysis, the data from Berthein (HCV), Gaza (HCV), Kangra (LSM) and Majhera (LSM) centres were excluded for zonal mean analysis.
- The location means for grain yield ranged from 12.65 q/ha (Katrain) to 32.68 q/ha (Bajaura) with 24.91 q/ha zonal mean across the centres. Amongst test entry, VLB175 ranked first with mean grain yield of 29.44 q/ha followed HBL876 at second rank with grain yield 29.25 q/ha, HBL875 ranked three with grain yield 27.71 q/ha, VLB177 ranked fourth with grain yield 27.7 q/ha and UPB1102 ranked fifth with grain yield 27.7 q/ha in the first non-significant group. The dual-purpose check BHS380 ranked thirteen with mean grain yield of 24.76 q/ha.

II. Green fodder yield performance

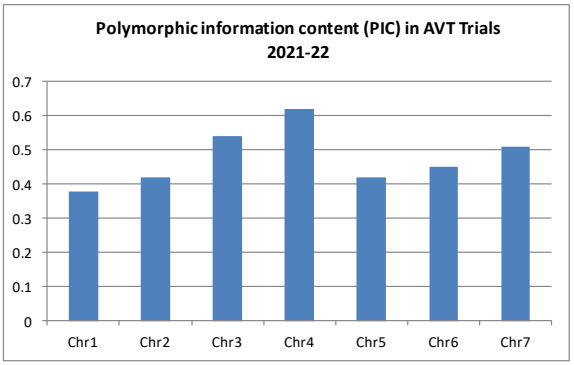
- The cutting of green fodder was made after the 70 days sowing of the trial. The data of Almora, Gaza, Katrain, Majhera and Malan were not included in zonal pooled analysis on account of the LSM, while Khudwani was not included due to HCV.
- The location means for green fodder yield ranged from 25.8 q/ha (Bajaura) to 182.1 (Berthein) with 97.7 q/ha zonal mean across centres. Amongst genotypes, the entry HBL877 ranked first with mean green fodder yield of 117 q/ha and VLB175 ranked second with green fodder yield

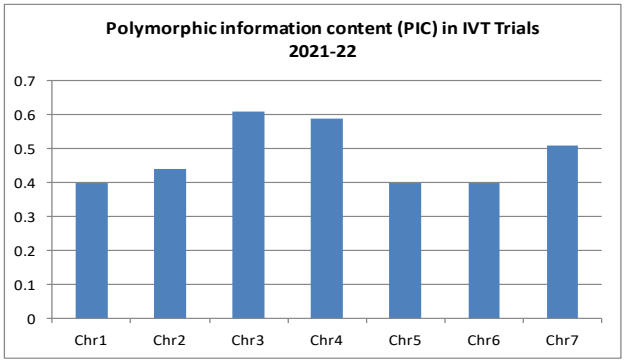
116.1 q/ha. The best check HBL113 (110.3 q/ha) ranked third for green fodder yield followed by dual purpose check BHS380 (109.6 q/ha) and VLB118 (109.5 q/ha) in 1st NSG.

- Taking in view of the overall performance for dual purpose i.e., grain yield and fodder yield together, a joint ranking of all the genotypes was developed and on the basis of this criteria the entry VLB175 ranked first with 1 and 2 rankings in grain (29.44 q/ha) and forage yield (116.1 q/ha) respectively. No other entry or check performed like VLB175 in both traits, thus it may be considered for further testing. Additionally, VLB175 ranked 2nd in normal trial for grain yield. Indicating its superiority for both normal and dual-purpose utilization.

Molecular Profiling of Barley Trials 2021-22

Molecular profiles were generated to distinguish entries with their respective checks in barley trials including both, IVT and AVT for 2021-22. Total 46 SSR/STS markers covering all the seven linkage groups of barley were screened with 109 lines including entries and checks. Total 97 alleles were scored for both trials. The band fragment size varied from 90 bp to 1500 bp with PIC values ranging from 0.0 to 0.69 for screened molecular markers. Molecular statistics were also evaluated for AVT and IVT trial level. For AVT trials, all entries were clearly distinguished in UPGMA clustering in range of 0.54-.1.0 similarity coefficient in UPGMA based dendrogram. Average PIC across linkage groups varies from .38 to .61 for test entries and their respective check. In IVT trials, average PIC across seven linkage groups of barley varies from 0.4 to 0.60 and chromosome 3H was found most variable. In barley trials for 2021-22, all the test entries could be distinguished using screened markers and generated unique profiles. Molecular statistics were comparable with previous crop season trials suggesting that genetic variability in barley improvement programme have been maintained is sustained this year also.





Breeder seed production

The breeder seed production of 632.31q of 21 varieties was allocated among 8 BSP centres against the breeder seed indent of 22 varieties from DAC&FW for production during 2020-21. Seven states *viz*., Punjab, Haryana, Himachal Pradesh, Madhya Pradesh, Rajasthan, Uttar Pradesh and Uttarakhand and four public sector agencies *viz*., National Seeds Corporation, IFFDC, NAFED & KVSS as well as private seed companies under the National Seed Association of India indented breeder seed of different varieties. The highest breeder seed indent was placed by Rajasthan (190.00q) followed by Uttar Pradesh (120.0q), NSAI (31.6q), and National Seed Corporation (31.0q). From variety point of view, amongst 21 varieties, ***maximum breeder seed indent was received for the variety DWRB 137 (120.70q)*** followed by HUB 113 (50.0q), RD 2899 (49.10q) and RD 2907 (44.0q).

A total of 632.31q breeder seed with a surplus of 212.46q over the total allocated quantity (419.85q) of 21 varieties was produced by 8 BSP centres during 2021-22. Among 8 breeder seed production centres, maximum breeder seed was reported from RARI, Durgapura (306.20q) with surplus of 165.70q against allocation followed by CCSHAU, Hisar (139.160q) and IIWBR, Karnal (110.20q). Top ten breeder seed indented varieties contribute to the tune of 93.27% in total allocation whereas these varieties contribute 95.24% share in total breeder seed production during 2021-22. A total of 36.06q nucleus seed of 19 varieties was produced against 20.10q allocation in BNS-1 with a surplus of 15.96q seed during 2021-22. National Seed Corporation, New Delhi has reported a total of 23.15q carry over test stock seed of variety DWRB 182 notified in 2021.

Zonal Monitoring

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 (Table 1.5). 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 1.5: Zonal monitoring visits of the barley teams

Zone	Date	Centres visited	Team Members
NEPZ Team I	23-26 Feb	Kanpur, Dalipnagar, Kumarganj, Saini, & Varanasi	Drs. Chuni Lal, Ravindra Kumar, SP Singh, and PK Gupta
NEPZ Team II	23-26 Feb	Kalyani, Ranchi, Sabour and Pusa	Drs. RPS Verma, SK Bishnoi
CZ	04-07 March	Vijapur*, Udaipur, Bhilwara	Drs. RPS Verma, L. Kumar, PS Shekhawat, MR Yadav
NWPZ Team I	04-07 March	Bawal, Navgaon, Durgapura, Tabiji,	
Team II NWP Zone	07-10 March	Hisar, SG Nagar, Bhatinda and Ludhiana	Drs. AS Kharub, J Kumar, R. Kumar, Simarjit Kaur

**Monitored by Wheat team*

Germplasm Evaluation & Exchange

In order to facilitate the availability of promising new diversity in the national barley program, the All India Coordinated Wheat and Barley Improvement Program (AICWBIP) organizes the import and conduct of international trials and nurseries in country. During Rabi 2021-22, two international yield trials and one observation nurseries were supplied from ICARDA which included a total of 158 genotypes for different production conditions (Table 1.6). One set each of these nurseries and trials was also evaluated at ICAR-IIWBR, Karnal. Rest of the sets were evaluated at different locations as per the requirements.

In place of the Field Day, which is organized every year to give opportunity to barley breeders of NARS to select material from these nurseries as to cater their local needs, as one week program was organized for breeders to make selections due to Covid-19 pandemic. In addition, EIBGN (45 entries) was supplied to 12 different locations as a set of 75 entries including six checks repeated five times at each location was supplied to twelve locations across NWPZ, NEPZ and NHZ. Similarly, the NBGSN comprising of a set of 19 promising genetic stocks endowed with trait(s) of breeding value, was supplied at 12-centres for utilization.

Table 1.6: International trials and nurseries evaluated during crop season 2021-22

SN.	Trials/Nurseries	Genotypes received	National Check	# Sets	Locations
1	2022 International Barley Yield Trial for Feed Forage and Malt in Favourable Environments (IBYT-FFM-22)	23	DWRB137	4	Durgapura, Hisar, Kanpur, Karnal
2	2022 International Barley Yield Trial for Arid and Semi-Arid regions (IBYT-ASA)	23	Lakhan	4	Pantnagar, Karnal Durgapura, Kanpur,
3	2022 International Barley Observation Nursery (IBON-22)	112 + 3 checks	DWRB137	5	Hisar, Kanpur, Karnal, Ludhiana, Durgapura,

CROP PROTECTION

Survey and surveillance for diseases and pests

During farmers field surveys conducted by different scientist of cooperative centers, none of the rust was observed in the surveyed areas. Incidence of loose smut, covered smut, leaf stripe and bacterial streak diseases was noted *in traces* to 2 percent on some fields in the Jaipur and Dausa district of Rajasthan. Surveys were also conducted to determine the incidence of insect-pests and their natural enemies on barley crop. The main insect pest observed was aphid and its incidence was found to be moderate to high in barley fields at all the locations. Among natural enemies, coccinellid beetles, chrysoperla and syrphid fly were frequently noticed predating on barley aphids.

Pathotypes distribution and seedling resistance tests

During 2021-22, there was no report of yellow, stem and leaf rusts of barley from the farmer's fields. Eight barley stripe rust samples were received from barley screening nurseries at Durgapura, Rajasthan. These samples were pathotyped on differentials and only one pathotype 57 (0S0) was identified in all samples.

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 six pathotypes of *Puccinia striiformis* f. sp. *hordei* (M, 57, 24, G, Q and 6S0), five pathotypes of *P. graminis* f. sp. *tritici* (11, 21A-2, 40A, 117-6 and 122), and 5 isolates of *P. hordei* (H1, H2, H3, H4 and H5). None of the NBDSN and EBDSN entries was resistant to all the tested pathotypes of *Psh, Ph* and *Pgt*. In seedling rust resistance evaluation, out of 109 lines of NBDSN, none of the lines was resistant to all three rusts of barley (Table 1.7). Eight lines were resistant to both leaf and stripe rust pathotypes/isolates. In addition, several lines were resistant to stripe (27 entries), leaf rust (23 entries) and stem (2) rusts.

Table 1.7: Seedling rust resistance in NBDSN lines during 2021-22

Rust/s	No. of lines	Lines
Leaf and stripe	08	BHS352(C), BHS491, HBL875, HBL878, K603(C), KB2008, LAKHAN(C), VLB177
Stripe	27	BH1046, BHS489, DWRB137(C), DWRB182(C), DWRB226, DWRB228, HUB113(C), KB2004, KB2013, KB2015, NDB1756, NDB1783, NDB1784, NDB1785, NDB1800, PL937, PL940, RD2899, RD3034, RD3049, RD3054, RD3059, RD3061, RD3063, UPB1095, UPB1105, UPB1107
Leaf	23	BH1041, BH1043, BHS400(C), BHS490, BHS492, DWRB230, DWRB232, DWRB234, HBL113(C), HBL874, HBL876, HUB281, KARAN16(C), NDB1789, PL935, PL938, RD3050, RD3055, RD3056, RD3062, VLB118(C), VLB175, VLB176
Stem	02	UPB1102, UPB1104

Field screening and chemical control experiments on diseases and pests

In case of field screening for diseases and pests the significant findings are as below:

- Out of 396 entries in IBDSN from different breeding centers, 23 entries were found free from yellow rust (ACI = 0) and 182 entries showed resistant reaction having ACI less than 10.
- Total 109 entries evaluated in NBDSN, 19 entries found free from yellow rust, 60 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 22 entries showed moderate level of resistance resistant with an average score (double digit) 14-35 and HS < 57.
- Among 43 EBDSN entries, 4 found free from yellow rust, whereas 18 shown resistant reaction. The 6 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%, Picoxystrobin 7.05% + Propiconazole 11.7% and Propiconazole 25% was found most effective in management of foliar blight.
- A total of 109 barley NBDSN entries (including checks were screened against foliar aphid at seven locations. On the basis of aphid score recorded location-wise, seven entries at Durgapura viz., two at Karnal and one at Kanpur were categorized as moderately resistant (Score = 3). Another set of 31 barley promising entries along with highly susceptible check (Alfa-93) were tested against aphids at six locations five entries viz., BCLA51, HVS 14, HLR 20, ICARDA-9, ICARDA-11 and ICARDA-27 were found to be in resistant category (Grade 2) at four locations.
- Efficacy of new insecticide molecules and their combinations were tested against foliar aphid in barley. Treatment of Thiamethoxam 25% WG@50 gm/ha, Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha and Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (Alika) @150 ml/ha was found the best treatment followed by Sulfoxaflor 12 % SC @250 ml/ha in managing aphid population in barley.
- A total 109 entries of NBDSN and 43 of EBDSN were screened against the Cereal Cyst Nematode (CCN) at two locations viz. Durgapura, and Hisar. Most of the entries fall in the category of susceptible or highly susceptible.

RESOURCE MANAGEMENT

To increase the production, productivity and profitability of the barley growing farmers, updating of package of practices of barley crop is continuous process and the need of the hour. Seven special trials were conducted in different zones to achieve the objective. A total of 54 trials were proposed and conducted at different locations and 53 were reported, one trial was rejected by monitoring team.

AVT-Feed- NEPZ (Nitrogen levels, Production conditions and varieties)

The trial was conducted at Varanasi and Kanpur. The test entry PL 917 (33.44 q ha-1) was inferior to recently released checks; it produced 15.8 % less as compared to best Check DWRB137). The genotypes responded up to 75 kg Nitrogen/ha.

Recommendations from the concluded experiments in past years

- **Productivity enhancement through adjusting sowing dates in barley**

  The optimum sowing dates recommended after three years of experimentation in different production keeping in view the productivity of barley are NWPZ: 01-15 November; NEPZ: 11-15 November, CZ: 01-15 November and NHZ: 20 October-05 November.
- **Yield maximization of barley through integrated nutrient supply and PGRs application**

  On the basis of superiority in productivity and economics, Fertilizer (RDF)+10t FYM + PGR(Plant Growth regulator : chlormequat-chlorid (CCC) @1.25 L ha-1 at GS30-31 followed by ethephon (Cerone) @0.5 L ha-1 at GS39-40) is recommended in all the zones.

- **Effect of Zn application on quality and productivity of barley**

  On the basis of superiority in productivity, quality and economics soil application with zinc sulphate @ 25 kg/ha and soil application @12.5 kg Zn Sulphate per ha followed by foliar spray (0.5% zinc sulphate) were recommended for all the zones. Both the treatments were at par and superior to other treatments.
- **Enhancing productivity and quality of barley using Silicon in low moisture areas.**

  On the basis of superiority in Productivity and economics, silicon @ 150kg/ha with three irrigations are recommended for application in barley.

Ongoing experiments

SPL4: Enhancing nutrient use efficiency through nano fertilizer in barley

The experiment was conducted at five locations in NWPZ and different combinations of nano fertilizer were used to optimize nano nitrogen dose for barley. The productivity of barley increased with increase in the level of nitrogen up to recommended level and the addition of nano nitrogen did not effect significantly. The productivity of recommended dose and recommended + Nano N were similar and significantly more than the other treatments.

SPL 5: Effect of Zn application on quality and productivity of barley

The trial was conducted in all zones and zinc treatment includes control, soil application, foliar application (0.5% zinc sulphate) and soil and foliar application. In all the zones, Soil application with zinc sulphate @ 25 kg/ha and soil application @12.5 kg Zn Sulphate per ha followed by foliar spray (0.5% zinc sulphate) were recommended for higher productivity and quality. Both the treatments were at par and superior to other treatments.

SPL 7: Effect of sowing method and Seed rate on Barley productivity

The trial was conducted at five locations in NWPZ in split plot design having sowing method in main plot and seed rate in sub plot. The normal sowing and paired row were similar in productivity and seed rate @ 100 kg/ha was superior to 75 and 87.5 kg/ha. The highest yield (42.54 q/ha) was obtained in paired row with 100 kg seed /ha.

QUALITY EVALUATION

Malt barley trial

The major industrial use of barley is in malting and brewing industry. In order to make higher quality malt, the raw material should have certain minimum quality traits. This year a total 217 samples of malt barley trials received from eight locations of North Western Plain Zone were analyzed in the quality laboratory of Barley Improvement Programme at IIWBR Karnal. The samples consisted of six entries in AVT and 25 genotypes of Initial Varietal Trial (IVT) including checks. Several genotypes were observed as good source for individual grain and malt quality traits (Table 1.8), though they may not have good values for remaining traits. The mean values were taken for identifying promising lines based on minimum standards determined by the 'NCGMBD' for malt barley in the country revised time to time with the latest revision on 22.06.2020.

Barley quality screening nursery

The Barley Quality Screening Nursery was conducted for finding better sources of hulless and malt barley for different quality traits at six locations i.e., Karnal, Hisar, Pantnagar, Durgapura, Ludhiana and Kanpur. The nursery was sent under four categories i.e., low protein barley, naked/hulless barley, evaluation of protein/beta glucan content in entries contributed by malt barley & molecular breeding programme and for higher anti-oxidant activity. The promising genotypes from 489 samples analyzed in the nursery are given in table 1.9.

Table 1.8: Promising entries for individual malting quality traits

Trait	Promising entries
Hectoliter weight	DWRB 219, DWRB 221
Bold Grains	UPB 1108, RD 3055, PL 933, RD 3056, DWRB 233
Husk Content	DWRB 221
Grain β- glucan	DWRB 221, BH 1040, DWRB 233, DWRB 229, UPB 1107
Malt Friability	RD 3056, DWRB 230, RD 3055, BH 1043
Hot water extract	RD 3056, RD 3057, DWRB 230
Filtration Rate	DWRB 219, PL 934, RD 3063, DWRB 233, UPB 1108
Diastatic Power	RD 3058, UPB 1108
FAN Content	DWRB 230, RD 3056, RD 3055
Wort β- glucan	DWRB 230, DWRB 229, BH 1040
Over all MQ	DWRB 221** RD 3056**

**Better or at par to the best check **As compared to two row checks only*

Table-1.9: Promising entries from BQSN for different traits

Traits	Promising entries#
Protein Content	**Low** (BCU 6315, BCU 6316, BCU 6369) **High** (HLR-136, HLR-24, HLR-34, HLR-10)
Starch Content	BCU 6400*, BCU 5968*, HLR-196, HLR-64, HLR-322, HLR-90
Malt Friability	BCU 6369, BCU 6316, BCU 5968*, BCU 6444*, BCU 5969*, BCU 6315, BCU 6398*, BCU 6482*
Hot Water Extract	BCU6400*, BCU5968*, BCU6444*, BCU6316, BCU6398*, BCU5969*, BCU5915**
Diastatic Power	BCU 6398*, BCU 6482*
Free Amino Nitrogen	BCU 5709, BCU 6482*
Antioxidant Activity	BCU 2336
Grain Beta Glucan Content	Low (RMB 2103) High (HLR-90, HLR-240)

*#At par or better than Indian check variety *Hulless barley **Black colored grain*

Feed barley

The feed grain samples (497) from various trials grown at different locations were analyzed for physical parameters and protein content. 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 entries having higher thousand grain weight, protein content and hectoliter weight have been listed in table 1.10 below.

Table 1.10: Promising entries for thousand grain weight, protein content and hectoliter weight

No.	Trial	Zone	1000 GW	Protein content	Hectoliter weight
1	IVT (IR)	NWPZ	HUB 281	UPB 1105	HUB 281
2	IVT (IR)	NEPZ	PL 937	KB 2015	UPB 1105
3	IVT (IR)	CZ	PL 936	HUB 281, BH 1045	UPB 1105
4	AVT (RF)	NHZ	HBL 876	BHS 400 ©	VLB 179, HBL 877
5	IVT (RF)	NEPZ	RD 3050	NDB 1789	RD 3050
6	IVT-SAL/ALK	NWPZ/NEPZ/CZ	KB 2013	KB 3060	RD 2907 ©
7	IVT-IRTS-NB	NWPZ/NEPZ/CZ	KB 2019©	KB 2019©	Karan 16©
8	AVT-IRFB	NEPZ	RD 3034	DWRB137 ©	RD 3034

FRONTLINE DEMONSTRATIONS

During the *rabi* crop season 2021-22, 250 Barley Frontline Demonstrations (BFLDs) of one acre each were allotted to 32 cooperating centers all over India in eight states/UT namely, Himachal Pradesh, Uttar Pradesh, Jammu & Kashmir, Punjab, Haryana, Rajasthan and Madhya Pradesh. Out of these, 228 BFLDs were conducted by 29 centers, covering 238 acres area of 277 farmers (Table 1.11). Improved barley varieties with complete package of practices (irrigation management, nutrient management, weed control, seed treatment etc.) were demonstrated. The center wise yield gain under barley FLD was highest at center Rewa (89.13%) followed by Tikamgarh (50.80%), Lalitpur (39.57%) in CZ, Gorakhpur (34.97) in NEPZ, Bajaura (34.85%) in NHZ and Kathua (32.37%) in NWPZ. The yield gain was lowest at Bathinda (03.02%) in NWPZ.

Table 1.11: State wise distribution of barley FLDs and yield gains during rabi 2021-22

State	BFLDs Allotted	BFLDs Conducted	Number of farmers	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (%)
HP	17	7	29	28.83	21.38	34.85***
All UP	72	60	64	38.83	32.03	21.23***
J&K	8	8	21	27.50	20.78	32.37***
Punjab	33	33	37	38.80	35.03	10.78***
Haryana	33	33	34	43.93	40.98	7.20**
Rajasthan	48	48	51	53.93	44.35	21.59***
MP	39	39	41	37.85	27.93	35.54***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

The highest gain in barley yield was recorded in MP (35.54 %) followed by HP (34.85%), J&K (32.37 %), Central UP (28.09%), Eastern UP (24.15%), Rajasthan NWPZ (22.47%) and All Rajasthan (21.59 %). The lowest gain in yield was reported in Haryana (7.20 %) (Table 1.11). The yield gain due to improved varieties over check was highest in NHZ (34.85 %) followed by CZ (28.98 %), NEPZ (24.15 %) and NWPZ (15.25 %) (Table 6). Therefore, efforts should be made to increase barley yield in the NHZ, CZ and NEPZ by promoting recent barley production technologies in collaboration with the state department of agriculture.

Table 1.12: Zone wise distribution of barley FLDs and yield gains during rabi 2021-22

Zone	BFLDs Allotted	BFLDs Conducted	Number of farmers	BFLDs yield (q/ha)	Zonal mean yield (q/ha)	Gain (%)
NHZ	17	7	29	28.83	21.38	34.85***
NEPZ	52	40	42	34.70	27.95	24.15***
NWPZ	112	112	133	44.98	39.03	15.25***
CZ	69	69	73	39.28	30.45	28.98***

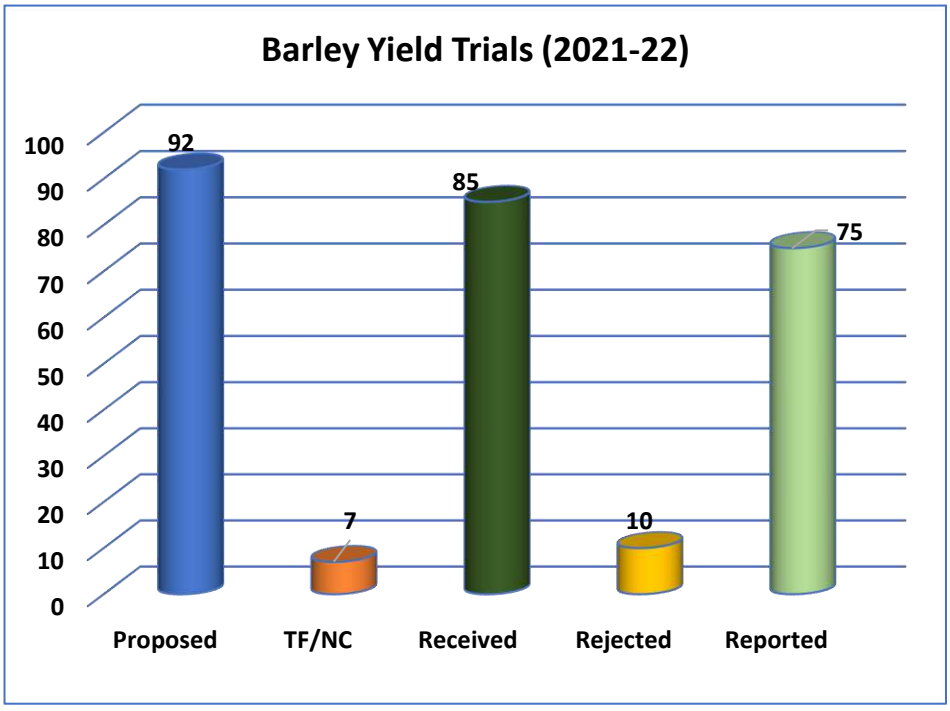
**** Significant at 1 per cent level, ** Significant at 5% level, * Significant at 10 per cent level, NS is Non-significant*

BREAK UP OF BARLEY IMPROVEMENT YIELD TRIALS

(RABI 2021-22)

S. No.	Trial Name	No. of centers				
		Proposed	Not Conducted / Failed/ Not Received	Data Received	Data Rejected	Data Reported
1.	AVT-IR-MB-	11	-	11	1 (Navgaon-RMT)	10
2.	AVT-IR-FB-NEPZ	7	1 (Kumarganj-TF/RMT)	6	1 (Kalyani) Late sowing	5
3.	IVT-IR-MB-NWPZ	11	-	11	2 (Navgaon, SG Nagar) – RMT wrong layout	9
4.	IVT-IR-FB-NWPZ/NEPZ/CZ	20	2 Gwalior-NC, Kumarganj (TF/RMT)	18	1 Kalyani (LSM & Late sowing)	17
5.	IVT-RF-NEPZ	8	1 Kumarganj (TF/RMT)	7	1 (Sabour- HCV)	6
6.	IVT-IR-NB/HLS (NWPZ/NEPZ/CZ)	15	2 Gwalior (NC), Kumarganj (TF/RMT)	13	1 BHU Varanasi (LSM)	11
7.	AVT-SST-NWPZ/NEPZ	8	1 Kumarganj (TF/RMT),	6	1 Bhilwara (RMT)	6
8.	AVT-RF-NHZ (Grain)	12	-	12	2 Katrain (LSM&HCV), Majhera (LSM)	10
	AVT-RF-NHZ (Dual Purpose)	12*	1* (Wadura-NC)	11*	Grain= 4 (Berthein, Gaza, Kangra, and Majhera)	7*
					Forage= 6 (Almora, Malan, Katrain, Majhera, Khudwani, and Gaza)	5*
	TOTAL	**92**	**7**	**85**	**10**	**75**
				91.3%		**81.5 % (P) 89.3 % (R)**

*P= percent of proposed trials, R= percent of received trials *not included the total as it is part of AVT-RF-NHZ*



Performance of test sites during Rabi 2021-22

(A) MAIN CENTRES

No.	Centres	No. of Trials			Trials Rejected		
		Allotted	Name	Conducted	No.	Name	Reason
1.	Almora	1	AVT-RF-NHZ	1	-	-	-
2.	Bajaura	1	AVT-RF-NHZ	1	-	-	-
3.	Durgapura	4	AVT-MB, IVT-IR-MB, IVT-IR-NB, IVT-IR-FB,	4	-	-	-
4.	Kumarganj	5	AVT-FB-NEPZ, IVT-IR-FB, IVT-RF-NEPZ, IVT-IR-NB, IVT-SST	5	5*	-	TF/RMT
5	Hisar HAU	5	AVT-IR-MB-NWPZ, IVT-IR-MB-NWPZ, IVT-IR-NB, IVT-IR-FB, AVT-SST	5	-	-	-
6.	Kanpur	4	AVT-IR-FB-NEPZ, IVT-RF-NEPZ, IVT-IR-FB, IVT-IR-NB	4	-	-	-
7.	Karnal	4	AVT-IR-MB, IVT-IR-MB, IVT-IR-NB, IVT-IR-FB,	4	-	-	-
8.	Ludhiana	4	AVT-IR-MB, IVT-IR-MB, IVT-IR-NB, IVT-IR-FB,	4	-	-	-
9.	Shimla	1	AVT-RF-NHZ	1	-	-	-
10.	Varanasi	4	AVT-IR-FB, IVT-IR-FB, IVT IR-NB, IVT-RF-NEPZ,	4	1	IVT-NB	LSM
11.	Pantnagar	4	AVT-IR-MB, IVT-IR-MB, IVT-IR-NB, IVT-IR-FB,	4	-	-	-
	Total (A)	**37**		**37**	**1**	**-**	**-**

Contd….

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

No.	Centres	No. of Trials Proposed & Conducted			Trials Rejected		
		Allotted	Name	Conducted	No.	Name	Reason
1	Bawal	2	AVT-IR-MB-NWPZ, IVT-IR-MB-NWPZ,	2	-	-	-
2	Bathinda	2	AVT-IR-MB-NWPZ, IVT-IR-MB-NWPZ,	2	-	-	
3	Berthein	1	IVT-RF-NHZ	1	-	-	-
4	Bhilwara	1	IVT-SST	1	1*	IVT-SST	RMT
5	Chiyanki	1	IVT-RF-NEPZ	1	-	-	-
6	Dalipnagar	1	IVT-SST	1	-	-	-
7	Fatehpur	1	IVT-SST	1	-	-	-
8	Gwalior	2	IVT-IR-FB, IVT-IR-NB	2	***2****	***IVT-IR-FB, IVT-IR-NB***	***NC***
9	Gaza	1	AVT-RF-NHZ	1	-	-	-
10	Hisar (IIWBR)	1	IVT-SST	1	-	-	-
11	Kalyani	2	AVT-IR-FB, IVT-IR-FB	2	2	AVT-IR-FB, IVT-IR-FB	LS &LSM
12	Kangra	1	IVT-RF-NHZ	1	-	-	-
13	Karnal, CSSRI	1	IVT-SST	1			
14	Katrain	1	IVT-RF-NHZ	1	1	IVT-RF-NHZ	LSN, HCV
15	Khudwani	1	IVT-RF-NHZ	1	-	-	-
16	Majhera	1	IVT-RF-NHZ	1	1	IVT-RF-NHZ	LSM
17	Malan	1	IVT-RF-NHZ	1	-	-	-
18	Modipuram	4	AVT-MB-NWPZ, IVT-IR-MB-NWPZ, IVT-IR-FB, IVT-IR-NB,	4	-	-	-
19	Morena	2	IVT-IR-FB, IVT-IR-NB	2	-	-	-
20	Navgaon	2	AVT-IR-MB, IVT-IR-MB	2	2*	AVT-IR-MB, IVT-IR-MB	RMT
21	Pusa, CAU	3	AVT-IR-FB, IVT-IR-FB, IVT-RF-NEPZ	3	-	-	-
22	Rajauri	1	IVT-RF-NHZ	1	-	-	-
23	Ranchi	4	AVT-IR-FB, IVT-IR-FB, IVT-RF-NB, IVT-RF-NEPZ	4	-	-	-
24	Sabour	3	AVT-IR-FB, IVT-IR-FB, IVT-RF-NEPZ	3	1	IVT-RF-NEPZ	HCV
25	Saini	1	IVT-RF-NEPZ	1	-	-	-
26	Samdari	2	IVT-FB, IVT-SST	2	-	-	-
27	Sriganganagar	2	AVT-IR-FB, IVT-IR-MB,	2	1*	IVT-IR-MB,	RMT
28	Tabiji	3	AVT-IR-MB, IVT-IR-MB, IVT-IR-FB,	3	-	-	-
29	Tikamgarh	2	IVT-IR-FB, IVT-IR-NB,	2			
30	Udaipur	2	IVT-IR-FB, IVT-IR-NB	2			
31	Vijapur	2	IVT-IR-FB, IVT-IR-NB,	2	-	-	-
32	Wadura	1	IVT-RF-NHZ	1	-	-	-
	Total (B)	**55**		**55**			

HCV =High CV, TF = Trial failed, UR- unrealistic data, LSM = Low site mean, RMT= rejected by monitoring team

Trial wise locations during Rabi 2021-22

SN	Trial Name	Locations	Total
1	AVT-IR-MB-NWPZ	Bawal, Hisar, Karnal, Ludhiana, Bathinda, Durgapura, Navgaon, Tabiji, SG Nagar, Pantnagar, Modipuram	11
2	AVT-IR-FB-NEPZ	Kanpur, Varanasi, Kumarganj, Pusa (CAU), Sabour, Ranchi, Kalyani	7
3	IVT-IR-MB-NWPZ	Bawal, Hisar, Karnal, Ludhiana, Bathinda, Durgapura, Navgaon, Tabiji, SG Nagar, Pantnagar, Modipuram	11
4	IVT-IR-FB-NWPZ/ NEPZ/CZ	Hisar, Karnal, Ludhiana, Durgapura, Tabiji, Modipuram, Pantnagar, Samdari, Udaipur, Morena, Gwalior, Tikamgarh, Vijapur, Kanpur, Varanasi, Kumarganj, Kalyani, Pusa (CAU), Sabour, Ranchi,	20
5	IVT-RF-NHZ	Bajaura, Berthein, Kangra, Katrain, Malan, Shimla, Almora, Ranichauri, Majhera, Rajouri, Khudwani, Wadura	12
6	IVT-IR-NB-HLS-NWPZ /NEPZ/CZ	Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Modipuram, Kanpur, Varanasi, Kumarganj, Tikamgarh, Morena, Gwalior, Udaipur, Vijapur, Ranchi	15
7	IVT-SST-NWPZ/NEPZ	CSSRI Karnal, CCSHAU Hisar, IIWBR Hisar, Bhilwara, Fatehpur, Samdari, Dalipnagar, Kumarganj,	8
8	IVT-RF-NEPZ	Kanpur, Varanasi, Kumarganj, Saini, Pusa (CAU), Sabour, Ranchi, Chiyanki	8
	Total		92

PARENTAGE OF BARLEY STRAINS UNDER COORDINATED EVALUATION DURING RABI 2021-22

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	19
4	KUMARGANJ, N.D.U.A&T.	NDB	9
5	HISAR, C.C.S.H.A.U.	BH	7
6	KANPUR, C.S.A.U.&T.	KB	7
7	KARNAL, ICAR-I.I.W.B.R.	DWRB	13
8	LUDHIANA, P.A.U.	PL	9
9	PANTNAGAR, G.B.P.U.A.&T.	UPB	10
10	SHIMLA, RS, I.A.R.I.	BHS	5
11	VARANASI, B. H. U.	HUB	1
	Total (Entries + Checks)		90 + 19

SN	Entries	Parentage
ICAR-IARI, RS, Shimla		
1.	BHS 488	BHS385 / BHS369
2.	BHS 489	BHS285 / BHS169
3.	BHS 490	HBL704 / BHS369
4.	BHS 491	HBL704 / UPB1008
5.	BHS 492	HBL704 / RD2751
GBPUA&T, Pantnagar		
6.	UPB1086	MSEL//LIMON/BICHY2000
7.	UPB1095	DWRB102/ WI2269/Espe/3/WI2291/Bgs//Hml-02 (IBYT-LRA-M-10-11)-11
8.	UPB 1101	DWRB102/ WI2269/Espe/3/WI2291/Bgs//Hml-02 (IBYT-LRA-M-10-11)-11
9.	UPB 1102	VLB 130 / IBYT-LRA-C (2013-14)-5
10.	UPB 1103	UPB 1002 / VLB 132
11.	UPB1104	BCU 73 / UPB 1002 // BH959
12.	UPB1105	BH 959 / SLB39-05/4/7028/2759/3/69-82//Ds/Apro (IBYT-LRA-C-(10-11)-12
13.	UPB1106	UPB 1001 / BH 965
14.	UPB1107	BH 902 / DWRUB 52 // BHS 414
15.	UPB1108	BH 965 / IBYT-LRA-C(10-11)-12 // UPB 1001
ICAR-VPKAS, Almora		
16.	VLB 175	ZIGZIG/3/LBIRAN/UNA80//LIGNEE640
17.	VLB 176	GLORIA-BAR/COPAL//M104
18.	VLB 177	BLLU/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
19.	VLB 178	IBON HI 19-103 (P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/6/ P.STO/3/LBIRAN/UNA80// LIGNEE640/4/BLLU/5/PETUNIA 1)
20.	VLB 179	GLORIABAR/COPAL//PM5/BEN/3/SEN/4/PETUNIA1/5/PETUNIA2//PENCO/ CHEVRONBAR/4/PETUNIA2/3/CHAMICO/TOCTE//CONGONA
CSKHPKV, RRS, Bajaura		
21.	HBL 874	HBL 276 / DWR 81
22.	HBL 875	CANELA/LIMON/BICHY2000
23.	HBL 876	Aths/Lignee686/3/DeirAlla106/Sv.Asia/Attiki/4/24569/5/AwBiack/Aths//Arar/3/9Cr27907 /Robo/4/CompCr229//As46/Pro/3/DeirAlla106/DI71/Strain 205
24.	HBL 877	HBL 316 / HUB 113
25.	HBL 878	DWRUB64 / EC 667378

BHU, Varanasi		
26.	HUB281	RIHANE-03 / KARAN-15
CCSHAU, Hisar		
27.	BH1040	BH 992 / BH 946
28.	BH1041	BH 987 / BH 946
29.	BH1042	BH 968 / BH 946
30.	BH1043	DWRB 127/DWRB 101
31.	BH1044	HBL 713 / BH 946
32.	BH1045	HUB 113 / BH 946
33.	BH1046	HBL 713/BH 902
RARI, SKNAU, Durgapura		
34.	RD3034	RD 2035/RD 2660
35.	RD3037	RD 2035/RD 2660
36.	RD3047	RD 2832 / RD 2833 // RD 2786
37.	RD3048	RD 2552 / RD 2035// RD 2715
38.	RD3049	RD 2830 / RD 2715// RD 2660
39.	RD3050	NDB 1561 / RD 2508// BH 902
40.	RD3051	RD 2832 / RD 2833// RD 2503
41.	RD3052	RD 2035 / RD 2660// RD 2833
42.	RD3053	RD 2035 / RD 2660
43.	RD3054	BH 946 / RD 2830// RD 2503
44.	RD3055	DWRB 92 / RD 2891
45.	RD3056	RD 2891 / RD 2892
46.	RD3057	KB 1363 / RD 2892
47.	RD3058	BH 902 / DWRB 92
48.	RD3059	RD 2830 / RD 2715// RD 2660
49.	RD3060	RD 2830 / RD 2715// BH 902
50.	RD3061	RD 2552 / RD 2715
51.	RD3062	RD 2552 / RD 2035// Raj Kiran
52.	RD3063	DWRB 92 / RD 2894
PAU, Ludhiana		
53.	PL917*	STANDER-BAR/CABUYA/6/ROBUR-BAR/142-B//ASTRIX/SUTTER334.3/3/ SUMBARD400/5/CI10622/CI5824//PAICO/3/GLORIA-BAR/COPAL/4/BBSC
54.	PL933	BH981 / PL807
55.	PL934	DWR62 / DWRUB76
56.	PL935	DWRUB52 / PL807
57.	PL936	DWRUB52 / PL807
58.	PL937	DWRUB52 / PL807
59.	PL938	PL807 / H. Spon. ACC NO. 361
60.	PL939	Mutant of RD2552-BM91-187
61.	PL940	Mutant of RD2552-BM99-238
CSAUA&T, Kanpur		
62.	KB2004	K141/M112/TRADITION/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU /5/PETUNIA1 {IBON-HI (2011-12)-34}
63.	KB2008	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/6/LEGACY// PENCO/CHEVRON-BAR
64.	KB2013	Alanda-01/Rhn-03
65.	KB2015	BH 949 / K 560
66.	KB2018	IBON-MRA (11-12)-16 / IBYT-MRA (11-12)-16
67.	KB2019	DWRB99 / K 1155
68.	KB2031	K 560 / K 1149
	NDUA&T, Faizabad	
69.	NDB1756	FRANKLIN-BAR//LIMON/BICHY2000
70.	NDB1776	FRANKLIN-BAR//LIMON/BICHY2000
71.	NDB1782	CABUYA/MJA//PETUNIA 1/5/PENCO/CHEVRON-BAR/3/ATACO/

72.	NDB1783	BERMEJO//HIGO/4/PETUNIA 1
73.	NDB1784	FURAT-3
74.	NDB1785	ALANDA//SSN/LIGNEE640/3/QB813-2
75.	NDB1789	MSEL/LOGAN-BAR
76.	NDB1793	CABUYA/4/GLORIA-BAR/COPAL//BEN.4D/3/S.P-B/5/PETUNIA1/6/P.STO /3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
77.	NDB1800	CABUYA/4/GLORIA-BAR/COPAL//BEN.4D/3/S.P-B/5/PETUNIA1/6/P.STO /3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
ICAR-IIWBR, Karnal		
78.	DWRB219	BETZS/DWRB88
79.	DWRB221	DWRUB52/RD2508
80.	DWRB223	PENCO/CHEVRON-BAR/3/LEGACY//PENCO/CHEVRON-BAR
81.	DWRB225	CANELA// LIMON/ BICHY2000
82.	DWRB226	RD2786/BH946
83.	DWRB227	PL426/BCU6225
84.	DWRB228	BCU6899/DL88
85.	DWRB229	DWR28/BH902
86.	DWRB230	DWRUB52/BH885
87.	DWRB231	DWRB101/DWR28
88.	DWRB232	DWRB101/DWRB123
89.	DWRB233	DWRB123/DWR28
90.	DWRB234	DWRUB52/DWR81
Checks (19)		
91.	BH946	BHMS22A/BH549//RD2552
92.	BHS352	HBL240/BHS504//VLB129
93.	BHS380	VOILET/MJA/7/ABN-B6/BA/GAL// FZA-B /5/DG/DC-B/ PT-BAR /3/RA-B/BA /3/4/TRYIGAL…
94.	BHS400	34th IBON-9009
95.	DWRUB52	DWR17/K551
96.	DWRB137	DWR28/DWRUB64
97.	DWRB182	DWRUB52/DWRB78
98.	HBL113	SELECTION FROM ZYPHYZE
99.	HUB113	KARAN280/C138
100.	K603	K257/C138
101.	Karan16	AZAM (DWARF)1/EB7576
102.	Lakhan	K12/IB226
103.	NDB1173	BYTLRA 3-(1994-95)/NDB217
104.	PL891	IBON 343/12th HSBN-176
105.	RD2794	RD2035/RD2683
106.	RD2849	DWRUB52/PL705
107.	RD2899	RD2592/RD2035//RD2715
108.	RD2907	RD103/RD2518//RD2592
109.	VLB118	14th EMBSN-9313

ADVANCED VARIETAL TRIAL (IRTS)-MALT BARLEY-NWPZ (2021-22)

The Advanced Varietal Trial (IRTS) of malt barley was proposed at 11 locations in North Western Plains Zone (NWPZ) of the country. The trial was conducted at all locations as per prescribed layout except at Navgaon centre. Due to faulty layout of the trial the monitoring team recommended the rejection of the trial of Navgaon centre. Finally, the yield and ancillary data from remaining ten locations were considered for location wise as well as zonal analysis.

The trial consisted of six genotypes with DWRB219 and DWRB221 as the test entries while rest four genotypes namely DWRUB52, DWRB137, DWRB182 and RD2849 were checks for a meaningful comparison of the test entries.

The monitoring of the trial was carried out at all centres during the appropriate stage of the crop. During monitoring, the team was satisfied with the status of genetic purity and performance of entries at all locations. No serious disease/pest incidence was reported at any centre in the crop season except a mild incidence of spot blotch at Hisar and Pantnagar centre. Over all the condition of the trial was very good at all centres.

In case of grain yield, the trials mean value ranged from 35.87 q/ha (Bawal) to 58.31 q/ha (Modipuram) with 45.30 q/ha over all mean of NWP Zone.

Amongst the genotypes, the test entry DWRB219 ranked first with 49.40 q/ha and was observed as significantly superior to rest of entries and checks.

Grain Yield Data (q/ha) 2021-22

AVT-IRMB-NWPZ **Rabi 2021-22**

Varieties	Entry Code	NWPZ			NWPZ			NWPZ			NWPZ			NWPZ			NWPZ		
		Bathinda			Ludhiana			Bawal			Hisar			Karnal			Durgapura		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
DWRB219	AVT-MB-3	46.82	2	1	44.84	2	1	33.88	6	0	44.92	1	1	58.13	1	1	58.33	1	1
DWRB221	AVT-MB-6	47.23	1	1	35.00	6	0	35.71	3	0	40.25	4	0	37.49	5	0	50.00	3	0
DWRUB52©	AVT-MB-4	42.71	6	0	42.71	3	0	36.53	2	0	34.97	6	0	44.42	3	0	46.39	5	0
DWRB182©	AVT-MB-1	44.28	3	0	42.29	4	0	40.02	1	1	39.81	5	0	34.59	6	0	46.39	6	0
RD2849©	AVT-MB-5	43.67	4	0	38.96	5	0	34.29	5	0	44.58	2	1	54.57	2	0	48.06	4	0
DWRB137©	AVT-MB-2	43.16	5	0	48.54	1	1	34.76	4	0	44.50	3	1	39.62	4	0	58.06	2	1
	G.M.	44.65			42.06			35.87			41.50			44.80			51.20		
	S.E.(M)	0.78			1.70			0.79			1.62			1.17			1.54		
	C.D.	1.93			4.21			1.96			4.01			2.91			3.82		
	C.V.	3.49			8.08			4.41			7.80			5.24			6.02		
	DOS	18.11.21			10.11.21			06.11.21			10.11.21			11.11.21			10.11.21		

Varieties	Entry Code	NWPZ			NWPZ			NWPZ			NWPZ			**Zonal**		
		Tabiji			SG Nagar			Pantnagar			Modipuram			**NWPZ**		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	**Yield**	**Rk**	**G**
DWRB219	AVT-MB-3	47.61	4	0	39.72	3	0	53.53	1	1	65.85	1	1	**49.40**	**1**	**1**
DWRB221	AVT-MB-6	48.85	3	0	46.59	1	1	47.87	3	0	53.29	5	0	**44.20**	**4**	**0**
DWRUB52©	AVT-MB-4	51.51	2	1	36.99	4	0	46.45	5	0	57.43	4	0	**44.00**	**5**	**0**
DWRB182©	AVT-MB-1	44.61	5	0	43.58	2	1	34.07	6	0	48.75	6	0	**41.80**	**6**	**0**
RD2849©	AVT-MB-5	44.18	6	0	36.62	5	0	48.03	2	0	62.46	2	0	**45.50**	**3**	**0**
DWRB137©	AVT-MB-2	57.13	1	1	33.75	6	0	47.25	4	0	62.07	3	0	**46.90**	**2**	**0**
	G.M.	48.98			39.54			46.20			58.31			**45.30**		
	S.E.(M)	2.43			1.33			0.67			0.98			**0.443**		
	C.D.	6.02			3.30			1.67			2.43			**1.0**		
	C.V.	9.92			6.73			2.91			3.37					
	DOS	14.11.21			05.11.21			19.11.21			16.11.21					

Ancillary data of AVT (IRTS)-MB-NWPZ **Rabi 2021-22**

VARIETY	Agronomic traits						
	Days to Heading	Days to maturity	Plant height (cm)	Lodging (%)	Tillers /m	2R/6R	Spike length (cm)
DWRB219	88 (69-103)	131 (117-139)	99 (84-109)	0	131 (83-205)	2	7.9 (7.0-9.0)
DWRB221	88 (69-104)	131 (115-142)	99 (87-107)	0	123 (82-160)	2	8.1 (7.0-9.0)
DWRUB52©	88 (71-105)	131 (117-140)	98 (82-109)	0	110 (80-161)	2	7.9 (7.0-9.0)
DWRB137©	83 (64-97)	128 (111-138)	89 (72-107)	0	118 (73-195)	6	7.9 (6.0-10.0)
DWRB182©	87 (68-107)	128 (112-137)	99 (81-110)	10	138 (93-172)	2	8.7 (7.0-10.0)
RD2849©	91 (70-109)	130 (115-139)	98 (86-112)	5	126 (96-185)	2	7.9 (6.0-9.0)

VARIETY	Grain traits			Disease & Insects					
	Colour	H / N	TGW (g)	Rust		P M	Smut	L.B	Aphid
				YR	BR				
DWRB219	LY	H	49.1 (35.1-55.0)	0	0	0	Ts	1	0
DWRB221	Y	H	49.7 (40.1-57.0)	0	0	0	S	1	0
DWRUB52©	LY	H	47.6 (40.0-55.0)	0	0	0	F	1	0
DWRB137©	Y	H	47.0 (33.1-54.0)	0	0	0	Ts	1	0
DWRB182©	LY	H	46.6 (29.5-59.0)	0	0	0	F	23	0
RD2849©	Y	H	46.6 (35.0-53.0)	0	0	0	F	1	0

INITIAL VARIETAL TRIAL-MALT BARLEY-NWPZ

The Initial Varietal Trial of Malt Barley (IVT-IRMB-NWPZ) was proposed at 11 locations in North Western Plains Zone of the country. The trial was raised accordingly and successfully at all locations but due to wrong layout at Navgaon and Sriganganagar centres the monitoring team rejected the trial. Finally, the data from remaining nine locations were considered for zonal mean analysis.

There were 25 genotypes in this trial and out of which 21 genotypes were the test entries contributed by different centres and the remaining four genotypes (DWRUB52, DWRB137, DWRB182 and RD2849) were included as the check varieties in the trial. Among 21 test entries, four entries (BH1040, BH1041, BH1042, BH1043) were contributed from Hisar centre, six entries (DWRB229, DWRB230, DWRB231, DWRB232, DWRB233, DWRB234) from ICAR-IIWBR Karnal, four entries (PL933, PL934, PL935, PL938) from PAU Ludhiana, five entries (RD3055 RD3056, RD3057, RD3058, RD3063) from Durgapura and rest two entries (UPB1107, UPB1108) from Pantnagar centre were contributed for the trial.

The monitoring of the trial was done at all centres at the optimum time during crop season. From conductance as well as performance point of view the entire trial at all locations was nice except wrong layout at Navgaon and Sriganganagar centre. Entries number 3, 7, 9, 18, 19 and 20 were observed as segregating or higher mixture, hence recommended for rejection. In case of disease/pest incidence, no major problem was reported at the any location except a mild incidence of spot blotch at Hisar and Pantnagar centre. Overall, the status of the crop was very good at all centres.

The yield and ancillary data have been given in the corresponding tables. After the decoding of the entries, it was observed that in addition to the check DWRB137, there was one more six-row type entry, might be wrongly contributed in the trial by any one of the centers and this has created a doubt in the identity of the two six row entries. However, DWRB182 (two-row check) was correct and utilized for interpretations.

In case of grain yield, the location mean value ranged from 34.98 q/ha (Hisar) to 58.01q/ha (Modipuram) with a zonal mean of 45.5 q /ha. In this trial the check variety DWRB182 (49.60) stood at first rank, hence no test entry could beat the best check.

IVT-IRMB-NWPZ **Rabi 2021-22**

Variety	Entry Code	NWPZ			NWPZ			NWPZ			NWPZ			NWPZ		
		Bathinda			Ludhiana			Bawal			Hisar			Karnal		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
BH1040	IVT-MB-18	37.4	23	0	41.65	21	0	31.97	23	0	30.31	19	0	29.26	22	0
BH1041	IVT-MB-1	49.66	1	1	50.00	9	1	42.41	16	0	38.29	9	0	38.4	8	0
BH1042	IVT-MB-23	47.15	4	1	57.51	2	1	51.6	9	0	44.57	1	1	36.67	15	0
BH1043	IVT-MB-12	43.71	12	0	35	25	0	38.98	20	0	38.65	6	0	22.48	25	0
DWRB229	IVT-MB-17	37.88	22	0	47.49	12	0	52.5	7	0	35.87	14	0	45.26	4	0
DWRB230	IVT-MB-15	37.39	24	0	50.82	8	1	32.44	22	0	28.26	21	0	35.12	17	0
DWRB231	IVT-MB-24	45.8	8	1	57.5	3	1	46.35	11	0	37.8	10	0	38.17	11	0
DWRB232	IVT-MB-7	44.22	11	0	44.17	16	0	56.53	3	0	27.54	23	0	26.41	24	0
DWRB233	IVT-MB-19	38.24	21	0	48.33	11	0	64.22	1	1	24.52	25	0	41.48	6	0
DWRB234	IVT-MB-4	36.69	25	0	51.67	6	1	55.91	6	0	35.87	15	0	28.21	23	0
PL933	IVT-MB-8	39.9	18	0	38.32	23	0	38.43	21	0	29.71	20	0	36.88	14	0
PL934	IVT-MB-5	45.45	10	1	41.68	19	0	51.11	10	0	33.21	17	0	45.86	3	0
PL935	IVT-MB-21	46.16	7	1	53.32	4	1	55.91	5	0	37.44	11	0	35.22	16	0
PL938	IVT-MB-6	48.97	2	1	43.34	17	0	61.49	2	1	36.23	13	0	37.95	12	0
RD3055	IVT-MB-14	42.82	15	0	51.66	7	1	31.45	24	0	36.35	12	0	34.67	18	0
RD3056	IVT-MB-22	39.1	19	0	40	22	0	42.39	17	0	27.05	24	0	53.86	1	1
RD3057	IVT-MB-16	46.41	6	1	45.83	14	0	45.35	13	0	39.25	5	1	31.51	21	0
RD3058	IVT-MB-10	40.8	17	0	42.5	18	0	42.48	15	0	39.37	4	1	49.57	2	0
RD3063	IVT-MB-25	38.92	20	0	41.67	20	0	41.8	18	0	43	2	1	32.43	20	0
UPB1107	IVT-MB-9	45.62	9	1	45.83	13	0	44.11	14	0	33.57	16	0	33.49	19	0
UPB1108	IVT-MB-13	43.39	14	0	49.16	10	0	31.33	25	0	38.41	7	0	38.18	10	0
DWRUB52©	IVT-MB-2	47.38	3	1	36.68	24	0	45.54	12	0	32.85	18	0	37.36	13	0
DWRB182©	IVT-MB-20	41.09	16	0	52.49	5	1	52.45	8	0	39.86	3	1	38.68	7	0
RD2849©	IVT-MB-11	43.58	13	0	59.16	1	1	40.44	19	0	28.02	22	0	38.25	9	0
DWRB137 ©	IVT-MB-3	47.14	5	1	44.17	15	0	56.24	4	0	38.41	7	0	43.93	5	0
	Mean	43.00			46.80			46.14			34.98			37.17		
	S.E. m	1.87			3.88			2.62			2.25			2.62		
	C.D.	4.62			9.58			6.47			5.45			6.33		
	C.V.	6.16			11.72			8.04			9.11			9.96		
	D.O.S.	18.11.21			10.11.21			06.11.21			10.11.21			11.11.21		

IVT-IRMB-NWPZ Rabi 2021-22

Variety	Entry Code	NWPZ			NWPZ			NWPZ			NWPZ			**Zonal**		
		Durgapura			Tabiji			Pantnagar			Modipuram			**NWPZ**		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	**Yield**	**RK**	**G**
BH1040	IVT-MB-18	56.94	5	1	28.06	25	0	36.75	23	0	50.76	20	0	**38.10**	**25**	**0**
BH1041	IVT-MB-1	54.17	13	0	57.5	4	0	45.27	10	0	50.49	22	0	**47.40**	**9**	**0**
BH1042	IVT-MB-23	56.94	5	1	50.28	12	0	39.39	18	0	54.24	14	0	**48.70**	**3**	**1**
BH1043	IVT-MB-12	55.56	8	1	48.89	13	0	50.67	3	0	50.56	21	0	**42.70**	**21**	**0**
DWRB229	IVT-MB-17	43.06	23	0	33.61	24	0	48.04	7	0	56.53	13	0	**44.50**	**17**	**0**
DWRB230	IVT-MB-15	57.64	2	1	59.72	3	1	41.29	16	0	67.08	6	1	**45.50**	**14**	**0**
DWRB231	IVT-MB-24	53.47	15	0	36.67	23	0	56.19	2	1	62.78	9	0	**48.30**	**5**	**1**
DWRB232	IVT-MB-7	54.86	11	0	47.5	16	0	39.16	19	0	53.47	17	0	**43.80**	**18**	**0**
DWRB233	IVT-MB-19	45.14	20	0	41.94	20	0	45.62	9	0	62.5	10	0	**45.80**	**13**	**0**
DWRB234	IVT-MB-4	52.08	16	0	38.89	22	0	27.32	24	0	52.71	18	0	**42.10**	**22**	**0**
PL933	IVT-MB-8	47.22	19	0	48.89	13	0	42.71	13	0	52.71	18	0	**41.60**	**24**	**0**
PL934	IVT-MB-5	54.86	10	0	60	2	1	37.33	21	0	69.17	2	1	**48.70**	**2**	**1**
PL935	IVT-MB-21	40.97	25	0	55.28	6	0	26.44	25	0	53.61	16	0	**44.90**	**16**	**0**
PL938	IVT-MB-6	54.17	13	0	43.06	19	0	50.22	5	0	54.03	15	0	**47.70**	**7**	**1**
RD3055	IVT-MB-14	56.25	7	1	50.56	10	0	56.98	1	1	68.19	3	1	**47.70**	**8**	**0**
RD3056	IVT-MB-22	54.86	11	0	45.83	17	0	39.86	17	0	62.22	11	0	**45.00**	**15**	**0**
RD3057	IVT-MB-16	43.75	21	0	53.06	8	0	41.92	15	0	40.07	25	0	**43.00**	**20**	**0**
RD3058	IVT-MB-10	57.64	2	1	41.67	21	0	44.41	11	0	66.94	8	1	**47.30**	**10**	**0**
RD3063	IVT-MB-25	59.03	1	1	47.78	15	0	42.27	14	0	69.93	1	1	**46.30**	**12**	**0**
UPB1107	IVT-MB-9	43.06	23	0	55.56	5	0	46.06	8	0	42.5	24	0	**43.30**	**19**	**0**
UPB1108	IVT-MB-13	55.56	8	1	65.56	1	1	43.54	12	0	67.01	7	1	**48.00**	**6**	**1**
DWRUB52©	IVT-MB-2	43.75	21	0	51.39	9	0	36.79	22	0	45.69	23	0	**41.90**	**23**	**0**
DWRB182©	IVT-MB-20	49.31	17	0	54.72	7	0	50.23	4	0	67.78	4	1	**49.60**	**1**	**1**
RD1849©	IVT-MB-11	57.64	2	1	50.56	10	0	49.65	6	0	67.71	5	1	**48.30**	**4**	**1**
DWRB137 ©	IVT-MB-3	47.92	18	0	44.17	18	0	37.82	20	0	61.6	12	0	**46.80**	**11**	**0**
	Mean =	51.83			48.44			43.04			58.01			**45.5**		
	S.E. m =	1.80			2.78			1.97			1.82			**0.828**		
	C.D. =	4.36			6.73			4.87			4.41			**1.9**		
	C.V. =	4.91			8.12			6.48			4.45					
	D.O.S. =	10.11.21			14.11.21			18.11.21			15.11.21					

Ancillary data of IVT-IR-MB-NWPZ Trial (2021-22)

Variety	Agronomic traits						Grain traits			Disease & Insects					
	DH	DM	PH (cm)	Tillers/ m	2R/6R	SL (cm)	G.C.	H/HL	TGW (g)	YR	BR	PM	Smut	LB	Aphid
BH1040	93 (73-104)	131 (115-140)	104 (93-111)	143 (72-224)	2	8.1 (7.0-9.0)	Y	H	45.0 (39.0-53.0)	0	0	0	R	11	0
BH1041	92 (71-103)	132 (113-140)	95 (74-104)	129 (80-176)	2	8.1 (7.0-9.0)	Y	H	50.0 (45.3-54.4)	0	0	0	R	22	0
BH1042	90 (69-104)	130 (114-141)	103 (95-117)	132 (89-202)	2	8.1 (6.0-10.0)	LY	H	48.4 (28.9-55.0)	0	0	0	R	12	0
BH1043	92 (72-104)	131 (118-141)	100 (99-121)	118 (79-152)	2	8.1 (7.0-9.0)	Y	H	44.2 (35.2-56.6)	10S	0	0	R	32	0
DWRB229	88 (69-99)	132 (116-142)	98 (76-109)	129 (80-187)	2	8.1 (6.7-10.0)	Y	H	46.5 (38.8-53.0)	0	0	0	Ts	12	0
DWRB230	93 (72-103)	132 (118-140)	97 (89-105)	134 (66-254)	2	7.9 (6.0-9.0)	LY	H	51.1 (43.7-56.0)	0	0	0	R	23	0
DWRB231	91 (71-105)	132 (116-142)	98 (99-111)	144 (92-206)	2	8.2 (67.7-9.0)	Y	H	48.3 (39.4-57.1)	0	0	0	Ts	12	0
DWRB232	87 (66-98)	130 (115-140)	108 (97-123)	124 (85-165)	2	9.2 (8.0-10.0)	Y	H	55.1 (46.7-61.0)	0	0	0	R	23	0
DWRB233	94 (71-105)	133 (118-141)	103 (92-115)	118 (81-166)	2	9.7 (8.0-11.0)	Y	H	55.3 (47.2-63.0)	0	0	0	Ts	23	0
DWRB234	89 (69-104)	130 (115-142)	96 (83-109)	127 (83-160)	2	8.0 (6.7-11.0)	LY	H	47.1 (36.0-58.4)	0	0	0	R	34	0
PL933	93 (71-108)	132 (117-139)	107 (99-121)	131 (76-178)	2	9.7 (7.0-12.0)	LY	H	54.1 (44.0-60.0)	0	0	0	R	23	0
PL934	92 (72-103)	130 (117-140)	98 (91-108)	129 (81-184)	2	8.2 (6.0-10.0)	Y	H	50.2 (40.8-56.2)	0	0	0	R	13	0
PL935	91 (71-102)	131 (115-140)	99 (92-111)	128 (65-206)	2	8.7 (7.0-11.0)	Y	H	52.8 (42.2-61.0)	0	0	0	Ts	33	0
PL938	92 (73-103)	132 (119-140)	95 (80-103)	134 (62-245)	2	8.0 (6.0-10.0)	LY	H	47.8 (42.7-52.7)	0	0	0	R	12	0
RD3055	94 (73-107)	131 (117-140)	93 (81-101)	143 (80-230)	2	7.4 (6.3-9.0)	LY	H	50.3 (40.3-57.8)	0	0	0	R	12	0
RD3056	97 (79-111)	132 (119-142)	99 (93-106)	140 (71-213)	2	9.0 (8.0-11.0)	Y	H	46.3 (35.5-56.3)	0	0	0	Ts	13	0
RD3057	92 (72-105)	131 (113-142)	105 (88-119)	127 (67-218)	2	8.6 (7.0-10.0)	LY	H	48.8 (39.7-58.0)	0	0	0	R	12	0
RD3058	93 (75-105)	133 (119-141)	101 (93-109)	139 (70-224)	2	8.7 (8.0-10.0)	Y	H	50.1 (42.8-56.0)	0	0	0	Ts	23	0
RD3063	86 (65-98)	131 (113-142)	91 (78-101)	112 (71-156)	6	8.1 (7.0-10.0)	LY	H	48.8 (40.2-56.0)	0	0	0	S	12	0
UPB1107	91 (69-104)	131 (112-140)	94 (84-105)	145 (96-232)	2	8.0 (6.0-9.0)	Y	H	45.6 (38.9-53.2)	0	0	0	Ts	13	0
UPB1108	89 (70-97)	129 (116-141)	90 (73-103)	144 (68-209)	2	7.6 (6.0-10.0)	LY	H	50.7 (44.4-61.0)	0	0	0	HS	34	0
DWRUB52©	89 (70-100)	129 (116-139)	99 (88-110)	132 (73-212)	2	8.5 (7.9-9.0)	Y	H	49.7 (40.6-55.0)	0	0	0	R	23	0
DWRB182©	89 (70-101)	131 (117-141)	98 (86-109)	144 (73-251)	2	8.2 (7.0-11.0)	LY	H	49.0 (42.1-53.6)	0	0	0	S	23	0
RD2849©	87 (66-97)	129 (111-139)	106 (99-121)	134 (75-200)	2	8.7 (8.0-9.0)	LY	H	47.7 (39.7-54.3)	0	0	0	R	32	0
DWRB137©	89 (69-99)	132 (116-140)	100 (88-109)	136 (91-180)	6	8.9 (7.0-11.0)	LY	H	48.4 (41.8-54.0)	0	0	0	Ts	12	0

DH= Days to heading, DM= Days to maturity, PH= Plant height, SL= Spike length, H/HL= Hulled/Hulless, TGW= Thousand grain weight, YR= Yellow rust, BR= Brown rust, PM= Powdery mildew, LB= Leaf blight

ADVANCED VARIETAL TRIAL (IRTS) FEED BARLEY-NEPZ

The AVT-IRTS-NEPZ was proposed at seven locations in the NEPZ and was conducted by all centers. The trial consisted of four entries and two checks, namely HUB113 and DWRB137. One test entry (PL917) was in the final year of testing, while the remaining three test entries, RD3034, UPB1095 and NDB1756 were in the first year of AVT testing.

The Zonal monitoring teams visited the trials at Kalyani, Ranchi, Sabour, Pusa, Kanpur, Kumarganj and Varanasi locations of NEPZ. It was vitiated at Kumarganj by the monitoring committee as it was grazed by the cattle.

In entries RD3034 and DWRB137(C) off types were observed and were recommended for purification. In the entry PL917 a mixture of plants with different plant heights, spike length, leaf size was observed and has been recommended for dropping from the trial. No incidence of disease and insect/ pest infestation was observed in any of the entry of the trial except leaf blights higher incidences at most of the centers.

The data from six locations were subjected to statical analysis and data from Kalyani centre were not included in the pooled analysis because of late sowing (10.12.2021) and low location mean yield (25.28 q/ha). The results from rest of the five centers were included in zonal pooled analysis.

The location means for grain yield ranged from 29.74 q/ha (~ 30q/ha) at Ranchi to 49.74 q/ha at RPCAU, Pusa with 39.3 q/ha zonal mean across the centres in NEPZ. The test entry NDB1756 ranked 1st in the zone with mean grain yield 41.80 q/ha followed by entry RD3034 (41.3 q/ha) and check DWRB137 (40.80 q/ha) in the first non-significant group.

Grain Yield Data (q/ha)

AVT-IRFB-NEPZ **Rabi 2021-22**

Varieties	Entry Code AVT-IRFB-NEP	NEPZ			NEPZ			NEPZ			NEPZ			NEPZ			**Zonal**		
		Varanasi			Kanpur			RPCAU, Pusa			Ranchi			Sabour			**NEPZ**		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	**Yield**	**Rk**	**G**
NDB1756	1	32.25	5	0	43.66	3	1	54.01	3	0	36.59	1	1	42.60	1	1	**41.80**	**1**	**1**
PL917*	4	23.65	6	0	38.59	6	0	36.47	6	0	28.08	4	0	38.18	5	0	**33.00**	**6**	**0**
RD3034	2	42.04	1	1	46.38	1	1	45.17	5	0	32.61	3	0	40.42	2	1	**41.30**	**2**	**1**
UPB1095	3	36.41	3	0	41.49	5	0	54.35	2	1	21.74	6	0	39.28	4	1	**38.70**	**5**	**0**
DWRB137©	6	32.57	4	0	44.75	2	1	57.49	1	1	32.97	2	0	36.28	6	0	**40.80**	**3**	**1**
HUB113©	5	39.42	2	0	43.30	4	1	50.97	4	0	26.45	5	0	39.99	3	1	**40.00**	**4**	**0**
G.M.		**34.39**			**43.03**			**49.74**			**29.74**			**39.46**			**39.30**		
S.E.(M)		0.80			1.45			1.32			1.16			1.75			**0.597**		
C.D.		1.98			3.59			3.27			2.88			4.34			**1.4**		
C.V.		4.65			6.74			5.31			7.81			8.88					
DOS		22.11.21			23.11.21			14.11.21			8.11.21			15.11.21					

Summary of ancillary and disease data

Advance Varietal Trial -IR-FB **ZONE: NEPZ** *Rabi* – 2021-22

Entry	Entry Code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION				
		Days to Heading (75%)	Days to Maturity (75%)	Tillers per mete	Plant height (cm)	Spike length (cm)	Two/ Six Row	Colour	1000-grain weight (g)	H/N	Rusts		SMUT		Leaf Blight (LS)
											YR	BR	L (%)	C (%)	
NDB1756	AVT-IRFB-E1	79 (70-83)	118 (101-139)	122 (60-187)	99 (79-127)	7.6 (5.5-9)	6	LY	43 (36-51	H	0	0	F		34 (00-79)
PL917*	AVT-IRFB-E4	78 (66-83)	117 (96-137)	106 (62-150)	95.(69-112)	8.4 (6.4-10)	6	Y	36(28-42)	H	0	0	Ts		45 (00-79)
RD3034	AVT-IRFB-E2	79 (72-86)	119 (104-130)	102 (66-143)	89 (64-109)	7.6 (5.6-9)	6	Y	39 (31-50)	H	0	0	F		34 (00-89)
UPB1095	AVT-IRFB-E3	84 (74-94)	120 (98-140)	120 (62-219)	92 (68-108)	7.6 (6.5-9)	6	Y	39.(34-48)	H	0	0	F		34 (00-79)
DWRB137©	AVT-IRFB-E6	82 (73-90)	116 (98-135)	147 (84-241)	88 (69-113)	7.7 (5.4-9)	6	LY	39 (33-49)	H	0	0	F		23 (00-79)
HUB113©	AVT-IRFB-E5	76 (65-83)	115 (98-134)	110 (69-153)	79 (57-102)	7.2 (5-9)	6	P	43 (33-50)	H	0	0	F		45 (12-79)

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

This trial was proposed at 20 locations across NWPZ (8), NEPZ (7) and central zone (5) in northern plains region of the country. All the centers conducted the trial except Gwalior in Central Zone. The trial consisted of 21 test-entries and three checks, namely (BH946, HUB113 and DWRB137). To fit the trial in a 5 x 5 lattice design, one filler was also included.

During the crop season the monitoring teams visited Hisar, Ludhiana, Durgapura, Tabiji centres of NWPZ and Kalyani, Ranchi, Sabour, RPCAU Pusa, Kanpur, Kumarganj (Ayodhya) and Varanasi locations of NEPZ. In central zone the Udaipur center was also monitored by the barley team, while at Vijapur center the wheat team took the notes.

Entries BH1044, RD3052 and DWRB225 were reported segregation/mixture by the teams. In several other entries off types were reported across the zones and recommended for purification. In case of diseases and insect/pest high levels of covered smut (>5%) were observed in PL939, PL936, RD3054 and KB2031 at different locations of NWPZ. High incidence of leaf blight was observed in entries RD2899 (89) and PL936 (47) in NEPZ.

The results from all the eight locations were included for zonal pooled analysis in NWPZ. In NEPZ this trial was rejected at Kumarganj by the monitoring team and data from Kalyani location were not included in the zonal pooled analysis as the sowing of this trial was much delayed (10.12.21) at this location. The remaining five locations were considered for pooled zonal analysis of NEPZ. In the Central Zone, Gwalior centre has not conducted this trial and data from the remaining four locations were included in zonal pooled analysis.

The location means for grain yield ranged from 34.43 q/ha (Ludhiana) to 57.07 q/ha (Durgapura) with 46.2 q/ha zonal mean in NWPZ. Entry UPB1106, ranked first with 50.8 q/ha grain yield in NWPZ and was followed by nine more entries in the 1st NSG, while DWRB137 was the best check and ranked 14th. Two test entries UPB1106 (50.8 q/ha) and KB2004 (49.9 q/ha) ranking 1 and 3, respectively gave significantly higher grain yields over the best check variety of this zone.

In NEPZ, location means ranged from 35.60 q/ha (Varanasi) to 53.14 q/ha (Kanpur) with zonal mean 43.20 q/ha. The entry DWRB226 recorded significantly higher yield (50.90 q/ha) over the best check DWRB137, though there were six more entries (RD3053, UPB1106, BH1045, KB2004, UPB1105 and Filler) in the 1st NSG with numerically higher yield than best check.

In case of central zone, the location mean ranged from 46.45 q/ha (Vijapur) to 59.90 q/ha (Tikamgarh) with 52.7 q/ha zonal mean. Entry RD3053 (59.1 q/ha) ranked first followed by KB2004 (58.4 q/ha), HUB281 (58.0 q/ha), PL937 (56.3 q/ha) and RD3052 (56.1 q/ha) in the first NSG. All the five entries were significantly superior than the best check DWRB137 (50.0 q/ha). In all there were six more entries with significant superiority to the check DWRB137.

IVT-IRFB-NWPZ **Rabi 2021-22**

Variety	Entry code	NWPZ			NWPZ			NWPZ			NWPZ			NWPZ		
		Hisar			Karnal			Ludhiana			Durgapura			Tabiji		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
BH1044	IVT-IRFB-3	50.41	5	0	55.45	5	0	40.58	3	1	60.53	10	1	53.28	13	0
BH1045	IVT-IRFB-17	34.01	21	0	37.41	21	0	31.16	19	0	60.84	7	1	44.63	19	0
DWRB225	IVT-IRFB-25	40.14	19	0	44.15	19	0	31.88	17	0	48.86	22	0	41.11	22	0
DWRB226	IVT-IRFB-23	49.48	7	0	54.43	7	0	31.88	17	0	60.62	9	1	65.73	1	1
Filler	IVT-IRFB-9	48.63	8	0	53.49	8	0	40.58	3	1	63.58	1	1	64.3	2	1
HUB281	IVT-IRFB-5	32.65	23	0	35.91	23	0	37.68	8	1	42.97	25	0	43.65	20	0
KB2004	IVT-IRFB-20	53.8	3	1	59.18	3	1	39.86	6	1	57.84	14	0	44.7	18	0
KB2015	IVT-IRFB-7	47.92	10	0	52.72	10	0	40.58	3	1	44.25	24	0	52.39	15	0
KB2031	IVT-IRFB-12	46.25	13	0	50.88	13	0	33.33	13	0	62.21	4	1	53.63	12	0
NDB1793	IVT-IRFB-13	44.98	14	0	49.48	14	0	32.61	16	0	62.1	5	1	50.29	17	0
NDB1800	IVT-IRFB-10	27.54	24	0	30.3	24	0	28.99	20	0	57.84	14	0	54.33	11	0
PL936	IVT-IRFB-6	43.09	16	0	47.4	16	0	28.26	22	0	57.53	16	0	41.04	23	0
PL937	IVT-IRFB-21	33.81	22	0	37.2	22	0	36.96	9	0	48.18	23	0	59.44	5	1
PL939	IVT-IRFB-2	51.21	4	0	56.33	4	0	23.19	25	0	58.05	13	1	51.42	16	0
PL940	IVT-IRFB-8	47.11	11	0	51.82	11	0	36.96	9	0	55.85	18	0	52.92	14	0
RD2899	IVT-IRFB-22	39.45	20	0	43.39	20	0	36.23	11	0	54.7	20	0	54.59	10	0
RD3051	IVT-IRFB-16	47.97	9	0	52.77	9	0	33.33	13	0	61.75	6	1	63.06	4	1
RD3052	IVT-IRFB-18	55.54	2	1	61.09	2	1	39.13	7	1	55.42	19	0	43.52	21	0
RD3053	IVT-IRFB-1	50.06	6	0	55.06	6	0	28.99	20	0	59.14	11	1	39.8	24	0
RD3054	IVT-IRFB-11	42.37	17	0	46.61	17	0	42.03	2	1	62.69	2	1	55.63	8	0
UPB1105	IVT-IRFB-4	41.81	18	0	45.99	18	0	27.54	23	0	62.29	3	1	54.82	9	0
UPB1106	IVT-IRFB-19	57.55	1	1	63.3	1	1	44.93	1	1	53.13	21	0	57.22	7	1
BH946©	IVT-IRFB-24	46.81	12	0	51.49	12	0	25.36	24	0	58.51	12	1	35.47	25	0
DWRB137©	IVT-IRFB-14	44.38	15	0	48.82	15	0	36.23	11	0	57.27	17	0	63.34	3	1
HUB113©	IVT-IRFB-15	27.25	25	0	29.97	25	0	32.61	15	0	60.65	8	1	58.2	6	1
Mean =		44.17			48.59			34.43			57.07			51.94		
S.E.m =		2.03			2.24			3.37			2.24			3.85		
C.D. =		5.02			5.52			8.15			5.54			9.50		
C.V. =		6.51			6.51			13.83			5.56			10.48		
D.O.S. =		11.11.21			11.11.21			10.11.21			10.11.21			15.11.21		

IVT-IRFB-NWPZ **Rabi 2021-22**

Variety	Entry code	NWPZ			NWPZ			NWPZ			**Zonal**		
		Samdari			Pantnagar			Modipuram			**NWPZ**		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	**Yield**	**RK**	**G**
BH1044	IVT-IRFB-3	32.39	22	0	51.86	8	0	52.66	6	0	**49.6**	**4**	**1**
BH1045	IVT-IRFB-17	40.94	13	1	44.69	15	0	40.22	20	0	**41.7**	**21**	**0**
DWRB225	IVT-IRFB-25	40.07	14	1	48.53	13	0	38.95	23	0	**41.7**	**22**	**0**
DWRB226	IVT-IRFB-23	42.03	9	1	40.3	19	0	49.76	8	0	**49.3**	**6**	**1**
Filler	IVT-IRFB-9	45.65	3	1	34.01	22	0	49.4	9	0	**50**	**2**	**1**
HUB281	IVT-IRFB-5	33.55	21	0	33.48	23	0	49.88	7	0	**38.7**	**25**	**0**
KB2004	IVT-IRFB-20	50	1	1	54	6	0	39.86	22	0	**49.9**	**3**	**1**
KB2015	IVT-IRFB-7	34.42	19	0	31.28	24	0	42.39	16	0	**43.2**	**19**	**0**
KB2031	IVT-IRFB-12	43.77	5	1	56.83	4	0	48.49	10	0	**49.4**	**5**	**1**
NDB1793	IVT-IRFB-13	43.7	6	1	49.1	10	0	60.51	3	1	**49.1**	**8**	**1**
NDB1800	IVT-IRFB-10	43.12	8	1	59.97	3	0	47.46	11	0	**43.7**	**18**	**0**
PL936	IVT-IRFB-6	43.12	7	1	65.07	2	1	61.96	1	1	**48.4**	**10**	**1**
PL937	IVT-IRFB-21	32.1	24	0	39.84	20	0	36.65	24	0	**40.5**	**24**	**0**
PL939	IVT-IRFB-2	42.03	9	1	65.46	1	1	46.38	12	0	**49.3**	**7**	**1**
PL940	IVT-IRFB-8	45.65	3	1	42.43	17	0	42.27	17	0	**46.9**	**15**	**0**
RD2899	IVT-IRFB-22	36.96	18	1	48.65	12	0	43	15	0	**44.6**	**16**	**0**
RD3051	IVT-IRFB-16	40.07	14	1	51.04	9	0	35.93	25	0	**48.2**	**11**	**0**
RD3052	IVT-IRFB-18	34.06	20	0	48.7	11	0	42.15	18	0	**47.5**	**12**	**0**
RD3053	IVT-IRFB-1	41.16	12	1	41.43	18	0	40.22	20	0	**44.5**	**17**	**0**
RD3054	IVT-IRFB-11	41.3	11	1	37.14	21	0	61.96	1	1	**48.7**	**9**	**1**
UPB1105	IVT-IRFB-4	37.68	17	1	54.56	5	0	54.35	5	0	**47.4**	**13**	**0**
UPB1106	IVT-IRFB-19	28.48	25	0	44.78	14	0	56.88	4	0	**50.8**	**1**	**1**
BH946©	IVT-IRFB-24	32.25	23	0	53.69	7	0	42.15	18	0	**43.2**	**20**	**0**
DWRB137©	IVT-IRFB-14	39.86	16	1	43.65	16	0	45.05	13	0	**47.3**	**14**	**0**
HUB113©	IVT-IRFB-15	48.55	2	1	30.99	25	0	43.6	14	0	**41.5**	**23**	**0**
	Mean =	39.72			46.86			46.88			**46.2**		
	S.E. m =	5.12			1.46			2.23			**1.073**		
	C.D. =	12.39			3.54			5.39			**2.5**		
	C.V. =	18.23			4.41			6.72					
	D.O.S. =	1.11.21			18.11.21			16.11.21					

IVT-IRFB-NEPZ **Rabi 2021-22**

Variety	Entry code	NEPZ			NEPZ			NEPZ			NEPZ			NEPZ			**Zonal**		
		RPCAU, Pusa			Kanpur			Ranchi			Sabour			Varanasi			**NEPZ**		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	**Yield**	**RK**	**G**
BH1044	IVT-IRFB-3	38.65	11	0	50.74	16	0	45.36	7	1	49.74	13	0	38.90	7	0	**44.70**	**11**	**0**
BH1045	IVT-IRFB-17	47.71	6	1	63.70	3	1	44.27	8	1	49.75	12	0	37.62	10	0	**48.60**	**4**	**1**
DWRB225	IVT-IRFB-25	36.23	15	0	43.36	24	0	39.38	17	0	53.43	10	0	34.09	18	0	**41.30**	**17**	**0**
DWRB226	IVT-IRFB-23	36.23	15	0	59.87	5	1	51.46	2	1	68.29	2	1	38.69	8	0	**50.90**	**1**	**1**
Filler	IVT-IRFB-9	48.91	2	1	52.97	12	0	47.85	5	1	47.65	15	0	41.11	4	0	**47.70**	**7**	**1**
HUB281	IVT-IRFB-5	32.00	18	0	46.37	20	0	35.28	20	0	41.83	18	0	34.43	17	0	**38.00**	**21**	**0**
KB2004	IVT-IRFB-20	50.12	1	1	45.58	22	0	51.39	3	1	60.08	5	0	34.87	15	0	**48.40**	**5**	**1**
KB2015	IVT-IRFB-7	29.59	23	0	51.46	15	0	30.02	23	0	25.29	25	0	37.03	11	0	**34.70**	**24**	**0**
KB2031	IVT-IRFB-12	32.00	18	0	56.85	9	1	41.24	14	0	29.42	23	0	28.29	23	0	**37.60**	**23**	**0**
NDB1793	IVT-IRFB-13	31.40	20	0	57.95	6	1	45.4	6	1	49.36	14	0	34.85	16	0	**43.80**	**13**	**0**
NDB1800	IVT-IRFB-10	47.58	7	1	47.81	19	0	33.93	21	0	53.7	9	0	36.99	12	0	**44.00**	**12**	**0**
PL936	IVT-IRFB-6	35.27	17	0	52.91	13	0	50.31	4	1	44.43	17	0	40.88	5	0	**44.80**	**10**	**0**
PL937	IVT-IRFB-21	31.40	20	0	48.48	18	0	28.92	24	0	56.09	7	0	29.49	22	0	**38.90**	**19**	**0**
PL939	IVT-IRFB-2	48.07	4	1	52.64	14	0	42.62	11	0	34.08	22	0	36.10	13	0	**42.70**	**15**	**0**
PL940	IVT-IRFB-8	37.20	13	0	39.79	25	0	51.49	1	1	27.34	24	0	35.68	14	0	**38.30**	**20**	**0**
RD2899	IVT-IRFB-22	44.69	8	1	57.92	7	1	44.23	9	1	40.31	19	0	18.43	25	0	**41.10**	**18**	**0**
RD3051	IVT-IRFB-16	28.99	25	0	45.67	21	0	41.52	13	0	60.12	4	0	33.30	19	0	**41.90**	**16**	**0**
RD3052	IVT-IRFB-18	36.47	14	0	45.47	23	0	41.75	12	0	34.33	21	0	31.48	20	0	**37.90**	**22**	**0**
RD3053	IVT-IRFB-1	48.31	3	1	55.04	11	0	39.73	15	0	58.16	6	0	45.84	2	1	**49.40**	**2**	**1**
RD3054	IVT-IRFB-11	40.10	9	0	56.39	10	1	37.22	19	0	44.56	16	0	40.31	6	0	**43.70**	**14**	**0**
UPB1105	IVT-IRFB-4	30.19	22	0	57.87	8	1	37.78	18	0	67.35	3	1	47.54	1	1	**48.10**	**6**	**1**
UPB1106	IVT-IRFB-19	39.13	10	0	61.51	4	1	30.56	22	0	74.93	1	1	38.60	9	0	**48.90**	**3**	**1**
BH946©	IVT-IRFB-24	37.44	12	0	65.21	1	1	43.34	10	0	55.38	8	0	30.02	21	0	**46.30**	**9**	**0**
DWRB137©	IVT-IRFB-14	47.95	5	1	63.75	2	1	39.61	16	0	37.16	20	0	42.95	3	0	**46.30**	**8**	**0**
HUB113©	IVT-IRFB-15	29.59	23	0	49.16	17	0	13.27	25	0	50.8	11	0	22.55	24	0	**33.10**	**25**	**0**
	Mean =	38.61			53.14			40.32			48.54			35.60			**43.20**		
	S.E.m =	3.59			4.04			3.29			3.91			1.51			**1.517**		
	C.D. =	8.68			9.97			8.13			9.64			3.72			**3.6**		
	C.V. =	13.14			10.74			11.55			11.38			5.98					
	D.O.S. =	22.11.21			23.11.21			8.11.21			17.11.21			22.11.21					

IVT-IRFB-CEN Zone **Rabi 2021-22**

Variety	Entry code	CZ			CZ			CZ			CZ			**Zonal**		
		Udaipur			Morena			Tikamgarh			Vijapur			**CZ**		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	**Yield**	**RK**	**G**
BH1044	IVT-IRFB-3	54.21	7	1	33.22	25	0	60.97	13	0	43.68	20	0	**48**	**23**	**0**
BH1045	IVT-IRFB-17	55.14	4	1	60.47	7	0	57.9	18	0	44.26	17	0	**54.4**	**9**	**0**
DWRB225	IVT-IRFB-25	52.06	12	1	60.36	8	0	59.53	14	0	45.36	13	0	**54.3**	**10**	**0**
DWRB226	IVT-IRFB-23	47.52	19	0	49.99	17	0	52.38	21	0	48.28	6	0	**49.5**	**21**	**0**
Filler	IVT-IRFB-9	54.37	6	1	53.63	13	0	64.68	6	0	46.02	12	0	**54.7**	**6**	**0**
HUB281	IVT-IRFB-5	52.89	11	1	65.15	3	1	67.13	4	0	46.89	9	0	**58**	**3**	**1**
KB2004	IVT-IRFB-20	51.14	14	1	63.93	4	1	63.12	10	0	55.52	3	0	**58.4**	**2**	**1**
KB2015	IVT-IRFB-7	56.3	2	1	61.78	6	0	52.25	22	0	44.14	18	0	**53.6**	**11**	**0**
KB2031	IVT-IRFB-12	40.83	24	0	48.2	20	0	68.69	3	1	51.05	4	0	**52.2**	**15**	**0**
NDB1793	IVT-IRFB-13	57.07	1	1	62.7	5	0	53.05	20	0	45.18	14	0	**54.5**	**8**	**0**
NDB1800	IVT-IRFB-10	49.51	16	1	57.52	9	0	62.32	11	0	48.74	5	0	**54.5**	**7**	**0**
PL936	IVT-IRFB-6	49.74	15	1	55.86	12	0	58.7	16	0	44.91	15	0	**52.3**	**14**	**0**
PL937	IVT-IRFB-21	53.02	10	1	66.92	2	1	64.61	8	0	40.69	21	0	**56.3**	**4**	**1**
PL939	IVT-IRFB-2	47.34	20	0	46.41	22	0	70.32	2	1	47.97	7	0	**53**	**12**	**0**
PL940	IVT-IRFB-8	43.58	21	0	56.9	10	0	57.74	19	0	39.59	23	0	**49.5**	**22**	**0**
RD2899	IVT-IRFB-22	54.05	8	1	53.22	14	0	58.85	15	0	44.45	16	0	**52.6**	**13**	**0**
RD3051	IVT-IRFB-16	48.26	18	0	69.73	1	1	43.88	25	0	40.21	22	0	**50.5**	**19**	**0**
RD3052	IVT-IRFB-18	51.39	13	1	52.26	15	0	61.05	12	0	59.59	2	1	**56.1**	**5**	**1**
RD3053	IVT-IRFB-1	55.97	3	1	49.61	18	0	64.65	7	0	65.98	1	1	**59.1**	**1**	**1**
RD3054	IVT-IRFB-11	54.78	5	1	56.53	11	0	47.55	24	0	46.64	10	0	**51.4**	**17**	**0**
UPB1105	IVT-IRFB-4	42.13	23	0	46.37	23	0	71.35	1	1	44.02	19	0	**51**	**18**	**0**
UPB1106	IVT-IRFB-19	49.18	17	1	47.25	21	0	64.77	5	0	47.53	8	0	**52.2**	**16**	**0**
BH946©	IVT-IRFB-24	33.31	25	0	44.33	24	0	50.17	23	0	46.08	11	0	**43.5**	**25**	**0**
DWRB137©	IVT-IRFB-14	53.73	9	1	48.9	19	0	58.3	17	0	39.21	24	0	**50**	**20**	**0**
HUB113©	IVT-IRFB-15	43.09	22	0	50.13	16	0	63.43	9	0	35.37	25	0	**48**	**24**	**0**
Mean =		50.02			54.45			59.90			46.45			**52.7**		
S.E.m =		3.52			2.75			1.49			3.33			**1.442**		
C.D. =		8.69			6.80			3.69			8.21			**3.4**		
C.V. =		9.95			7.15			3.53			10.12					
D.O.S. =		30.11.21			24.11.21			12.11.21			18.11.21					

Summary of ancillary and disease data

ZONE: NWPZ

Initial Varietal Trial –FB- -(IR)

***Rabi* – 2021-22**

Name of Entry	Entry Code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION				
		Days to Heading (75%)	Days to Maturity (75%)	Tillers per mete	Plant height (cm)	Spike length (cm)	Two/ Six Row	Colour	1000-grain weight (g)	H/N	Rusts		SMUT		Leaf Blight (LS)
											YR	BR	L (%)	C (%)	
BH1044	IVT-IRFB-E3	81 (56-103)	125 (112-140)	144 (87-212)	97 (67-113)	8 (5-11)	6	LY	33 (13-40)	H	0	0		F	02 (01-02)
BH1045	IVT-IRFB-E17	92 (67-114)	134 (120-145)	150 (88-320)	110 (95-126)	8 (7-9)	6	LY	41 (19-51)	H	0	0		F	12 (01-12)
DWRB225	IVT-IRFB-E25	91 (64-110)	133 (121-145)	124 (80-190)	107 (91-121)	9 (6-11)	6	LY	36 (18-45)	H	5S	0		HS	24 (02-35)
DWRB226	IVT-IRFB-E23	88 (67-107)	132 (117-147)	146 (98-212)	102 (88-109)	7 (6-9)	6	LY	40 (19-50)	H	0	0		F	34 (23-45)
FILLER	IVT-IRFB-E9	86 (65-102)	129 (116-143)	135 (85-240)	104 (89-125)	8 (7-9)	6	LY	38 (18-47)	H	0	0		F	34 (12-45)
HUB281	IVT-IRFB-E5	84 (64-103)	125 (112-140)	136 (98-206)	100 (90-116)	8 (6-11)	2	Y	46 (22-53)	H	0	0		F	23 (02-23)
KB2004	IVT-IRFB-E20	87 (63-104)	130 (117-145)	142 (98-204)	99 (84-120)	7 (6-8)	6	LY	37 (16-46)	H	0	0		F	23 (01-45)
KB2015	IVT-IRFB-E7	91 (65-111)	134 (121-148)	129 (100-150)	94 (83-110)	7 (6-8)	6	A	35 (15-48)	H	0	0		TS	45 (23-56)
KB2031	IVT-IRFB-E12	87 (68-107)	130 (119-146)	134 (93-183)	105 (90-116)	8 (7-9)	6	LY	33 (16-43)	H	0	0		S	45 (23-56)
NDB1793	IVT-IRFB-E13	88 (69-105)	129 (115-140)	152 (86-310)	106 (97-119)	8 (7-8)	6	LY	37 (18-46)	H	0	0		TS	34 (23-45)
NDB1800	IVT-IRFB-E10	89 (70-105)	131 (117-143)	153 (119-214)	102 (88-112)	7 (6-8)	6	Y	37 (18-48)	H	0	0		F	12 (01-12)
PL936	IVT-IRFB-E6	80 (62-96)	127 (113-139)	134 (100-280)	87 (68-113)	8 (7-10)	6	LY	43 (24-51)	H	0	0		F	34 (02-56)
PL937	IVT-IRFB-E21	79 (61-97)	129 (112-141)	135 (72-236)	91 (74-102)	7 (5-10)	6	LY	44 (22-53)	H	0	0		F	12 (01-12)
PL939	IVT-IRFB-E2	91 (71-108)	132 (120-142)	121 (70-220)	108 (95-119)	10 (8-12)	6	LY	37 (17-47)	H	0	0		HS	02 (01-02)
PL840	IVT-IRFB-E8	91 (68-110)	131 (117-141)	154 (98-217)	100 (87-114)	8 (7-12)	6	LY	36 (15-49)	H	0	0		F	35 (12-57)
PL2899	IVT-IRFB-E22	87 (71-107)	126 (110-143)	123 (80-194)	103 (87-121)	8 (7-10)	6	LY	40 (15-50)	H	0	0		F	68 (56-89)
RD3051	IVT-IRFB-E16	86 (64-103)	128 (115-140)	141 (80-208)	102 (96-111)	7 (6-9)	6	LY	35 (15-46)	H	0	0		TS	24 (02-35)
RD3052	IVT-IRFB-E18	86 (70-102)	126 (112-139)	153 (100-285)	101 (85-112)	7 (5-10)	6	Y	35 (15-45)	H	0	0		F	13 (02-23)
RD3053	IVT-IRFB-E1	88 (64-105)	129 (111-144)	133 (69-260)	111 (89-132)	9 (8-10)	6	LY	42 (19-51)	H	0	0		F	23 (12-23)
RD3054	IVT-IRFB-E11	82 (63-104)	127 (113-140)	132 (100-165)	90 (77-110)	9 (7-13)	6	Y	44 (22-53)	H	0	0		HS	24 (13-35)
UPB1105	IVT-IRFB-E4	79 (55-97)	128 (113-141)	127 (93-171)	105 (95-122)	8 (7-10)	6	LY	44 (20-53)	H	0	0		F	35 (12-57)
UPB1106	IVT-IRFB-E19	84 (59-104)	124 (112-137)	121 (92-145)	92 (82-102)	8 (7-11)	6	A	34 (12-65)	H	0	0		F	13 (12-13)
BH946 ©	IVT-IRFB-E24	89 (66-104)	127 (110-145)	160 (98-273)	94 (71-112)	8 (7-10)	6	LY	28 (12-36)	H	0	0		TS	12 (01-12)
DWRB137 ©	IVT-IRFB-E14	86 (63-105)	128 (110-144)	142 (108-240)	88 (75-103)	7 (7-9)	6	LY	35 (16-46)	H	0	0		F	24 (02-35)
HUB113 ©	IVT-IRFB-E15	88 (70-103)	130 (119-142)	135 (90-216)	113 (99-128)	9 (8-10)	6	LY	40 (19-48)	H	0	0		HS	24 (12-35)

Initial Varietal Trial –FB- -(IR) **ZONE: NEPZ**

Summary of ancillary and disease data ***Rabi* – 2021-22**

Entry	Entry Code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION				
		Days to Heading (75%)	Days to Maturity (75%)	Tillers per mete	Plant height (cm)	Spike length (cm)	Two/ Six Row	Colour	1000-grain weight (g)	H/N	Rusts		SMUT		Leaf Blight (LS)
											YR	BR	L (%)	C (%)	
BH1044	IVT-IRFB-E3	76 (67-81)	115 (100-127)	133 (96-179)	81.4 (65-107)	8 (7-9)	6	Y	35 (33-39)	H	0	0	F	0	23 (00-89)
BH1045	IVT-IRFB-E17	87 (73-94)	120 (100-127)	113 (83-173)	94.9 (73-124)	8 (7-9)	6	LY	37 (32-44)	H	0	0	F	0	34 (0-79)
DWRB225	IVT-IRFB-E25	84 (76-90)	120 (102-131)	123 (73-225)	89.4 (72-108)	9 (7-10)	6	Y	38 (33-43)	H	0	0	F	0	34 (00-79)
DWRB226	IVT-IRFB-E23	83 (73-91)	121 (100-131)	122 (84-167)	91.8 (68.7-111)	7 (6-8)	6	Y	38 (27-49)	H	0	0	F	0	34 (00-89)
FILLER	IVT-IRFB-E9	81 (74-85)	115 (98-124)	125 (85-172)	85.4 (74.4-111)	7 (7-9)	6	Y	39 (30-46)	H	0	0	Ts	0	34 (00-89)
HUB281	IVT-IRFB-E5	79 (74-84)	117 (102-130)	133 (85-184)	86 (72.1-103)	8 (6-11)	2	Y	45 (30-54)	H	0	0	F	0	45 (0-89)
KB2004	IVT-IRFB-E20	84 (76-92)	120 (104-132)	129 (86-185)	87.4 (77-103)	8 (6-10)	6	LY	40 (34-45)	H	0	0	F	0	34 (00-89)
KB2015	IVT-IRFB-E7	87 (73-94)	119 (101-126)	130 (87-162)	80.9 (61-106)	7 (5-9)	6	LY	38 (33-49)	H	0	0	F	0	35 (00-79)
KB2031	IVT-IRFB-E12	85 (75-92)	118 (98-127)	120 (100-138)	85.2 (70-104)	8 (6-10)	6	LY	39 (31-58)	H	0	0	F	0	34 (00-79)
NDB1793	IVT-IRFB-E13	82 (73-86)	117 (100-130)	108 (85-148)	92.6 (81.5-108)	8 (6-9)	6	Y	39 (33-45)	H	0	0	Ts	0	45 (23-89)
NDB1800	IVT-IRFB-E10	84 (76-94)	121 (106-127)	112 (64-157)	84.1 (62-109)	7 (6-8)	6	Y	38 (31-46)	H	0	0	F	0	34 (00-89)
PL936	IVT-IRFB-E6	80 (70-85)	116 (98-127)	113 (65-166)	74.2 (55-87)	8 (6-9)	6	Y	44 (34-50)	H	0	0	Ts	5	34 (13-79)
PL937	IVT-IRFB-E21	76 (66-84)	117 (98-125)	106 (65-174)	82.6 (67.6-101)	8 (6-9)	6	Y	42 (31-55)	H	0	0	F	0	45 (00-89)
PL939	IVT-IRFB-E2	84 (65-90)	119 (98-125)	102 (66-195)	93.3 (83-118)	9 (8-10)	6	Y	39 (35-44)	H	0	0	F	0	34 (00-79)
PL840	IVT-IRFB-E8	86 (72-91)	117 (98-124)	115 (60-181)	87.3 (68.6-108)	8 (5-10)	6	Y	36 (30-46)	H	0	0	Ts	Ts	35 (00-79)
PL2899	IVT-IRFB-E22	78 (74-83)	115 (98-130)	106 (72-136)	88 (73.2-103)	8 (7-9)	6	Y	38 (30-49)	H	0	0	F	0	45 (00-79)
RD3051	IVT-IRFB-E16	84 (75-89)	118 (102-130)	136 (72-206)	85.6 (70-109)	8 (6-9)	6	LY	37 (30-42)	H	0	0	F	0	33 (00-79)
RD3052	IVT-IRFB-E18	83 (74-86)	117 (98-133)	118 (70-152)	87.3 (73.9-112)	8 (7-10)	6	LY	36 (31-43)	H	0	0	F	0	45 (0-79)
RD3053	IVT-IRFB-E1	83 (73-87)	117 (105-124)	129 (76-228)	88 (70-113)	8 (6-10)	6	LY	42 (37-52)	H	0	0	F	0	45 (00-79)
RD3054	IVT-IRFB-E11	79 (66-88)	117 (104-126)	106 (72-167)	77.4 (61.1-92)	8 (6-11)	6	LY	42 (29-48)	H	0	0	F	3	35 (00-79)
UPB1105	IVT-IRFB-E4	76 (72-81)	116 (98-131)	117 (87-170)	85.3 (62.9-114)	8 (6-9)	6	LY	44 (31-53)	H	0	0	Ts	0	23 (00-79)
UPB1106	IVT-IRFB-E19	79 (67-86)	115 (96-127)	133 (80-203)	79.5 (58.9-98)	7 (6-9)	6	Y	36 (28-42)	H	0	0	F	0	34 (00-89)
BH946 ©	IVT-IRFB-E24	81 (66-88)	117 (96-127)	121 (102-139)	84.9 (62.3-97)	8 (7-10)	6	LY	33 (26-40)	H	0	0	F	0	34 (00-89)
DWRB137©	IVT-IRFB-E14	82 (68-88)	118 (96-131)	115 (80-143)	73 (57-97)	8 (4-9)	6	LY	38 (32-48)	H	0	0	F	0	23 (00-79)
HUB113 ©	IVT-IRFB-E15	84 (74-93)	119 (96-129)	97 (66-148)	88.8 (77-113)	8 (7-11)	6	LY	41 (31-53)	H	0	0	F	0	34 (00-79)

Initial Varietal Trial –FB -(IR) **ZONE: CZ**

Summary of ancillary and disease data ***Rabi* – 2021-22**

Name of Entry	Entry Code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION					Aphids (1-5)
		Days to Heading (75%)	Days to Maturity (75%)	Tillers per mete	Plant height (cm)	Spike length (cm)	Two/ Six Row	Colour	1000-grain weight (g)	H/N	Rusts		SMUT		Leaf Blight (LS)	
											SR	LR	L (%)	C (%)		
BH1044	IVT-IRFB-E3	69 (54-80)	113 (100-130)	119 (66-183)	88 (73-111)	7 (6-7)	6	Y	45 (37-50)	H	10S	10MS	-	4	02	4
BH1045	IVT-IRFB-E17	78 (70-85)	120 (111-126)	112 (72-166)	102 (89-115)	7 (6-8)	6	LY	44 (38-50)	H	TR	0	-	3	00	3
DWRB225	IVT-IRFB-E25	77 (70-81)	118 (111-126)	102 (50-137)	106 (98-112)	8 (6-9)	6	Y	43 (36-50)	H	TR	0	-	1	01	1
DWRB226	IVT-IRFB-E23	73 (62-79)	115 (105-128)	130 (54-217)	98 (89-114)	7 (6-8)	6	Y	44 (31-50)	H	TMS	TR	CS	2	00	2
FILLER	IVT-IRFB-E9	69 (57-74)	115 (103-133)	125 (68-202)	93 (81-117)	7 (5-8)	6	Y	42 (32-50)	H	TMS	TR	-	3	12	3
HUB281	IVT-IRFB-E5	72 (57-80)	116 (100-132)	122 (90-154)	104 (83-117)	8 (7-8)	2	Y	50 (43-56)	H	10MS	TR	-	1	00	1
KB2004	IVT-IRFB-E20	75 (68-82)	119 (105-131)	106 (73-137)	96 (86-110)	7 (6-8)	6	LY	39 (35-42)	H	10S	TMS	-	3	12	3
KB2015	IVT-IRFB-E7	76 (70-82)	121 (109-129)	117 (76-142)	94 (85-104)	6 (5-7)	6	LY	43 (38-49)	H	30S	10S	-	2	13	2
KB2031	IVT-IRFB-E12	74 (63-79)	120 (105-132)	128 (65-201)	99 (89-111)	7 (7-9)	6	LY	41 (33-50)	H	10MS	5MS	-	1	12	1
NDB1793	IVT-IRFB-E13	74 (69-78)	115 (102-131)	111 (60-175)	105 (90-119)	7 (6-8)	6	Y	43 (36-47)	H	30S	10S	-	2	13	2
NDB1800	IVT-IRFB-E10	75 (72-78)	118 (110-129)	109 (73-146)	105 (87-125)	8 (7-10)	6	Y	44 (35-55)	H	TMS	TR	-	2	13	2
PL936	IVT-IRFB-E6	71 (60-75)	115 (99-134)	121 (60-205)	84 (64-101)	7 (7-8)	6	Y	47 (42-57)	H	20MS	TMS	-	5	01	5
PL937	IVT-IRFB-E21	73 (69-76)	117 (100-135)	94 (56-117)	102 (82-114)	8 (7-9)	6	Y	44 (38-53)	H	10S	5MS	-	5	01	5
PL939	IVT-IRFB-E2	77 (71-82)	118 (110-128)	114 (66-152)	109 (98-117)	8 (7-10)	6	Y	41 (28-50)	H	10MS	TMS	-	2	01	2
PL840	IVT-IRFB-E8	75 (68-79)	118 (108-131)	124 (76-194)	96 (84-106)	7 (6-8)	6	Y	41 (36-45)	H	10S	10MS	-	2	24	2
PL2899	IVT-IRFB-E22	74 (60-82)	119 (104-137)	113 (73-153)	105 (98-115)	8 (7-8)	6	Y	44 (34-50)	H	10S	TMS	-	1	12	1
RD3051	IVT-IRFB-E16	74 (69-80)	116 (105-126)	114 (56-147)	97 (84-110)	7 (7-8)	6	LY	44 (36-55)	H	10MS	10MS	-	1	01	1
RD3052	IVT-IRFB-E18	74 (67-79)	115 (103-128)	105 (70-142)	98 (81-112)	8 (7-10)	6	LY	44 (40-52)	H	20S	10MS	-	2	14	2
RD3053	IVT-IRFB-E1	73 (58-81)	116 (104-131)	128 (61-207)	107 (94-121)	8 (7-8)	6	LY	52 (44-59)	H	TMS	TR	-	2	12	2
RD3054	IVT-IRFB-E11	71 (63-75)	114 (100-128)	117 (58-206)	88 (68-105)	7 (6-7)	6	LY	47 (42-56)	H	5MS	TMS	-	5	00	5
UPB1105	IVT-IRFB-E4	69 (54-76)	115 (99-132)	128 (67-175)	103 (89-112)	8 (7-9)	6	LY	47 (40-59)	H	5MS	TR	CS	1	01	1
UPB1106	IVT-IRFB-E19	72 (59-79)	113 (99-128)	97 (77-139)	86 (66-106)	8 (8-8)	6	Y	35 (23-46)	H	TMS	TR	-	5	00	5
BH946 ©	IVT-IRFB-E24	74 (61-82)	116 (103-133)	103 (65-142)	92 (65-113)	7 (7-8)	6	LY	36 (22-50)	H	10S	TMS	-	3	01	3
DWRB137©	IVT-IRFB-E14	75 (64-81)	117 (106-127)	110 (79-151)	90 (65-105)	8 (6-10)	6	LY	40 (32-50)	H	TMS	TR	CS	3	00	3
HUB113 ©	IVT-IRFB-E15	76 (69-83)	118 (107-123)	94 (48-125)	104 (91-120)	8 (6-9)	6	LY	46 (35-51)	H	TMS	TMS	-	5	01	5

SR= Stem rust

INITIAL VARIETAL TRIAL-FEED BARLEY (RAINFED- TIMELY SOWN) - NEPZ

The IVT-RFTS-NEPZ was proposed at eight locations in the NEP Zone and was conducted by all centres. The trial consisted of 13 genotypes including 11 test entries and two checks, namely K603 and Lakhan. Among 11 test entries, five entries (RD3037, RD3047, RD3048, RD3049 and RD3050) were contributed from Durgapura centre, three entries (NDB1784, NDB1785 and NDB1786) submitted by Kumarganj centre, two entries (KB2008 and KB2018) and one entry (DWRB225) were contributed by Kanpur and Karnal, respectively.

The zonal monitoring team visited the trials at different centres during the ideal stage of the crop. The overall performance of the trial was satisfactory at all locations except Kumarganj, where the trial failed because of improper management. In case of disease-pest incidence, low to severe incidence of spot blotch has been reported in the zone. The maximum severity of spot blotch was reported at the Varanasi centre.

The data from Sabour centres were not considered for pooled analysis due to high CV and results from rest six centers were included in zonal pooled analysis.

The location means for grain yield ranged from 20.68 q/ha (Varanasi) to 37.40 q/ha (Pusa) with 31.0 q/ha trial zonal mean across the centres. Entry NDB1785 ranked first with mean grain yield of 35.00 q/ha followed by NDB1784 (33.70 q/ha), DWRB225 (33.70 q/ha) and the best check variety K603 (33.40 q/ha) in the first significant group.

Grain Yield Data (q/ha)

IVT-RF-NEPZ **Rabi 2021-22**

Varieties	Entry Code IVT-RF- NEPZ	NEPZ			NEPZ			NEPZ			NEPZ			NEPZ			NEPZ			**Zonal**		
		Kanpur			Varanasi			Saini			Ranchi			Chiyanki			Pusa			NEPZ		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	**Yield**	**Rk**	**G**
DWRB225	IVT-RF-10	37.5	1	1	17.36	7	0	42.39	1	1	31.88	9	0	29.78	10	0	43.18	1	1	**33.70**	**3**	**1**
KB2008	IVT-RF-2	18.12	13	0	34.18	1	1	21.74	12	0	31.52	11	0	36.3	4	0	-	-	-	**28.40**	**11**	**0**
KB2018	IVT-RF-7	28.26	7	0	24.73	6	0	31.88	6	0	35.51	7	0	33.41	7	0	33.82	8	0	**31.30**	**7**	**0**
NDB1784	IVT-RF-4	30.07	4	0	27.67	4	0	36.23	4	0	34.78	8	0	32.68	8	0	40.76	3	1	**33.70**	**2**	**1**
NDB1785	IVT-RF-12	32.97	3	1	14.4	8	0	39.13	2	1	42.03	3	0	39.93	3	0	41.55	2	1	**35.00**	**1**	**1**
NDB1789	IVT-RF-6	33.7	2	1	13.2	9	0	29.89	7	0	31.52	12	0	29.42	12	0	32.61	9	0	**28.40**	**10**	**0**
RD3037	IVT-RF-1	25.72	9	0	10.7	13	0	25.36	9	0	53.26	1	1	43.73	1	1	39.31	4	1	**33.00**	**5**	**0**
RD3047	IVT-RF-8	22.46	12	0	31.55	3	0	24.64	11	0	25.72	13	0	23.62	13	0	37.74	6	0	**27.60**	**12**	**0**
RD3048	IVT-RF-3	29.71	6	0	12.41	10	0	36.23	3	0	31.88	9	0	29.78	10	0	38.35	5	1	**29.70**	**8**	**0**
RD3049	IVT-RF-9	27.17	8	0	11.88	11	0	29.71	8	0	43.12	2	0	41.01	2	1	36.23	7	0	**31.50**	**6**	**0**
RD3050	IVT-RF-13	22.83	10	0	27.4	5	0	25.18	10	0	36.23	6	0	34.46	6	0	30.5	10	0	**29.40**	**9**	**0**
K603©	IVT-RF-11	29.71	5	0	32.27	2	1	31.88	5	0	37.68	5	0	35.58	5	0	-	-	-	**33.40**	**4**	**1**
LAKHAN©	IVT-RF-5	22.83	10	0	11.1	12	0	17.39	13	0	38.41	4	0	29.91	9	0	-	-	-	**23.90**	**13**	**0**
	G.M.	27.77			20.68			30.13			36.43			33.82			37.40			**31.0**		
	S.E.(M)	1.94			1.01			2.00			1.78			1.51			2.23			**0.731**		
	C.D.	4.63			2.41			4.77			4.26			3.62			5.37			**1.7**		
	C.V.	13.98			9.78			13.26			9.80			8.96			11.92					
	DOS	30.10.21			03.11.21			10.11.21			09.11.21			05.11.21			08.11.21					

Summary of ancillary and disease data

IVT-RFTS-NEPZ **Rabi: 2021-22**

Variety	Agronomic traits							Grain traits			Disease & Insects					
	D.H	D.M	P.H (cm)	Lodg (%)	Tillers/ meter	2/6R	SL (cm)	G.C.	H/HL	T.G.W (g)	YR	BR	P.M	Smut	L.B	Aphid
DWRB225	77 (69-83)	123 (114-137)	86 (72-98)	0	101 (68-161)	6	8.1 (7.0-9.0)	Y	H	42.1 (33.0-48.0)	0	0	0	F	35	2
KB2008	80 (74-89)	120 (111-137)	62 (50-82)	25 (0-100)	69 (40-98)	6	7.2 (5.0-8.0)	LY	H	39.6 (28.0-47.0)	0	0	0	F	78	3
KB2018	78 (69-84)	123 (106-140)	86 (72-95)	0	87 (71-125)	6	8.6 (8.0-10.0)	Y	H	42.8 (37.0-49.0)	0	0	0	Ts	35	1
NDB1784	75 (69-78)	123 (110-140)	78 (68-94)	0	85 (70-144)	6	7.0 (6.0-8.0)	LY	H	45.9 (35.0-52.8)	0	0	0	F	34	1
NDB1785	92 (83-104)	129 (113-144)	75 (55-95)	0	98 (63-146)	6	7.2 (6.0-9.0)	LY	H	42.4 (35.2-48.2)	0	0	0	F	35	4
NDB1789	93 (84-104)	129 (121-138)	86 (77-91)	15(0-60)	91 (52-210)	6	7.8 (7.0-9.0)	LY	H	42.0 (33.9-48.0)	0	0	0	F	34	2
RD3037	97 (92-106)	130 (123-140)	77 (63-89)	0	92 (61-135)	6	8.4 (7.8-9.0)	LY	H	43.2 (36.0-49.0)	0	0	0	F	24	5
RD3047	78 (68-91)	123 (112-140)	80 (63-93)	0	71 (43-131)	6	8.4 (7.0-9.0)	LY	H	42.7 (38.6-46.1)	0	0	0	F	35	2
RD3048	82 (76-90)	125 (114-138)	74 (62-91)	0	92 (59-167)	6	8.2 (7.0-9.0)	LY	H	41.8 (34.0-47.0)	0	0	0	F	34	2
RD3049	85 (81-89)	126 (114-138)	78 (64-94)	0	90 (58-176)	6	7.6 (7.0-8.0)	LY	H	41.9 (37.0-46.9)	0	0	0	F	34	2
RD3050	72 (62-78)	120 (103-139)	72 (58-90)	0	116 (71-194)	2	7.0 (6.0-8.0)	LY	H	46.4 (38.0-52.4)	0	0	0	F	36	2
K603©	75 (70-81)	117 (110-139)	65 (50-84)	25(0-100)	69 (43-92)	6	7.6 (5.0-9.0)	LY	H	39.1 (30.7-48.0)	0	0	0	F	89	3
Lakhan©	77 (72-84)	121 (114-134)	70 (61-78)	25(0-100)	75 (68-87)	6	6.4 (5.0-8.0)	Y	H	40.5 (31.0-49.0)	0	0	0	F	89	1

DH= Days to heading, DM= Days to maturity, PH= Plant height, SL= Spike length, H/HL= Hulled/Hulless, TGW= Thousand grain weight, YR= Yellow rust, BR= Brown rust, PM= Powdery mildew, LB= Leaf blight

SOIL SALINITY TOLERANCE YIELD TRIAL

The IVT-IRTS-Sal/Alk trial was proposed at 8 locations and was conducted by all the centres. The trial consisted of 14 genotypes including three checks (NDB1173, RD2794 and RD2907) and 11 entries contributed by different centers.

The Zonal Monitoring Teams visited the trials at Dalipnagar and Kumarganj in NEPZ and Fatehpur, CCSHAU, Hisar, IIWBR Hisar in NWPZ and Bhilwara in CZ during the crop season. As per the recommendations of the Zonal Monitoring Teams, the trials at Bhilwara (due to faulty layout) and Kumarganj (poor performance and animal grazing) centres were rejected. The data from rest of the six centers were included in zonal pooled analysis.

In case of disease pest incidence, low to high incidence of leaf blight (Dalipnagar and CCSHAU, Hisar) were observed in all the entries while traces of loose and covered smuts (at Dalipnagar) were observed in two of the entries. Low to moderate aphid incidence was observed at IIWBR, Hisar location in all the entries.

The location means for grain yield ranged from 21.73 q/ha (CSSRI, Karnal) to 47.11 q/ha (IIWBR, Hisar) with 32.40 q/ha over all mean across the centres.

Entry KB2031 ranked first with mean grain yield of 36.20 q/ha and followed by entries DWRB228 (35.70 q/ha), RD3059 (34.80 q/ha) and NDB1782 (34.50 q/ha) in the first NSG. However, only the first two were significantly superior to the best check RD2907, while other two were only numerically higher.

IVT-SAL/ALK- Plains **Grain Yield (q/ha)** **Rabi 2021-22**

Varieties	Entry code	Hisar HAU			Hisar IIWBR			Karnal CSSRI			Fatehpur			Samdari			Dalipnagar			**Zonal**		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	**Yield**	**Rk**	**G**
BH1046	IVT-SST-10	36.38	1	1	45.82	10	1	21.31	7	0	21.10	12	0	37.86	11	0	29.53	2	1	**32.00**	**10**	**0**
DWRB228	IVT-SST-4	33.03	2	1	48.21	6	1	28.81	3	0	28.77	11	0	47.25	4	1	28.26	4	1	**35.70**	**2**	**1**
KB2013	IVT-SST-6	32.67	3	1	48.48	4	1	19.46	9	0	30.80	8	0	38.77	10	0	23.55	6	0	**32.30**	**8**	**0**
KB2031	IVT-SST-1	31.10	6	1	55.65	2	1	35.92	1	1	32.07	6	0	43.8	5	1	18.84	10	0	**36.20**	**1**	**1**
NDB1776	IVT-SST-13	25.97	12	0	40.16	12	0	20.04	8	0	13.89	14	0	41.67	9	0	23.37	8	0	**27.50**	**14**	**0**
NDB1782	IVT-SST-11	30.56	7	0	56.34	1	1	16.31	12	0	40.01	3	0	48.77	2	1	15.22	12	0	**34.50**	**4**	**1**
NDB1783	IVT-SST-3	31.40	4	1	38.12	14	0	23.71	5	0	20.11	13	0	37.57	12	0	28.44	3	1	**29.90**	**12**	**0**
RD3059	IVT-SST-7	31.28	5	1	47.68	8	1	24.20	4	0	31.28	7	0	50.54	1	1	23.55	6	0	**34.80**	**3**	**1**
RD3060	IVT-SST-8	28.26	9	0	39.06	13	0	18.65	11	0	48.25	1	1	43.30	7	1	18.84	11	0	**32.70**	**6**	**0**
RD3061	IVT-SST-5	27.36	10	0	43.19	11	0	23.55	6	0	33.07	5	0	42.39	8	0	13.59	14	0	**30.50**	**11**	**0**
RD3062	IVT-SST-9	23.67	13	0	48.28	5	1	19.38	10	0	42.75	2	0	32.90	14	0	30.62	1	1	**32.90**	**5**	**0**
NDB1173©	IVT-SST-14	26.63	11	0	48.10	7	1	29.38	2	0	30.13	10	0	36.99	13	0	20.83	9	0	**32.00**	**9**	**0**
RD2794©	IVT-SST-2	29.05	8	0	47.54	9	1	16.03	13	0	30.46	9	0	47.46	3	1	24.64	5	0	**32.50**	**7**	**0**
RD2907©	IVT-SST-12	22.77	14	0	52.95	3	1	7.55	14	0	35.87	4	0	43.48	6	1	14.13	13	0	**29.50**	**13**	**0**
	G.M.	**29.29**			**47.11**			**21.73**			**31.33**			**42.34**			**22.39**			**32.40**		
	S.E.(M)	2.34			4.66			1.58			2.24			3.20			1.51			**1.145**		
	C.D.	5.59			11.10			3.76			5.34			7.62			3.61			**2.7**		
	C.V.	16.01			19.77			14.51			14.30			15.11			13.53					
	DOS	11-11-2021			01-11-2021			05-11-2021			09-11-2021			01-11-2021			12-11-2021					

Summary of ancillary and disease data

SN	Entry	H Days Mean& Range	M days Mean& Range	Height Mean & Range	Tillering/M Mean & Range	1000 GW Mean & Range	Spike length Mean & Range	Two/ Six Row	Colour	H/N	lodging (%)	Disease score		Aphid
												CS	LB	
1	AVT-SAL/ALK-1	91.8 (63-110.25)	104.86 (119.7-150.7)	176.0 (65-118)	176.0 (64-431.2)	37.89 (39-47.80)	7.1 (6-8.03)	6	LY	H	0	Ts	12	1
2	AVT-SAL/ALK-2	87.7 (71-104)	100.24 (111.7-146.2)	199.7 (54-109)	199.7 (89-571)	34.66 (31.4-49.6)	7.7 (6-10.21)	6	Y	H	20	F	02	1
3	AVT-SAL/ALK-3	88.0 (71-102)	100.53 (110.5-148.2)	179.4 (56-108)	179.4 (73-425.2)	37.58 (35-48.8)	6.7 (5-8.20)	6	LY	H	0	F	36	2
4	AVT-SAL/ALK-4	85.4 (69-102.5)	97.55 (111-149.2)	194.1 (62-100)	194.1 (95-545.5)	38.41 (41.5-47.8)	6.7 (5.5-7.63)	6	LY	H	30	F	23	4
5	AVT-SAL/ALK-5	86.5 (70-102.2)	98.82 (115.5-147)	197.5 (52-108)	197.5 (90-558.2)	36.96 (36-48.3)	7.0 (5-8.00)	6	LY	H	5	F	34	3
6	AVT-SAL/ALK-6	86.9 (71-103.5)	99.35 (113.2-149.7)	185.0 (51-110)	185.0 (79-515.5)	38.15 (41.6-49.3)	7.8 (6-8.24)	6	LY	H	0	F	24	1
7	AVT-SAL/ALK-7	90.0 (71-102)	102.86 (117.5-148)	183.6 (66-111)	183.6 (110-397.2)	37.70 (40-52.13)	7.1 (6-7.69)	6	LY	H	0	F	13	1
8	AVT-SAL/ALK-8	94.0 (68-118.7)	107.39 (117-148.7)	194.5 (51-104)	194.5 (83-459.7)	32.78 (31.1-44.6)	7.6 (6-9.80)	6	Y	H	0	F	12	1
9	AVT-SAL/ALK-9	96.6 (81.5-115.7)	110.41 (119-150)	167.6 (66-109)	167.6 (99-345.7)	33.07 (29.8-47.8)	7.2 (6-8.39)	6	LY	H	20	F	12	1
10	AVT-SAL/ALK-10	88.8 (69-107.7)	101.51 (112.5-150.7)	214.9 (57-113)	214.9 96-662.7)	37.25 (39-47.4)	6.9 (5-8.50)	6	LY	H	0	Ts	24	1
11	AVT-SAL/ALK-11	84.1 (71.7-99.7)	96.08 (113.5-145.5)	216.0 (69-106)	216.0 (92-618)	36.61 (39-45.8)	7.7 (7-8.81)	6	Y	H	0	F	34	1
12	AVT-SAL/ALK-12	88.5 (74-104.7)	101.18 (111.5-149)	155.7 (54-91)	155.7 (58-404.2)	37.09 (37.1-51.9)	6.7 (5-8.42)	6	Y	H	5	F	13	1
13	AVT-SAL/ALK-13	87.4 (63-103)	99.92 (110.2-145)	198.7 (58-97)	198.7 (114-447.7)	35.70 (37-45.7)	8.1 (7-10.0)	6	LY	H	0	F	47	2
14	AVT-SAL/ALK-14	88.0 (71-100)	100.57 (115-146)	167.5 (71-101)	167.5 (80-396)	36.27 (37-46.3)	8.9 (7-11.34)	6	LY	H	0	F	24	1

**LB score highest among two locations Dalipnagar and CCSHAU, Hisar *Smut from Dalipnagar only and Aphid from IIWBR Hisar only*

INITIAL VARIETAL TRIAL (IRRIGATED TIMELY SOWN) – HULLESS BARLEY

(NWPZ, NEPZ and CEZ)

This trial was proposed at 14 locations scattered in NWPZ (6), NEPZ (3) and central zone (5) in plains. The results were received from 12 locations as the Gwalior center did not conduct the trial and the trial failed rejected by monitoring team at Kumarganj.

The trial consisted of 5 entries and 2 checks, namely Karan16 and PL891. The monitoring teams visited Hisar, Ludhiana, Durgapura, Modipuram and Pantnagar in NWPZ and Kanpur, Kumarganj and Varanasi in NEP zone. The trial conducted at Kumarganj location was rejected by monitoring team due to poor crop stand from grazing. In entries DWRB 223, UPB1086 and UPB1104 off types were reported in NWP zone, while entry DWRB227 was reported as segregating/ mixture.

The data from all the six locations were included for zonal pooled analysis in NWPZ, while data from Varanasi location were not included due to LSM in NEPZ. In case of CZ the results from the four locations were included for pooled analysis.

The location means for grain yield ranged from 31.57 q/ha (Ludhiana) to 56.46 q/ha (Durgapura) with 40.15 q/ha zonal mean in NWPZ. Entry DWRB223 ranked 1st in the NWP zone and was significantly superior than rest of the entries and checks. In case of NEPZ, at Kanpur location, check PL891 ranked first with 41.67 q/ha grain yield and was the only genotype in first non- significant group.

In case of central zone, the location mean ranged from 29.52 q/ha (Vijapur) to 54.96 q/ha (Morena) with 43.0 q/ha zonal mean. The entry UPB1104 ranked first with mean grain yield 46.8 q/ha followed by DWRB223 (45.9 q/ha) and check Karan 16 with mean grain yield 44.9 q/ha, respectively in the first non-significant group.

IVT-IRTS-NB **Grain Yield (q/ha)** **Rabi 2021-22**

Varieties	Entry code	NWPZ			NWPZ			NWPZ			NWPZ			NWPZ			NWPZ			**NWPZ**		
		Hisar			Karnal			Ludhiana			Durgapura			Modipuram			Pantnagar			**NWPZ**		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	**Yield**	**Rk**	**G**
DWRB223	IVT-IR-NB-5	40.94	1	1	49.81	1	1	23.55	6	0	62.80	2	1	58.88	1	1	40.33	3	0	**46.05**	1	1
DWRB227	IVT-IR-NB-1	35.02	4	0	29.92	6	0	27.90	5	0	57.07	4	0	43.09	6	0	43.06	2	0	**39.34**	4	0
KB2019	IVT-IR-NB-4	19.63	7	0	36.04	3	0	34.78	3	0	44.99	7	0	44.29	5	0	24.21	7	0	**33.99**	7	0
UPB1086	IVT-IR-NB-7	37.14	2	0	28.90	7	0	43.12	1	1	66.43	1	1	45.41	3	0	39.89	4	0	**43.48**	3	0
UPB1104	IVT-IR-NB-3	24.52	6	0	30.88	5	0	36.23	2	0	49.21	6	0	45.14	4	0	35.30	5	0	**36.88**	6	0
KARAN16©	IVT-IR-NB-2	33.12	5	0	39.17	2	0	23.19	7	0	56.76	5	0	42.42	7	0	30.34	6	0	**37.50**	5	0
PL891©	IVT-IR-NB-6	36.29	3	0	30.93	4	0	32.25	4	0	57.97	3	0	55.04	2	0	50.54	1	1	**43.84**	2	0
	G.M.	**32.38**			**35.09**			**31.57**			**56.46**			**47.75**			**37.67**			**40.15**		
	S.E.(M)	1.32			0.86			1.41			1.78			1.34			1.59			**0.58**		
	C.D.	3.25			2.11			3.46			4.37			3.29			3.92			**1.35**		
	C.V.	8.15			4.88			8.90			6.29			5.60			8.45					
	DOS	11-11-2021			11-11-2021			11-11-2021			10-11-2021			16.11.2021			18.11.2021					

Varieties	Entry Code	NEPZ			CZ			CZ			CZ			CZ			**Zonal**		
		Kanpur			Morena			Tikamgarh			Udaipur			Vijapur			**CZ**		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	**Yield**	**Rk**	**G**
DWRB223	IVT-IR-NB-5	32.61	5	0	50.91	5	0	46.49	4	0	54.17	1	1	32.16	3	0	**45.9**	**2**	**1**
DWRB227	IVT-IR-NB-1	33.33	4	0	60.98	3	1	37.68	6	0	37.36	5	0	30.49	4	0	**41.6**	**6**	**0**
KB2019	IVT-IR-NB-4	33.51	3	0	40.51	7	0	46.85	3	0	32.36	7	0	22.49	7	0	**35.6**	**7**	**0**
UPB1086	IVT-IR-NB-7	36.23	2	0	63.22	1	1	44.95	5	0	37.46	4	0	32.82	2	0	**44.6**	**4**	**0**
UPB1104	IVT-IR-NB-3	27.17	7	0	61.05	2	1	61.27	2	1	40.36	3	0	24.46	6	0	**46.8**	**1**	**1**
KARAN16©	IVT-IR-NB-2	28.99	6	0	58.91	4	1	61.49	1	1	32.7	6	0	26.54	5	0	**44.9**	**3**	**1**
PL891©	IVT-IR-NB-6	41.67	1	1	49.17	6	0	34.93	7	0	45.67	2	0	37.69	1	1	**41.9**	**5**	**0**
	G.M.	**33.36**			**54.96**			**47.66**			**40.01**			**29.52**			**43.0**		
	S.E.(M)	1.77			2.35			0.69			1.79			1.19			**0.815**		
	C.D.	4.36			5.79			1.69			4.41			2.92			**1.9**		
	C.V.	10.62			8.56			2.88			8.97			8.03					
	DOS	30-10-2021			24-11-2021			13-11-2021			30-11-2021			18-11-2021					

Summary of ancillary and disease data

IVT- Huskless (IRTS)– NWPZ *Rabi 2021-22*

Entry	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION							
	H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillering per meter Mean & Range	Str.Stn. Mean & Range	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	90 (74-98)	132 (125-135)	101 (86-118)	135 (78-180)	-	6	8.0 (6.7-9)	A	32.3 (25.1-38.5)	N					F		24	
DWRB227	91 (66-103)	130 (121-137)	107 (94-126)	126 (107-157)	-	6	8.6 (7.3-10)	A	33.2 (29.1-37.8)	N					F		35	
KB2019	100 (86-110)	137 (124-146)	113 (95-130)	134 (75-203)	-	2	10.1 (9-12)	A	43.9 (36.3-47.3)	N					F		24	
UP1086	94 (73-103)	131 (124-136)	116 (101-133)	105 (82-129)	-	6	9.6 (8-11)	A	36.6 (31-41.1)	N					F		24	
UP1104	101 (81-110)	135 (126-143)	101 (81-121)	160 (99-224)	-	6	8.9 (8-10.3)	A	33.2 (25.3-38.9)	N					F		35	
KARAN16 ©	94 (76-104)	132 (122-136)	112 (99-125)	137 (106-176)	-	6	7.2 (5.7-8.4)	A	33.9 (27.4-38.1)	N					F		35	
PL891©	91 (71-100)	130 (122-139)	102 (84-119)	108 (93-130)	-	2	9.1 (8-10.4)	A	35.8 (25.5-42.5)	N					F		24	

Summary of ancillary and disease data IVT- Huskless (IRTS)– NEPZ *Rabi 2021-22*

Entry	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION							
	H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillering per meter Mean & Range	Str.Stn. Mean & Range	Two/ Six row	Spike length (cm)	Grain Colour	1000 gw (g) Mean & Range	H/N	RUST			SMUT		Hel. Disease		Aphid
											YL	BR	BL	L (%)	C (%)	Spot (%)	Leaf Blight	
DWRB223	85 (84-86)	127 (123-131)	90.0 (85-95)	103.5 (103-104)	-	6	8.5 (8-9)	A	34.2 (31-37)	N					F		24	
DWRB227	79 (79)	125 (119-130)	89.0 (67-111)	93 (68-118)	-	6	9.5 (9-10)	A	34.8 (31-39)	N					Ts		36	
KB2019	95 (93-97)	129 (122-136)	104.5 (98-111)	119 (118-120)	-	2	9.5 (9-10)	A	41.6 (41-42)	N					Ts		24	
UP1086	86 (86)	128 (124-131)	95.5 (80-111)	77.5 (59-96)	-	6	8.5 (7-10)	A	39.3 (39-40)	N					R		0	
UP1104	94 (93-95)	130 (123-136)	81.5 (73-90)	102 (78-126)	-	6	8.5 (7-10)	A	32.8 (30-36)	N					Ts		12	
KARAN16 ©	89 (88-90)	128 (123-132)	91.0 (81-101)	88 (83-93)	-	6	7.5 (7-8)	A	36 (35-37)	N					F		13	
PL891©	84 (81-86)	126 (121-131)	97.0 (93-101)	84 (65-103)	-	2	9 (8-10)	A	38.7 (36-41)	N					TS		24	

Summary of ancillary and disease data

IVT- Huskless (IRTS)– CEN Zone ***Rabi 2021-22***

Entry	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION							
	H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillering per meter Mean & Range	Str.Stn Mean & Range	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	78 (67-86)	116 (104-132)	88 (77-103)	133 (56-217)	-	6	8 (7-9)	A	32 (29-39)	N	10MS	TMS					02	3
DWRB227	76 (55-90)	116 (101-125)	98 (77-116)	134 (74-212)	-	6	9 (8-12)	A	35 (31-40)	N	TMS	TR					0	4
KB2019	85 (81-88)	118 (110-130)	103 (86-110)	107 (61-139)	-	2	9 (7-10)	A	41 (36-47)	N	TR	0					0	5
UP1086	72 (55-86)	115 (100-127)	95 (77-116)	102 (58-139)	-	6	8 (8-9)	A	38 (36-43)	N	10MS	5MS					0	5
UP1104	80 (67-87)	116 (106-127)	100 (80-120)	126 (75-194)	-	2	9 (7-12)	A	36 (32-39)	N	TR	0					0	4
KARAN16 ©	80 (69-87)	115 (102-127)	93 (79-102)	96 (62-125)	-	6	8 (7-9)	A	36 (30-40)	N	TR	10 MS					0	4
PL891©	80 (68-89)	117 (106-129)	90 (74-95)	94 (50-116)	-	6	8 (6-11)	A	40 (38-42)	N	TMS	TR					01	4

ADVANCED VARIETAL TRIAL (RAINFED) NORTHERN HILLS ZONE

The advanced varietal trial (RFTS) for Northern Hills Zone was proposed as combined trial for normal as well as dual purpose barley evaluation in one common trial. In this trial, total four replications were proposed and out of which two replications (R_1 and R_3) as normal for grain purpose and rest of two replications (R_2 and R_4) as dual purpose i.e., cut for green fodder as well as grain yield from regenerated crop for evaluation under rainfed conditions of northern hills. In dual purpose replications, the green fodder cutting was to be done at ~70 days after sowing of the trial. The trial was proposed at 12 locations across Uttarakhand, Himachal Pradesh, and Jammu & Kashmir and was conducted by all centres. Wadura center did not exercise cut for green forage and all four replications were taken as normal grain crop.

The trial consisted of 23 genotypes including 18 test entries while the rest five were the check varieties for grain purpose (HBL113, BHS352, BHS400 and VLB118) and BHS380 for dual purpose.

The zonal monitoring of the trials was done at Almora and Majhera locations during the crop season and observed no problem of genetic purity at any centre, except in genotype BHS490 which require purification. Overall performance of the trial was very good at the monitored centres.

A. Performance in no cut Replications (Normal)

After location wise analysis, the data from Katrain (LSM and HCV) and Majhera (LSM) centres were not considered for zonal mean analysis. The results from rest 10 centres were in accordance and included in zonal pooled analysis. The location means for grain yield ranged from 18.10 q/ha (Gaza) to 42.24 q/ha (Malan) with 30.2 q/ha zonal mean across the centres. Entry UPB1103 ranked first with mean grain yield of 35.0 q/ha and entry VLB175 ranked second with grain yield 34.8 q/ha in the first non-significant group. The check VLB118 (33.10 q/ha) was revealed as best check rank third.

B. Performance in Dual purpose (cut replications) trial

Grain yield performance: Though the trial was proposed at 12 locations but due to some reasons the conduction of dual-purpose replications could not be implemented at Wadura centre. After analysis, the data from Berthein (HCV), Gaza (HCV), Kangra (LSM) and Majhera (LSM) centres were excluded for zonal mean analysis. In this way, the data of remaining seven centres were considered for zonal pooled analysis for grain yield after regeneration in cut treatment. The relevant data of accessory traits in cut replications are given in ancillary table. The location means for grain yield ranged from 12.65 q/ha (Katrain) to 32.68 q/ha (Bajaura) with 24.91 q/ha zonal mean across the centres. Amongst test entry, VLB175 ranked first with mean grain yield of 29.44 q/ha followed HBL876 at second rank with grain yield 29.25 q/ha, HBL875 ranked three with grain yield 27.71 q/ha, VLB177 ranked fourth with grain yield 27.7 q/ha and UPB1102 ranked fifth with grain yield 27.7 q/ha in the first non-significant group. However, dual purpose check BHS380 ranked thirteen with mean grain yield of 24.76 q/ha.

Green fodder yield performance

The cutting of green fodder was made after the 70 days sowing of the trial. The data of Almora, Gaza, Katrain, Majhera and Malan were not included in zonal pooled analysis on account of their LSM, while Khudwani was not included due to HCV. The location means for green fodder yield ranged from 25.8 q/ha (Bajaura) to 182.1 (Berthein) with 97.7 q/ha zonal mean across centres. Amongst genotypes, the entry HBL877 ranked first with mean green fodder yield of 117 q/ha and VLB175 ranked second with green fodder yield 116.1 q/ha. The best check HBL113 (110.3 q/ha) ranked third for green fodder yield followed by dual purpose check BHS380 (109.6 q/ha) and VLB118 (109.5 q/ha) in 1st NSG.

Taking in view of the overall performance for dual purpose i.e., grain yield and fodder yield together, a joint ranking of all the genotypes was developed and on the basis of this criteria the entry VLB175 ranked first with 1 and 2 rankings in grain (29.44 q/ha) and forage yield (116.1 q/ha) respectively. No other entry or check performed like VLB175 in both traits, thus it may be considered for further testing. Additionally, VLB175 ranked 2nd in normal trial for grain yield. Indicating its superiority for both normal and dual-purpose utilization.

IVT-RFTS-NH Zone **Grain Yield (q/ha)-No cut** **Rabi: 2021-22**

Varieties	Entry code	Almora			Bajaura			Berthein			Gaza			Kangra		
		GY-NC			GY-NC			GY-NC			GY-NC			GY-NC		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS488	AVT-RF-NHZ-21	34.66	10	0	30.84	22	0	20.69	23	0	21.95	6	0	27.21	10	0
BHS489	AVT-RF-NHZ-20	29.71	17	0	32.51	19	0	32.5	19	0	21.84	7	0	32.08	2	0
BHS490	AVT-RF-NHZ-11	36.47	3	1	36.27	14	1	45.42	4	1	18.32	10	0	21.69	19	0
BHS491	AVT-RF-NHZ-4	26.93	20	0	31.01	21	0	33.47	16	0	26.71	2	1	19.57	23	0
BHS492	AVT-RF-NHZ-6	25.97	22	0	32.36	20	0	42.5	6	1	17.6	12	0	31.43	3	0
HBL874	AVT-RF-NHZ-23	34.42	11	0	49.08	1	1	41.53	7	0	19.46	9	0	27.32	9	0
HBL875	AVT-RF-NHZ-16	34.42	11	0	36.31	13	1	36.11	12	0	12.01	19	0	31.25	5	0
HBL876	AVT-RF-NHZ-2	32.97	14	0	34.74	17	0	34.72	15	0	12.32	18	0	26	11	0
HBL877	AVT-RF-NHZ-12	25.12	23	0	35.88	15	1	28.13	22	0	9.73	22	0	29.07	6	0
HBL878	AVT-RF-NHZ-17	33.21	13	0	40.89	3	1	30.35	20	0	9.63	23	0	25.13	12	0
UPB1101	AVT-RF-NHZ-13	34.78	8	0	36.6	10	1	44.44	5	1	26.4	3	1	28.16	8	0
UPB1102	AVT-RF-NHZ-5	35.39	5	1	38.49	6	1	53.47	1	1	14.6	16	0	20.17	20	0
UPB1103	AVT-RF-NHZ-9	29.35	18	0	39.81	4	1	45.56	3	1	31.57	1	1	45.91	1	1
VLB175	AVT-RF-NHZ-1	34.9	7	0	35.05	16	0	51.11	2	1	16.25	14	0	19.91	21	0
VLB176	AVT-RF-NHZ-18	31.88	15	0	36.58	11	1	33.13	17	0	13.98	17	0	24.09	14	0
VLB177	AVT-RF-NHZ-3	37.56	1	1	38.47	7	1	34.86	14	0	17.6	12	0	19.67	22	0
VLB178	AVT-RF-NHZ-7	34.78	8	0	37.41	9	1	36.81	11	0	26.19	4	1	22.47	17	0
VLB179	AVT-RF-NHZ-14	27.54	19	0	36.38	12	1	37.08	10	0	17.7	11	0	23.27	16	0
BHS352©	AVT-RF-NHZ-10	35.02	6	0	43.83	2	1	40.83	8	0	10.25	21	0	28.6	7	0
BHS380©	AVT-RF-NHZ-22	36.35	4	1	38.55	5	1	32.71	18	0	23.4	5	0	24.59	13	0
BHS400 ©	AVT-RF-NHZ-8	26.21	21	0	30.62	23	0	35.83	13	0	10.87	20	0	23.42	15	0
HBL113©	AVT-RF-NHZ-19	31.88	15	0	37.76	8	1	38.19	9	0	21.84	8	0	22.25	18	0
VLB118©	AVT-RF-NHZ-15	36.84	2	1	34	18	0	30.28	21	0	16.15	15	0	31.32	4	0
	G.M.	**32.45**			**36.67**			**37.38**			**18.10**			**26.29**		
	S.E.(M)	1.00			3.31			4.83			2.35			1.26		
	C.D.	2.43			8.04			11.73			5.70			3.06		
	C.V.	4.35			12.77			18.28			18.33			6.79		
	DOS	27-10-2021			2/11/2021			02.11.2021			29-10-2021			03.11.2021		

IVT-RFTS-NH Zone **Grain Yield (q/ha)-No cut** **Rabi: 2021-22**

Varieties	Entry code	Khudwani			Malan			Rajauri			Shimla			Wadura			NHZ		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS488	AVT-RF-NHZ-21	22.96	8	0	39.44	16	0	35.71	15	0	18.48	19	0	24.43	13	0	**27.60**	19	0
BHS489	AVT-RF-NHZ-20	21.33	11	0	44.31	9	0	48.37	8	0	18.17	22	0	26.97	7	0	**30.80**	11	0
BHS490	AVT-RF-NHZ-11	12.86	23	0	36.39	21	0	35.87	14	0	23.60	6	0	22.26	17	0	**28.90**	15	0
BHS491	AVT-RF-NHZ-4	29.44	3	0	43.37	11	0	52.22	6	0	23.37	7	0	28.05	4	0	**31.40**	8	0
BHS492	AVT-RF-NHZ-6	14.80	20	0	33.80	23	0	28.40	19	0	18.79	17	0	18.79	22	0	**26.40**	22	0
HBL874	AVT-RF-NHZ-23	21.43	9	0	43.43	10	0	22.83	21	0	19.57	14	0	22.26	17	0	**30.10**	13	0
HBL875	AVT-RF-NHZ-16	35.92	1	1	49.12	2	1	36.02	13	0	20.96	8	0	22.83	16	0	**31.50**	7	0
HBL876	AVT-RF-NHZ-2	19.39	14	0	42.24	12	0	58.88	3	0	25.93	2	0	25.26	12	0	**31.20**	9	0
HBL877	AVT-RF-NHZ-12	15.51	19	0	47.41	4	0	45.26	11	0	27.02	1	1	23.81	14	0	**28.70**	17	0
HBL878	AVT-RF-NHZ-17	16.73	16	0	46.89	6	0	26.09	20	0	18.79	17	0	27.33	6	0	**27.50**	20	0
UPB1101	AVT-RF-NHZ-13	16.43	17	0	47.36	5	0	30.43	18	0	19.25	15	0	26.19	10	0	**31.00**	10	0
UPB1102	AVT-RF-NHZ-5	21.43	9	0	48.14	3	1	48.54	7	0	23.91	4	0	17.13	23	0	**32.10**	4	0
UPB1103	AVT-RF-NHZ-9	23.98	6	0	37.84	18	0	55.43	5	0	19.10	16	0	21.07	20	0	**35.00**	1	1
VLB175	AVT-RF-NHZ-1	23.88	7	0	52.38	1	1	63.42	2	1	20.34	10	0	30.59	2	1	**34.80**	2	1
VLB176	AVT-RF-NHZ-18	20.61	12	0	45.60	8	0	64.83	1	1	18.48	19	0	26.50	9	0	**31.60**	6	0
VLB177	AVT-RF-NHZ-3	27.96	4	0	46.43	7	0	48.37	8	0	19.72	13	0	28.73	3	0	**31.90**	5	0
VLB178	AVT-RF-NHZ-7	18.78	15	0	34.68	22	0	21.68	23	0	18.48	19	0	22.26	17	0	**27.40**	21	0
VLB179	AVT-RF-NHZ-14	20.41	13	0	37.53	19	0	37.55	12	0	25.62	3	0	23.65	15	0	**28.70**	18	0
BHS352©	AVT-RF-NHZ-10	13.16	22	0	39.86	14	0	48.37	8	0	19.88	12	0	25.98	11	0	**30.60**	12	0
BHS380©	AVT-RF-NHZ-22	14.49	21	0	39.54	15	0	33.07	17	0	18.01	23	0	26.92	8	0	**28.80**	16	0
BHS400 ©	AVT-RF-NHZ-8	25.77	5	0	36.59	20	0	22.13	22	0	20.50	9	0	19.82	21	0	**25.20**	23	0
HBL113©	AVT-RF-NHZ-19	15.61	18	0	40.22	13	0	33.54	16	0	23.91	4	0	27.69	5	0	**29.30**	14	0
VLB118©	AVT-RF-NHZ-15	34.80	2	1	38.98	17	0	56.55	4	0	20.16	11	0	31.94	1	1	**33.10**	3	0
	G.M.	**21.20**			**42.24**			**41.46**			**20.96**			**24.80**			**30.2**		
	S.E.(M)	1.43			2.02			1.59			0.42			1.05			**0.723**		
	C.D.	3.48			4.90			3.85			1.03			2.97			**1.7**		
	C.V.	9.56			6.76			5.41			2.86			8.48					
	DOS	17-11-2021			07.11.21			24.11.2021			10.11.2021			16.10.2021					

Data from Katrain (LSM & HCV), Majhera (LSM) were not included in zonal mean

IVT-RFTS-NH Zone **Grain Yield (q/ha)- Cut treatment** **Rabi: 2021-22**

Varieties	Entry code	Almora			Bajaura			Katrain			Khudwani			Malan			Rajauri			Shimla			NHZ		
		GY-cut			GY-Cut			GY-Cut			GY-Cut			GY-Cut			GY-Cut			GY-Cut			GY-Cut		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS488	AVT-RF-NHZ-21	34.54	6	0	26.97	19	0	16.27	2	1	17.81	6	0	28.88	15	0	27.02	17	0	17	23	0	**24.07**	16	0
BHS489	AVT-RF-NHZ-20	30.92	16	0	34.27	8	1	14.45	11	1	14.64	13	0	31.06	12	0	34.64	10	0	17.39	20	0	**25.34**	10	0
BHS490	AVT-RF-NHZ-11	38.65	1	1	39.59	1	1	15.86	4	1	8.67	23	0	31.16	11	0	28.42	14	0	20.34	7	0	**26.1**	9	0
BHS491	AVT-RF-NHZ-4	24.76	20	0	24.89	22	0	8.65	20	0	23.98	2	1	45.03	2	1	36.37	8	0	20.81	5	0	**26.35**	8	0
BHS492	AVT-RF-NHZ-6	22.95	23	0	24.31	23	0	5.86	23	0	10.77	21	0	25.83	19	0	21.55	19	0	17.7	15	0	**18.42**	23	0
HBL874	AVT-RF-NHZ-23	32.85	12	0	33.69	11	1	10.58	17	0	15.71	12	0	29.81	13	0	18.32	21	0	18.09	11	0	**22.72**	18	0
HBL875	AVT-RF-NHZ-16	33.94	8	0	39.36	2	1	14.91	8	1	18.42	5	0	39.86	3	0	28.42	14	0	19.1	8	0	**27.71**	3	1
HBL876	AVT-RF-NHZ-2	32.97	11	0	34.24	9	1	15.45	6	1	17.04	8	0	33.54	7	0	47.56	2	1	23.91	2	1	**29.25**	2	1
HBL877	AVT-RF-NHZ-12	24.4	21	0	26.69	20	0	10.5	18	0	11.53	17	0	21.95	22	0	31.54	11	0	24.84	1	1	**21.63**	19	0
HBL878	AVT-RF-NHZ-17	31.64	13	0	34.72	7	1	7.83	22	0	11.43	19	0	28.11	17	0	19.39	20	0	17.7	15	0	**21.55**	21	0
UPB1101	AVT-RF-NHZ-13	34.3	7	0	37.56	3	1	10.39	19	0	11.53	17	0	28.67	16	0	25.78	18	0	17.7	15	0	**23.7**	17	0
UPB1102	AVT-RF-NHZ-5	31.64	13	0	32.71	13	1	15.88	3	1	15.82	11	0	37.99	4	0	37.93	5	0	21.89	4	0	**27.7**	5	1
UPB1103	AVT-RF-NHZ-9	25	19	0	37.41	4	1	10.85	15	0	17.35	7	0	29.14	14	0	37.89	6	0	17.93	12	0	**25.08**	12	0
VLB175	AVT-RF-NHZ-1	36.59	4	1	26.12	21	0	12.13	14	1	17.04	8	0	47.62	1	1	48.71	1	1	17.86	14	0	**29.44**	1	1
VLB176	AVT-RF-NHZ-18	33.7	9	0	32.63	14	1	10.79	16	0	16.84	10	0	37.94	5	0	43.06	3	0	17.39	20	0	**27.48**	6	0
VLB177	AVT-RF-NHZ-3	37.68	2	1	33.02	12	1	13.33	12	1	19.9	3	0	34.94	6	0	35.93	9	0	19.1	8	0	**27.7**	4	1
VLB178	AVT-RF-NHZ-7	31.4	15	0	35.92	6	1	12.73	13	1	13.27	16	0	21.79	23	0	12.28	23	0	17.7	15	0	**20.73**	22	0
VLB179	AVT-RF-NHZ-14	30.31	18	0	33.81	10	1	8.03	21	0	13.37	15	0	31.52	9	0	31.44	12	0	23.14	3	0	**24.52**	14	0
BHS352©	AVT-RF-NHZ-10	33.33	10	0	30.27	18	1	16.47	1	1	9.74	22	0	31.63	8	0	37.48	7	0	18.17	10	0	**25.3**	11	0
BHS380©	AVT-RF-NHZ-22	37.32	3	1	36.25	5	1	15.57	5	1	14.49	14	0	25	20	0	27.48	16	0	17.24	22	0	**24.76**	13	0
BHS400 ©	AVT-RF-NHZ-8	23.31	22	0	32.03	17	1	14.68	9	1	19.69	4	0	27.69	18	0	16.06	22	0	17.93	12	0	**21.63**	20	0
HBL113©	AVT-RF-NHZ-19	30.68	17	0	32.61	15	1	14.65	10	1	10.92	20	0	31.52	9	0	29.66	13	0	20.5	6	0	**24.36**	15	0
VLB118©	AVT-RF-NHZ-15	35.39	5	0	32.55	16	1	15.11	7	1	25.92	1	1	24.43	21	0	39.98	4	0	17.55	19	0	**27.28**	7	0
G.M.		**31.66**			**32.68**			**12.65**			**15.47**			**31.53**			**31.17**			**19.17**			24.91		
S.E.(M)		0.87			4.42			2.25			1.62			1.77			0.98			0.43			**0.81**		
C.D.		2.12			10.72			5.47			3.94			4.29			2.38			1.03			**1.89**		
C.V.		3.89			19.11			25.20			14.81			7.93			4.45			3.14					
DOS		27-10-2021			2/11/2021			7/11/2021			17-11-2021			07.11.21			24.11.2021			10.11.2021					

Data from Berthein (HCV), Gaza (HCV), Kangra (LSM), Majhera (LSM) were not included in zonal mean

IVT-RFTS-NH Zone **Forage Yield (q/ha)** **Rabi: 2021-22**

Varieties	Entry code	Bajaura			Berthein			Kangra			Rajouri			Shimla			NHZ		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS488	AVT-RF-NHZ-21	24.3	15	0	206.3	9	0	162.1	14	1	57.5	20	0	36.5	11	0	**97.3**	13	0
BHS489	AVT-RF-NHZ-20	23.0	18	0	171.6	16	0	149.2	17	0	99.4	9	0	32.0	21	0	**95.0**	15	0
BHS490	AVT-RF-NHZ-11	25.7	11	0	237.6	4	1	138.3	20	0	77.6	16	0	39.4	5	0	**103.7**	11	0
BHS491	AVT-RF-NHZ-4	22.3	19	0	185.4	15	0	102.8	23	0	88.5	13	0	34.0	15	0	**86.6**	19	0
BHS492	AVT-RF-NHZ-6	24.5	14	0	196.3	14	0	116.0	22	0	85.4	14	0	32.1	20	0	**90.9**	18	0
HBL874	AVT-RF-NHZ-23	19.2	23	0	169.4	17	0	179.7	3	1	51.2	23	0	35.2	13	0	**91.0**	17	0
HBL875	AVT-RF-NHZ-16	31.1	4	1	31.0	23	0	168.7	7	1	104.0	5	1	39.0	8	0	**74.7**	22	0
HBL876	AVT-RF-NHZ-2	25.6	12	0	201.6	11	0	158.2	15	0	102.5	6	0	39.4	5	0	**105.5**	9	0
HBL877	AVT-RF-NHZ-12	34.4	1	1	267.2	2	1	168.7	6	1	74.5	17	0	40.2	2	0	**117.0**	1	1
HBL878	AVT-RF-NHZ-17	28.3	5	0	164.2	19	0	116.5	21	0	57.5	20	0	39.1	7	0	**81.1**	20	0
UPB1101	AVT-RF-NHZ-13	20.5	22	0	152.6	20	0	151.3	16	0	99.4	9	0	31.7	22	0	**91.1**	16	0
UPB1102	AVT-RF-NHZ-5	21.6	21	0	197.6	13	0	168.0	8	1	99.4	9	0	39.8	3	0	**105.3**	10	0
UPB1103	AVT-RF-NHZ-9	31.5	3	1	213.8	6	0	162.2	13	1	111.8	2	1	28.0	23	0	**109.4**	6	1
VLB175	AVT-RF-NHZ-1	26.6	8	0	237.8	3	1	167.9	9	1	108.7	3	1	39.6	4	0	**116.1**	2	1
VLB176	AVT-RF-NHZ-18	25.9	10	0	165.7	18	0	174.5	5	1	102.5	6	0	32.5	19	0	**100.2**	12	0
VLB177	AVT-RF-NHZ-3	27.8	6	0	200.1	12	0	183.0	1	1	90.1	12	0	37.7	10	0	**107.7**	8	1
VLB178	AVT-RF-NHZ-7	27.5	7	0	206.9	8	0	165.5	10	1	108.7	3	1	35.6	12	0	**108.8**	7	1
VLB179	AVT-RF-NHZ-14	32.0	2	1	31.2	22	0	164.8	12	1	116.5	1	1	43.5	1	1	**77.6**	21	0
BHS352©	AVT-RF-NHZ-10	25.5	13	0	31.7	21	0	165.2	11	1	57.5	20	0	33.7	16	0	**62.7**	23	0
BHS380©	AVT-RF-NHZ-22	24.2	16	0	228.6	5	1	177.3	4	1	79.2	15	0	38.5	9	0	**109.6**	4	1
BHS400 ©	AVT-RF-NHZ-8	22.1	20	0	202.6	10	0	148.0	18	0	74.5	17	0	34.2	14	0	**96.3**	14	0
HBL113©	AVT-RF-NHZ-19	24.1	17	0	213.3	7	0	179.9	2	1	100.9	8	0	33.1	18	0	**110.3**	3	1
VLB118©	AVT-RF-NHZ-15	25.9	9	0	275.3	1	1	141.5	19	0	71.4	19	0	33.2	17	0	**109.5**	5	1
	G.M.	**25.8**			**182.1**			**156.9**			**87.8**			**36.0**			**97.7**		
	S.E.(M)	2.4			21.8			9.5			5.2			1.2			**4.9**		
	C.D.	5.8			52.9			23.0			12.7			2.8			**11.5**		
	C.V.	13.0			16.9			8.5			8.4			4.6					
	DOS	02.11.2021			02.11.2021			03.11.2021			24.11.2021			10.11.2021					

Data from Almora (LSM), Gaza (LSM), Katrain (LSM), Khudwani (HCV), Malan (LSM) and Majhera (LSM) were not included in zonal mean

Summary of ancillary and disease data

IVT- DUAL PURPOSE – (RF-TS)-NHZ -No cut trial

Rabi 2021-22

Entry	Code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION							
		H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillering per meter Mean & Range	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	
BHS488	AVT-RF-NHZ-21	129 (108-156)	177 (155-221)	82 (66-102)	101 (54-171)	6	6.9 (6.0-7.5)	LY	39 (33-51)	H	0							
BHS489	AVT-RF-NHZ-20	128 (104-159)	176 (153-214)	83 (66-96)	97 (38-180)	6	7.1 (6.0-8.5)	Y	43 (30-50)	N	0							
BHS490	AVT-RF-NHZ-11	128 (110-157)	175 (156-211)	86 (66-110)	103 (45-179)	6	6.8 (5.5-8.0)	LY	40 (33-49)	H	0							
BHS491	AVT-RF-NHZ-4	133 (121-160)	178 (159-218)	80 (63-100)	129 (71-198)	6	8.5 (7.7-9.0)	LY	36 (27-51)	H	0							
BHS492	AVT-RF-NHZ-6	128 (102-159)	175 (153-221)	77 (61-96)	96 (41-164)	2	7.9 (7.0-9.0)	Y	38 (28-48)	H	TS							
HBL874	AVT-RF-NHZ-23	129 (111-157)	176 (153-211)	82 (63-96)	115 (68-176)	6	6.6 (5.7-7.5)	Y	42 (34-48)	H	30S							
HBL875	AVT-RF-NHZ-16	128 (104-157)	174 (151-211)	88 (70-102)	101 (61-168)	6	7.8 (7.0-9.0)	LY	44 (35-53)	H	0							
HBL876	AVT-RF-NHZ-2	131 (113-159)	177 (159-221)	91 (69-111)	129 (80-224)	6	8.8 (7.0-10.0)	Y	47 (38-58)	H	5S							
HBL877	AVT-RF-NHZ-12	132 (113-159)	176 (152-226)	89 (66-110)	87 (58-134)	6	8.8 (7.6-10.0)	A	36 (28-48)	H	0							
HBL878	AVT-RF-NHZ-17	131 (111-159)	178 (154-214)	88 (65-105)	94 (44-150)	6	7.5 (6.5-8.6)	LY	39 (32-48)	H	0							
UPB1101	AVT-RF-NHZ-13	131 (111-157)	177 (154-224)	85 (64-103)	92 (42-141)	6	7.3 (6.7-8.0)	LY	42 (36-50)	H	0							
UPB1102	AVT-RF-NHZ-5	127 (105-156)	174 (155-211)	83 (63-103)	99 (51-166)	6	7.2 (6.2-9.0)	Y	41 (36-48)	H	5S							
UPB1103	AVT-RF-NHZ-9	133 (117-161)	177 (161-214)	81 (62-98)	147 (52-296)	6	8.0 (7.2-9.0)	LY	38 (31-51)	H	5S							

IVT- DUAL PURPOSE – (RF-TS)-NHZ Summary of ancillary and disease data *Rabi 2021-22*

Entry	Code	AGRONOMIC CHARACTERS							GRAIN CHARACTERISTICS			DISEASE REACTION							
		H. days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillering / meter Mean & Range	Str. Stn. Mean & Range	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	
VLB175	AVT-RF-NHZ-1	130 (114-157)	176 (154-216)	87 (65-108)	121 (58-184)		6	6.7 (4.7-9.5)	Y	39 (31-58)	H	0							
VLB176	AVT-RF-NHZ-18	131 (112-157)	177 (154-216)	86 (67-105)	102 (50-198)		6	6.3 (6.0-7.2)	LY	38 (31-45)	H	0							
VLB177	AVT-RF-NHZ-3	128 (104-159)	174 (152-213)	90 (70-105)	95 (49-152)		6	7.9 (7.5-8.2)	Y	41 (37-47)	H	0							
VLB178	AVT-RF-NHZ-7	129 (103-159)	176 (151-224)	79 (61-93)	112 (50-177)		6	6.3 (5.5-7.5)	Ly	39 (28-53)	H	10S							
VLB179	AVT-RF-NHZ-14	130 (112-157)	174 (152-214)	94 (69-113)	103 (75-164)		6	9.2 (8.0-11.0)	A	37 (26-50)	N	5MR							
BHS352 ©	AVT-RF-NHZ-10	130 (110-156)	175 (156-211)	86 (58-103)	107 (50-158)		6	7.4 (6.0-9.0)	A	38 (31-46)	N	0							
BHS380 ©	AVT-RF-NHZ-22	129 (107-159)	176 (152-211)	86 (68-101)	105 (64-153)		6	6.8 (5.8-8.0)	Y	42 (34-51)	H	0							
BHS400 ©	AVT-RF-NHZ-8	131 (113-155)	177 (157-226)	81 (61-99)	112 (65-194)		6	6.5 (5.6-7.0)	Y	35 (29-45)	H	0							
HBL113 ©	AVT-RF-NHZ-19	128 (102-158)	176 (152-221)	84 (67-105)	91 (45-172)		2	6.6 (6.0-7.3)	Y	38 (28-50)	H	0							
VLB118©	AVT-RF-NHZ-15	130 (112-159)	178 (154-212)	87 (67-105)	93 (60-149)		6	7.4 (4.5-9.0)	LY	42 (35-48)	H	0							

Trials Rejected and their reasons

Rejected Trials- AVT-IR-FB- NEP Zone

Varieties	**Kalyani**		
	Yield	**Rk**	**G**
AVT-IRFB-NEP-1	28.91	1	1
AVT-IRFB-NEP-2	27.72	2	1
AVT-IRFB-NEP-3	25.00	3	0
AVT-IRFB-NEP-4	24.57	4	0
AVT-IRFB-NEP-5	24.24	6	0
AVT-IRFB-NEP-6	24.35	5	0
G.M.	**25.80**	LSM	
S.E.(M)	0.92		
C.D.	2.28		
C.V.	7.12		
DOS	**10.12.21**	**Late sowing**	

Rejected Trials- IVT-IR-FB- NEP Zone

Variety	**Kalyani**			**Variety**	**Kalyani**		
	Yield	**RK**	**G**		**Yield**	**RK**	**G**
IVT-IRFB-1	35.87	2	1	IVT-IRFB-16	32.61	17	0
IVT-IRFB-2	35.33	5	1	IVT-IRFB-17	35.33	5	1
IVT-IRFB-3	35.33	5	1	IVT-IRFB-18	33.70	14	0
IVT-IRFB-4	35.87	2	1	IVT-IRFB-19	31.52	21	0
IVT-IRFB-5	33.15	16	0	IVT-IRFB-20	32.61	17	0
IVT-IRFB-6	33.70	14	0	IVT-IRFB-21	34.24	13	0
IVT-IRFB-7	32.07	19	0	IVT-IRFB-22	34.78	10	1
IVT-IRFB-8	34.78	10	1	IVT-IRFB-23	26.63	24	0
IVT-IRFB-9	30.98	22	0	IVT-IRFB-24	35.87	2	1
IVT-IRFB-10	34.78	10	1	IVT-IRFB-25	36.41	1	1
IVT-IRFB-11	35.33	5	1	Mean =	33.28		
IVT-IRFB-12	27.17	23	0	S.E. m =	0.71		
IVT-IRFB-13	35.33	5	1	C.D. =	1.71		
IVT-IRFB-14	32.07	19	0	C.V. =	3.01		
IVT-IRFB-15	26.63	24	0	D.O.S. =	**10.12.21**	**Late sowing**	

Rejected Trials-

IVT-RF-FB- NEP Zone				IVT-IRTS-NB- NEP Zone			
Entry	**Sabour**			**Entry**	**BHU Varanasi**		
	Yield	**Rk**	**G**		**Yield**	**Rk**	**G**
IVT-RF- NEPZ-1	16.88	10	0	IVT-IR-NB-1	13.87	7	0
IVT-RF- NEPZ-2	2.96	12	0	IVT-IR-NB-2	17.14	5	0
IVT-RF- NEPZ-3	22.43	7	0	IVT-IR-NB-3	15.60	6	0
IVT-RF- NEPZ-4	32.58	2	1	IVT-IR-NB-4	17.19	4	0
IVT-RF- NEPZ-5	1.93	13	0	IVT-IR-NB-5	19.27	2	0
IVT-RF- NEPZ-6	20.92	9	0	IVT-IR-NB-6	17.89	3	0
IVT-RF- NEPZ-7	33.57	1	1	IVT-IR-NB-7	21.06	1	1
IVT-RF- NEPZ-8	28.96	4	1	G.M.	**17.43**	**LSM**	
IVT-RF- NEPZ-9	28.77	6	1	S.E.(M)	0.56		
IVT-RF- NEPZ-10	28.89	5	1	C.D.	1.38		
IVT-RF- NEPZ-11	6.97	11	0	C.V.	6.41		
IVT-RF- NEPZ-12	31.19	3	1	DOS	08.11.21		
IVT-RF- NEPZ-13	21.44	8	0				
G.M.	21.35						
S.E.(M)	4.03						
C.D.	9.62						
C.V.	**37.74**	**High CV**					
DOS	10.11.21						

Rejected Trials- AVT-RF-NHZ- GY-No Cut

Varieties	Entry code	Katrain (GY-NC)			Majhera (GY-NC)		
		Yield	Rk	G	Yield	Rk	G
BHS488	AVT-RF-NHZ-21	18.47	1	1	15.58	1	1
BHS489	AVT-RF-NHZ-20	15.78	4	1	10.78	6	0
BHS490	AVT-RF-NHZ-11	14.84	10	1	10.48	7	0
BHS491	AVT-RF-NHZ-4	12.40	14	1	9.50	13	0
BHS492	AVT-RF-NHZ-6	11.49	17	1	6.70	23	0
HBL874	AVT-RF-NHZ-23	9.21	21	0	7.52	19	0
HBL875	AVT-RF-NHZ-16	15.61	5	1	13.55	3	1
HBL876	AVT-RF-NHZ-2	14.99	9	1	9.58	11	0
HBL877	AVT-RF-NHZ-12	11.84	16	1	10.25	9	0
HBL878	AVT-RF-NHZ-17	14.18	12	1	9.02	16	0
UPB1101	AVT-RF-NHZ-13	11.08	18	1	7.76	18	0
UPB1102	AVT-RF-NHZ-5	15.20	8	1	11.95	4	1
UPB1103	AVT-RF-NHZ-9	16.29	3	1	9.47	14	0
VLB175	AVT-RF-NHZ-1	15.26	7	1	9.19	15	0
VLB176	AVT-RF-NHZ-18	12.16	15	1	10.27	8	0
VLB177	AVT-RF-NHZ-3	11.06	19	1	13.81	2	1
VLB178	AVT-RF-NHZ-7	17.27	2	1	6.93	22	0
VLB179	AVT-RF-NHZ-14	10.37	20	1	11.49	5	1
BHS352©	AVT-RF-NHZ-10	6.96	22	0	7.31	21	0
BHS380©	AVT-RF-NHZ-22	14.51	11	1	9.53	12	0
BHS400 ©	AVT-RF-NHZ-8	13.44	13	1	7.52	20	0
HBL113©	AVT-RF-NHZ-19	15.55	6	1	10.05	10	0
VLB118©	AVT-RF-NHZ-15	4.50	23	0	8.17	17	0
	G.M.	**13.15**			**9.84**		
	S.E.(M)	2.88			1.07		
	C.D.	7.00			2.59		
	C.V.	**31.00**			15.32		

Rejected Trials- ***AVT-RF-NHZ-GY cut***

Varieties	Entry code	Berthein (GY-Cut)			Gaza (GY-Cut)			Kangra (GY-Cut)			Majhera (GY-Cut)		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS488	AVT-RF-NHZ-21	19.79	8	1	9.21	20	0	3.11	11	0	6.34	12	0
BHS489	AVT-RF-NHZ-20	19.44	10	1	10.66	17	0	3.55	6	0	9.03	2	1
BHS490	AVT-RF-NHZ-11	14.44	14	0	13.66	10	0	3.96	2	1	6.10	15	0
BHS491	AVT-RF-NHZ-4	19.31	11	1	12.94	12	0	2.16	23	0	4.57	22	0
BHS492	AVT-RF-NHZ-6	15.63	13	0	8.59	21	0	2.30	21	0	5.53	18	0
HBL874	AVT-RF-NHZ-23	20.00	7	1	9.73	19	0	2.92	14	0	5.45	19	0
HBL875	AVT-RF-NHZ-16	4.86	22	0	17.08	5	1	3.61	4	0	7.28	4	0
HBL876	AVT-RF-NHZ-2	26.18	2	1	23.29	1	1	3.58	5	0	5.37	20	0
HBL877	AVT-RF-NHZ-12	11.11	18	0	12.11	15	0	3.44	7	0	6.40	10	0
HBL878	AVT-RF-NHZ-17	2.29	23	0	6.42	23	0	3.42	8	0	4.38	23	0
UPB1101	AVT-RF-NHZ-13	19.65	9	1	8.07	22	0	3.31	9	0	7.07	5	0
UPB1102	AVT-RF-NHZ-5	27.08	1	1	14.08	8	0	2.46	20	0	9.13	1	1
UPB1103	AVT-RF-NHZ-9	20.35	4	1	16.98	6	1	2.57	18	0	6.46	9	0
VLB175	AVT-RF-NHZ-1	21.39	3	1	13.77	9	0	4.28	1	1	5.72	16	0
VLB176	AVT-RF-NHZ-18	5.83	21	0	20.08	3	1	3.03	13	0	6.30	13	0
VLB177	AVT-RF-NHZ-3	20.07	6	1	19.51	4	1	2.20	22	0	6.30	13	0
VLB178	AVT-RF-NHZ-7	20.21	5	1	15.32	7	0	3.66	3	0	6.97	6	0
VLB179	AVT-RF-NHZ-14	11.39	17	0	13.46	11	0	3.17	10	0	7.30	3	0
BHS352©	AVT-RF-NHZ-10	14.03	15	0	12.42	13	0	2.66	17	0	5.25	21	0
BHS380©	AVT-RF-NHZ-22	17.36	12	0	20.50	2	1	2.79	16	0	6.88	8	0
BHS400©	AVT-RF-NHZ-8	12.29	16	0	11.18	16	0	2.47	19	0	6.90	7	0
HBL113©	AVT-RF-NHZ-19	6.88	20	0	12.22	14	0	2.86	15	0	6.40	11	0
VLB118©	AVT-RF-NHZ-15	10.83	19	0	9.83	18	0	3.10	12	0	5.71	17	0
	G.M.	15.67			13.53			**3.07**			**6.38**		
	S.E.(M)	3.37			2.69			0.16			0.59		
	C.D.	8.19			6.53			0.38			1.42		
	C.V.	**30.43**			**28.10**			7.22			12.99		
	DOS	02.11.2021			29-10-2022			3/11/2021			02.11.2021		

Rejected Trials- ***AVT-RF-NHZ-FY cut***

Varieties	Almora Forage Yield			Gaza Forage Yield			Katrain Forage Yield			Khudwani Forage Yield			Majhera Forage Yield			Malan Forage Yield		
	Yield	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**
BHS488	7.67	15	0	5.55	17	0	5.43	17	0	60.87	19	0	12.42	7	0	5.55	17	0
BHS489	8.33	12	0	5.62	16	0	7.12	8	0	78.67	12	1	18.63	2	1	5.62	16	0
BHS490	10.63	8	0	7.86	10	0	5.54	15	0	85.92	7	1	10.09	10	0	7.86	10	0
BHS491	4.59	20	0	5.32	18	0	6.83	9	0	57.22	20	0	7.92	18	0	5.32	18	0
BHS492	8.82	10	0	4.45	22	0	6.52	10	0	101.60	3	1	13.20	6	0	4.45	22	0
HBL874	7.61	16	0	2.85	23	0	2.90	23	0	34.68	23	0	9.32	12	0	2.85	23	0
HBL875	15.40	1	1	9.83	3	1	7.25	7	0	82.82	9	1	11.64	8	0	9.83	3	1
HBL876	12.68	4	1	8.60	6	0	5.38	18	0	69.36	16	1	14.75	4	0	8.60	6	0
HBL877	13.10	3	1	6.51	13	0	8.80	3	0	53.83	21	0	9.16	14	0	6.51	13	0
HBL878	8.27	13	0	5.08	19	0	4.50	22	0	77.64	14	1	7.92	18	0	5.08	19	0
UPB1101	3.80	21	0	4.69	21	0	8.33	4	0	62.58	18	0	7.76	20	0	4.69	21	0
UPB1102	7.37	17	0	8.68	5	0	11.59	1	1	92.65	5	1	6.83	22	0	8.68	5	0
UPB1103	2.96	22	0	8.11	7	0	9.32	2	1	68.17	17	1	6.99	21	0	8.11	7	0
VLB175	11.17	6	0	6.42	14	0	7.35	6	0	75.57	15	1	17.24	3	0	6.42	14	0
VLB176	11.35	5	0	6.93	12	0	5.49	16	0	51.76	22	0	8.54	16	0	6.93	12	0
VLB177	7.37	18	0	10.94	1	1	4.73	21	0	85.71	8	1	10.09	10	0	10.94	1	1
VLB178	7.79	14	0	8.05	8	0	7.40	5	0	118.01	1	1	14.75	4	0	8.05	8	0
VLB179	14.37	2	1	8.88	4	0	6.37	12	0	99.38	4	1	20.96	1	1	8.88	4	0
BHS352©	8.45	11	0	7.93	9	0	6.06	13	0	79.71	11	1	9.32	12	0	7.93	9	0
BHS380©	7.00	19	0	9.86	2	1	6.42	11	0	78.67	12	1	8.54	16	0	9.86	2	1
BHS400 ©	2.72	23	0	4.81	20	0	4.97	19	0	103.52	2	1	8.70	15	0	4.81	20	0
HBL113©	10.39	9	0	5.70	15	0	4.76	20	0	86.96	6	1	10.87	9	0	5.70	15	0
VLB118©	10.99	7	0	7.46	11	0	5.59	14	0	81.07	10	1	6.37	23	0	7.46	11	0
G.M.	**8.82**			**6.96**			**6.46**			77.67			**10.96**			**6.96**		
S.E.(M)	1.01			0.78			0.97			20.55			1.13			0.78		
C.D.	2.45			1.90			2.36			49.89			2.74			1.90		
C.V.	16.17			15.90			21.30			**37.41**			14.56			15.90		
DOS	27-10-2021			29-10-2022			7/11/2021			17-11-2021			02.11.2021			07.11.21		

International Trials and Nurseries

During *rabi* 2021-22 season two international trials and one international germplasm nurseries were supplied from ICARDA. Each trial (IBYT-FFM and IBYT-ASA) comprised of 24 test entries and checks including one national check in each trial. The nursery IBON-2022 comprised each of 112 test entries and 3-checks (repeated 7-times) and one Indian check was also included locally. In total 161 genotypes were received from ICARDA. Each of these international trials were evaluated at four different selected locations including Karnal and the nursery (IBON) was conducted at 5 centers. Due to the pandemic of COVID-19 the Field Day which is organized every year to give opportunity to barley breeders of NARS to select material from these nurseries as to cater their local needs was organized as one week.

In addition, EIBGN (45 entries) was supplied to 12 different locations as a set of 75 entries including six checks repeated five times at each location was supplied to twelve locations in NWPZ (Chatha, Karnal, Hisar, Durgapura, Ludhiana, Pantnagar), NEPZ (Kanpur, Ayodhya, Varanasi) and NHZ (Khudwani, Shimla, Bajaura). Similarly, the NBGSN comprising of a set of 19 promising genetic stocks endowed with trait(s) of breeding value, received from different cooperating centres was supplied at 12-centres for utilization.

International trials and nurseries evaluated during crop season 2021-2022

Sr. No.	Trials/Nurseries	Genotypes received from ICARDA	National Check	# Sets	Locations
1	2022 International Barley Yield Trial for Feed Forage and Malt in Favourable Environments (IBYT-FFM-22)	23	DWRB137	4	Durgapura, Hisar, Kanpur, Karnal
2	2022 International Barley Yield Trial for Arid and Semi-Arid regions (IBYT-ASA-22)	23	Lakhan	4	Pantnagar, Durgapura, Kanpur, Karnal
3	2022 International Barley Observation Nursery (IBON-22)	112 + 3 checks	DWRB137	5	Hisar, Ludhiana, Durgapura, Kanpur, Karnal

International Barley Yield Trial for Feed Forage and Malt in Favourable Environments (IBYT-FFM-22)

The IBYT- FFM comprised of 24 entries including one Indian local check variety DWRB137 (Entry IBYT-FFM-1), and two ICARDA checks Entry IBYT-10 (VMorales=C1) and Entry IBYTFFM-20 (Rihane-01= C2). The trial was evaluated in an Alpha-Lattice Design with two replications at four locations namely, Durgapura, Hisar, Kanpur and Karnal of NWPZ under high input conditions. Data from all the locations were included in the national pooled analysis. The entry IBYT-FFM-19 ranked first with 41.28 q/ha, followed by IBYT-FFM-17 (40.88 q/ha), and IBYT-FFM-23 (40.34 q/ha) and five more entries in 1st NSG. The national check DWRB137 ranked 17th with 33.06 q/ha grain yield. The ICARDA checks ranked 10th (C1) and 14th (C2), respectively.

Grain yield, ranking and grouping of barley IBYT-IBYT-FFM -22 genotypes in rabi 2021-2022.

Varieties	Karnal			Durgapura			Ludhiana			Hisar			National Mean		
	Yield	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**
IBYT-FFM-1	42.58	1	1	24.44	23	0	28.98	20	0	36.25	13	0	**33.06**	17	0
IBYT-FFM-2	30.16	16	0	23.56	24	0	31.88	15	0	23.50	24	0	**27.27**	24	0
IBYT-FFM-3	32.18	14	0	28.33	20	0	26.08	23	0	24.50	22	0	**27.77**	23	0
IBYT-FFM-4	41.57	3	1	39.44	4	1	44.92	2	1	28.75	20	0	**38.67**	8	1
IBYT-FFM-5	27.71	19	0	28.33	20	0	31.88	14	0	29.75	19	0	**29.42**	22	0
IBYT-FFM-6	24.80	22	0	37.22	10	1	30.43	19	0	35.25	16	0	**31.93**	19	0
IBYT-FFM-7	29.30	17	0	37.78	9	1	33.33	12	0	51.25	6	1	**37.91**	9	0
IBYT-FFM-8	36.53	7	1	32.78	18	0	39.12	6	1	24.50	22	0	**33.23**	16	0
IBYT-FFM-9	31.98	15	0	34.44	15	0	39.12	6	1	36.25	13	0	**35.45**	15	0
IBYT-FFM-10	34.63	12	0	37.22	10	1	36.23	9	0	37.75	11	0	**36.46**	14	0
IBYT-FFM-11	21.98	24	0	33.33	17	0	28.98	20	0	33.75	18	0	**29.51**	21	0
IBYT-FFM-12	35.96	9	1	24.89	22	0	34.78	10	0	28.00	21	0	**30.91**	20	0
IBYT-FFM-13	35.12	10	1	35.00	14	0	46.37	1	1	41.88	10	0	**39.59**	5	1
IBYT-FFM-14	42.51	2	1	37.22	10	1	33.33	12	0	35.50	15	0	**37.14**	12	0
IBYT-FFM-15	35.07	11	1	32.22	19	0	42.02	4	1	51.50	5	1	**40.20**	4	1
IBYT-FFM-16	36.08	8	1	43.89	1	1	31.88	15	0	46.00	9	1	**39.46**	6	1
IBYT-FFM-17	39.03	5	1	39.44	4	1	27.53	22	0	57.50	1	1	**40.88**	2	1
IBYT-FFM-18	29.10	18	0	39.44	4	1	26.08	23	0	36.50	12	0	**32.78**	18	0
IBYT-FFM-19	39.61	4	1	38.89	8	1	31.88	15	0	54.75	2	1	**41.28**	1	1
IBYT-FFM-20	26.01	21	0	33.89	16	0	39.12	6	1	51.75	4	1	**37.69**	10	0
IBYT-FFM-21	37.57	6	1	43.89	1	1	31.88	15	0	34.00	17	0	**36.83**	13	0
IBYT-FFM-22	32.42	13	0	35.56	13	0	43.47	3	1	46.25	8	1	**39.42**	7	1
IBYT-FFM-23	27.57	20	0	42.78	3	1	42.02	4	1	49.00	7	1	**40.34**	3	1
IBYT-FFM-24	22.41	23	0	39.44	4	1	34.78	10	0	52.50	3	1	**37.28**	11	0
G.M.	**32.99**			**35.14**			**34.84**			**39.44**			**35.60**		
S.E.(M)	3.16			1.16			3.21			2.47			**1.32**		
C.D.	7.66			2.81			7.77			5.98			**3.09**		
C.V.	13.54			4.66			13.02			8.84					

IBYT-FFM is NC= DWRB137, IBYT-FFM is C1= V Morales and IBYT-20 is C2= Rihane-03

Mean and Range for ancillary characters of IBYT-IBYT-FFM -22 entries

Entry No	Row type	Days to heading	Plant height (cm)	Days to maturity	1000-grain weight (g)	Spike length (cm)
1 (NC)	6	87(75-94)	85(65-98)	128(111-135)	37(27-45)	8.4 (6.0-11.5)
2	2	92(80-102)	105(88-122)	128(112-135)	39(34-49)	7.6 (6.7-10.5)
3	2	84(74-96)	105(92-115)	126(111-132)	43(35-52)	8.1 (6.4-11.5)
4	2	95(86-101)	97(90-109)	129(113-135)	37(30-43)	7.8 (6.5-10.0)
5	2	93(80-100)	95(88-106)	127(112-134)	34(20-44)	8.5 (6.5-11.0)
6	2	97(89-103)	82(73-98)	128(112-136)	33(24-43)	8.8 (6.9-11.0)
7	2	90(78-100)	96(83-102)	128(111-136)	35(23-45)	8.2 (6.2-11.0)
8	2	91(76-107)	98(85-115)	128(113-136)	38(31-47)	8.2 (5.7-11.3)
9	2	95(86-101)	105(82-122)	129(111-136)	43(38-48)	8.7 (7.0-11.5)
10 (C1)	6	93(81-100)	100(85-116)	127(112-136)	34(20-53)	7.1 (5.2-9.5)
11	2	99(87-109)	93(87-101)	131(111-144)	32(27-42)	7.4 (6.2-10.0)
12	2	94(79-101)	101(93-111)	128(112-136)	35(21-44)	8.8 (7.5-12.0)
13	2	95(84-102)	104(95-121)	131(113-143)	33(26-39)	8.1 (6.0-11.5)
14	2	90(79-99)	103(90-111)	128(111-134)	43(36-51)	8.3 (7.0-10.0)
15	6	99(86-109)	105(89-122)	130(112-136)	30(20-35)	8.6 (7.0-11.7)
16	6	90(78-100)	103(82-113)	127(111-134)	29(23-38)	7.3 (6.0-9.0)
17	6	94(83-103)	94(79-106)	127(110-135)	32(28-36)	7.8 (6.0-10.8)
18	6	87(75-97)	102(85-114)	127(111-134)	33(24-44)	7.3 (6.3-9.5)
19	6	91(81-100)	100(83-111)	127(111-136)	28(22-37)	7.7 (6.8-10.0)
20 (C2)	6	102(91-109)	115(105-123)	133(117-143)	32(23-37)	5.8 (4.0-7.8)
21	6	92(79-100)	101(84-110)	128(113-135)	38(30-43)	8.3 (6.5-12.5)
22	6	91(81-99)	106(91-120)	127(111-134)	30(24-35)	8.8 (7.2-13.0)
23	6	93(80-102)	109(90-121)	127(112-136)	34(28-40)	7.6 (6.0-10.0)
24	6	96(86-103)	97(87-106)	131(112-143)	26(18-33)	7.4 (5.0-10.0)

NC= DWRB137, C1= Rihane-03, C2= V Morales

International Barley Yield Trial-ASA-2022-(IBYT-ASA-2022)

The IBYT-ASA-2022 comprising of 24 entries including one Indian local check variety Lakhan (Entry IBYT-FFM-1), and two ICARDA checks Entry IBYT-10 (Rihane-03 =C1) and Entry IBYTFFM-20 (Furat-03= C2). The trial was evaluated in an Alpha-Lattice Design with two replications at four locations namely Karnal, Pantnagar, Kanpur and Durgapura. Data from all the locations were included in the national pooled analysis. The location means for grain yield ranged from 29.23 q/ha (Karnal) to 46.80 q/ha (Pantnagar) with 36.08 q/ha zonal mean across the centres. The entry IBYT-ASA-8 ranked first with 44.63 q/ha followed by IBYT-ASA-4 ranked second with 41.07 q/ha, IBYT-ASA-9 ranked third with 40.33 q/ha, IBYT-ASA-19 ranked fourth with 38.79 q/ha and IBYT-ASA-3 ranked fifth with 37.49 q/ha grain yield and in first non-significant group. Similarly, National local check ranked sixth with 36.86 q/ha grain yield/ha and in first non-significant group.

IBYT-ASA Grain Yield (q/ha) **Rabi-2021-22**

Varieties	Karnal			Durgapura			Kanpur			Pantnagar			National Mean		
	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
IBYT-ASA-1	26.80	13	0	25.00	19	0	42.78	1	1	41.02	14	0	**36.86**	6	1
IBYT-ASA-2	20.07	22	0	20.56	23	0	26.67	20	0	57.13	6	0	**32.22**	17	1
IBYT-ASA-3	27.49	12	0	23.89	20	0	41.67	3	1	60.27	4	0	**37.49**	5	1
IBYT-ASA-4	34.79	3	0	19.44	24	0	36.11	5	1	69.48	1	1	**41.07**	2	1
IBYT-ASA-5	54.11	1	1	23.33	21	0	28.33	17	0	31.97	22	0	**33.46**	14	1
IBYT-ASA-6	33.67	5	0	22.22	22	0	33.89	8	0	55.02	9	0	**36.48**	7	1
IBYT-ASA-7	32.07	9	0	33.89	9	1	25.56	23	0	63.34	3	1	**35.79**	9	1
IBYT-ASA-8	50.84	2	1	33.89	9	1	24.44	24	0	69.34	2	1	**44.63**	1	1
IBYT-ASA-9	32.10	8	0	35.56	6	1	36.11	5	1	59.22	5	0	**40.33**	3	1
IBYT-ASA-10	22.44	20	0	30.44	15	0	32.22	9	0	36.67	20	0	**31.72**	19	1
IBYT-ASA-11	28.27	11	0	30.56	14	0	27.78	19	0	36.93	19	0	**30.85**	22	1
IBYT-ASA-12	23.32	18	0	35.00	7	1	25.83	22	0	50.47	10	0	**32.54**	16	1
IBYT-ASA-13	19.00	23	0	31.67	11	0	31.11	14	0	43.36	11	0	**32.12**	18	1
IBYT-ASA-14	26.50	15	0	35.00	7	1	30.56	15	0	37.80	18	0	**31.63**	20	1
IBYT-ASA-15	26.41	16	0	28.33	17	0	42.78	2	1	40.12	15	0	**36.08**	8	1
IBYT-ASA-16	32.76	7	0	31.44	12	0	34.44	7	0	41.80	13	0	**34.33**	12	1
IBYT-ASA-17	26.34	17	0	30.00	16	0	26.67	20	0	39.83	16	0	**31.07**	21	1
IBYT-ASA-18	31.36	10	0	26.11	18	0	32.22	9	0	42.99	12	0	**34.14**	13	1
IBYT-ASA-19	33.00	6	0	37.78	5	1	40.56	4	1	55.48	8	0	**38.79**	4	1
IBYT-ASA-20	15.87	24	0	40.00	2	1	31.67	12	0	56.27	7	0	**35.39**	10	1
IBYT-ASA-21	34.28	4	0	41.89	1	1	32.22	9	0	34.09	21	0	**35.15**	11	1
IBYT-ASA-22	26.74	14	0	31.11	13	0	31.67	12	0	31.05	23	0	**32.84**	15	1
IBYT-ASA-23	20.41	21	0	38.89	3	1	29.44	16	0	38.69	17	0	**29.91**	24	1
IBYT-ASA-24	23.00	19	0	38.33	4	1	28.33	17	0	30.99	24	0	**30.30**	23	1
G.M.	**29.23**			**31.01**			**32.21**			**46.80**			**36.08**		
S.E.(M)	2.60			1.10			3.08			2.65			**7.85**		
C.D.	6.29			2.66			7.47			6.42			**18.43**		
C.V.	12.56			5.00			13.53			8.00					

Mean and Range for ancillary characters of IBYT-ASA (2022) entries in Rabi (2021-22)

Entry Name	Row Type	Days to heading	Days to maturity	Plant height (cm)	1000-grain weight (g)	Spike length (cm)
1	6	88 (76-98)	131 (112-140)	98.4 (87.0-111.0)	39.5 (31.4-48.4)	9.7 (6.0-12.0)
2	2	97 (86-104)	129 (113-136)	91.3 (60.0-111.3)	42.0 (32.1-49.7)	8.6 (6.4-10.5)
3	2	92 (77-104)	130 (112-139)	96.4 (84.5-106.0)	43.0 (32.9-51.8)	9.3 (8.6-9.9)
4	2	88 (76-98)	128 (114-134)	88.4 (63.5-101.5)	41.6 (34.3-46.6)	8.3(6.5-9.5)
5	2	87 (72-99)	129 (113-137)	97.3 (69.5-122.5)	48.0 (42.6-51.7)	9.8 (7.8-13.0)
6	2	97 (89-101)	132 (116-139)	97.1 (76.0-110.0)	44.5 (36.8-50.2)	9.7 (6.7-12.0)
7	2	100 (88-106)	131 (113-140)	99.1 (71.5-114.0)	41.4 (32.6-48.4)	9.1 (6.5-10.0)
8	2	87 (75-104)	128 (113-138)	92.0 (67.0-106.0)	43.5 (35.8-51.3)	8.6 (6.7-9.5)
9	2	97 (87-104)	130 (112-138)	97.6 (77.0-119.5)	43.7 (36.5-52.6)	8.6 (6.0-10.7)
10	6	101 (93-107)	134 (121-141)	103.1 (77.0-120.0)	38.8 (28.6-46.6)	7.6 (5.8-10.0)
11	6	92 (76-109)	129 (112-141)	96.3 (61.0-116.0)	37.4 (25.4-46.6)	9.3 (5.8-12.0)
12	6	88 (72-102)	130 (113-137)	101.3 (64.0-124.8)	36.3 (30.4-45.6)	9.3 (7.6-11.5)
13	6	107 (92-113)	131 (114-138)	95.9 (80.0-117.5)	36.2 (21.8-51.1)	8.8 (7.9-10.4)
14	6	91 (83-101)	128 (113-135)	97.3 (73.0-116.8)	38.4 (25.7-46.7)	8.3 (7.0-9.8)
15	6	89 (72-107)	129 (113-136)	98.4 (73.0-119.5)	45.3 (35.3-54.2)	8.5 (6.6-11.3)
16	6	96 (84-109)	130 (112-142)	93.8 (62.0-111.5)	40.1 (27.0-45.0)	9.1 (6.6-12.5)
17	6	96 (85-105)	127 (111-136)	92.9 (63.5-115.5)	36.8 (29.2-47.7)	9.2 (6.9-11.3)
18	6	88 (75-101)	128 (111-136)	88.4 (64.5-104.5)	37.8 (28.2-43.1)	7.1 (5.8-8.5)
19	6	94 (82-103)	128 (112-136)	98.6 (74.5-110.0)	38.2 (30.0-44.9)	9.4 (9.0-10.0)
20	2	96 (86-102)	128 (111-137)	92.1 (64.0-107.5)	42.7 (31.5-50.4)	8.6 (6.6-9.8)
21	6	91 (75-110)	129 (112-141)	94.1 (59.5-113.8)	39.5 (27.7-49.1)	9.0 (6.5-11.0)
22	6	98 (86-106)	131 (119-140)	97.3 (72.0-120.8)	37.3 (24.2-44.7)	9.0 (6.8-10.8)
23	6	96 (86-102)	130 (117-135)	96.8 (72.5-110.5)	36.3 (22.7-45.5)	8.1 (6.7-9.8)
24	2	98 (87-107)	130 (115-139)	101.3 (80.5-110.3)	33.4 (26.7-43.6)	11.1(9.7-12.5)

International Barley Observation Nursery-High Input-2021 (IBON-HI-2022)

The IBON comprised of 112 test-entries and four checks (3-ICARDA checks- Rihane-03, Furat-03, VMorales and one local check, DWRB137 each check repeated 3-times. This nursery was raised at five locations namely, Durgapura, Hisar, Kanpur, Ludhiana and Karnal during *rabi* 2021-2022. All the locations recorded the data. Grain yield was expressed in Kg/ha as computed from a plot yield of 1.5 m^2. The range and means for ancillary characters and grain yield are given in the table below. The local check DWRB137 recorded the highest grain yield among the 4-check varieties with a mean yield of 3713 kg/ha and a range of 1304-9333 kg/ha obtained across the locations. This check ranked at 19th position among all the test entries and checks. The top ten ranked test entries for grain yield are IBON-HI-2022 Nos. 18, 79, 64, 62, 54, 56, 39, 100, 89 and 66 with descending order of ranking.

Top ten entries from IBON-2021-22 on mean grain yield basis.

Entry No.	Parentage	GY (kg/ha)	Rank
18	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.ARZ3/PACO/3/PALTON/7/PFC9214//PENCO/CHEVRON-BAR	4531	1
79	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/GLORIA-BAR/COPAL//PM5/BEN/3/SEN/4/PETUNIA 1/5/PETUNIA 2//PENCO/CHEVRON-BAR/4/PETUNIA 2/3/CHAMICO/TOCTE//CONGONA	4488	2
64	Ishi//Morales/221BYT7	4447	3
62	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA/8/M122	4393	4
54	MADRE SELVA/7/STANDER-BAR/API/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	4300	5
56	LOGAN-BAR/MSEL//AZAF/4/PFC9215/3/ZHEDAR#1/SHYRI//OLMO	4243	6
39	UC1135//UC1134/Lacey	4213	7
100	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/GLORIA-BAR/COPAL//PM5/BEN/3/SEN/4/PETUNIA 1/5/PETUNIA 2//PENCO/CHEVRON-BAR/4/PETUNIA 2/3/CHAMICO/TOCTE//CONGONA	4201	8
89	MSEL/LA MOLINA 95//SHAKIRA	4098	9
66	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CARDO/BRS180	4078	10
	DWRB137 (101) Local Check	3713	19

Mean and range (in parenthesis) for ancillary characters and grain yield of IBON-HI-22 entries

Entry	RT	Days to 75% heading	Plant height (cm)	Days to 75% maturity	1000-grains weight (g)	Spike length (cm)	Grain yield (Kg/ha)	Ranks based on mean yield
1	2	95 (81-104)	89 (68-104)	132 (123-136)	39 (33-43)	7 (6-8)	3384 (1739-4293)	78
2	6	89 (80-98)	93 (74-112)	130 (123-135)	33 (27-43)	9 (9-10)	3248 (1739-4333)	35
3	2	91 (76-109)	97 (83-105)	130 (121-138)	39 (32-47)	8 (7-9)	3497 (1739-4667)	62
4	2	84 (69-95)	96 (74-114)	127 (118-134)	40 (33-48)	7 (7-8)	4201 (1739-6467)	29
5	2	89 (76-100)	91 (75-109)	129 (121-136)	42 (32-49)	7 (6-8)	3384 (1739-4293)	54
6	2	94 (85-101)	94 (76-112)	131 (124-136)	41 (35-52)	7 (6-7)	3248 (1739-4333)	59
7	2	83 (64-93)	90 (75-104)	127 (119-134)	44 (40-48)	7 (6-7)	3497 (1739-4667)	42
8	2	85 (67-96)	93 (73-116)	127 (118-135)	42 (31-51)	7 (6-7)	4201 (1739-6467)	17
9	2	89 (78-97)	105 (97-112)	130 (123-136)	43 (35-56)	8 (7-8)	3384 (1739-4293)	15
10	2	93 (81-102)	100 (88-111)	131 (124-136)	39 (28-52)	8 (6-9)	3248 (1739-4333)	80
11	2	91 (77-102)	93 (78-113)	131 (124-136)	39 (31-49)	8 (7-9)	3497 (1739-4667)	91
12	2	91 (78-102)	99 (73-114)	131 (126-136)	42 (34-55)	9 (7-11)	4201 (1739-6467)	81
13	2	90 (80-97)	100 (80-113)	131 (124-135)	42 (33-57)	8 (7-9)	3384 (1739-4293)	96
14	2	88 (76-99)	102 (87-123)	130 (123-135)	51 (42-59)	8 (7-9)	3248 (1739-4333)	14
15	2	90 (76-102)	100 (78-114)	130 (122-136)	39 (20-53)	8 (8-9)	3497 (1739-4667)	75
16	6	93 (78-109)	100 (84-118)	131 (121-137)	38 (32-42)	6 (5-6)	4201 (1739-6467)	58
17	6	92 (80-105)	93 (72-106)	132 (122-137)	35 (28-43)	7 (6-7)	3384 (1739-4293)	45
18	6	90 (75-99)	94 (76-110)	130 (122-135)	34 (28-42)	7 (5-8)	3248 (1739-4333)	1
19	6	91 (76-104)	93 (72-104)	132 (123-138)	38 (35-46)	6 (4-7)	3497 (1739-4667)	43
20	6	88 (71-100)	102 (83-122)	130 (124-136)	38 (33-47)	7 (6-8)	4201 (1739-6467)	23
21	6	83 (67-92)	99 (78-117)	127 (123-132)	34 (29-42)	7 (5-8)	3384 (1739-4293)	76
22	6	98 (84-109)	98 (81-113)	132 (121-137)	35 (30-41)	6 (5-7)	3248 (1739-4333)	98
23	6	93 (83-104)	98 (73-117)	131 (122-137)	41 (35-48)	6 (5-7)	3497 (1739-4667)	71
24	6	89 (73-98)	100 (78-127)	131 (125-137)	41 (33-46)	6 (5-7)	4201 (1739-6467)	12
25	6	94 (83-101)	89 (71-104)	132 (123-138)	30 (20-46)	6 (6-7)	3384 (1739-4293)	97
26	6	90 (76-100)	93 (72-115)	131 (123-136)	35 (32-38)	7 (6-7)	3248 (1739-4333)	13
27	6	92 (81-100)	98 (75-113)	131 (125-135)	43 (35-51)	8 (6-10)	3497 (1739-4667)	73
28	6	88 (69-100)	95 (77-114)	131 (124-136)	40 (29-55)	6 (5-7)	4201 (1739-6467)	95
29	6	89 (73-100)	97 (80-114)	132 (123-137)	38 (23-48)	8 (6-9)	3384 (1739-4293)	90
30	6	98 (87-111)	106 (82-130)	134 (126-139)	40 (32-45)	8 (6-9)	3248 (1739-4333)	83
31	6	99 (89-109)	101 (83-114)	134 (127-139)	37 (26-47)	7 (6-9)	3497 (1739-4667)	100
32	6	87 (74-99)	94 (77-118)	130 (123-136)	35 (28-41)	8 (7-10)	4201 (1739-6467)	94
33	6	90 (76-102)	94 (76-115)	132 (124-136)	38 (29-51)	6 (5-8)	3384 (1739-4293)	89
34	6	92 (80-102)	99 (82-115)	131 (125-136)	37 (27-45)	7 (5-8)	3248 (1739-4333)	79
35	6	94 (83-103)	101 (82-119)	133 (128-136)	38 (31-51)	5 (4-7)	3497 (1739-4667)	67
36	6	95 (86-105)	110 (89-125)	133 (127-137)	38 (31-47)	6 (4-7)	4201 (1739-6467)	63
37	6	101 (94-109)	108 (89-124)	134 (125-137)	39 (31-50)	7 (6-8)	3384 (1739-4293)	53
38	6	87 (71-98)	98 (79-116)	130 (125-134)	41 (33-46)	6 (5-7)	3248 (1739-4333)	38
39	6	86 (73-93)	101 (86-114)	131 (126-138)	35 (24-40)	8 (7-8)	3497 (1739-4667)	7
40	6	92 (83-100)	101 (83-128)	131 (124-135)	39 (27-56)	6 (6-7)	4201 (1739-6467)	31
41	6	84 (70-94)	99 (84-111)	129 (123-134)	35 (25-43)	6 (5-7)	3384 (1739-4293)	87
42	2	84 (66-94)	102 (85-118)	129 (123-134)	38 (25-48)	8 (8-9)	3248 (1739-4333)	66
43	6	95 (86-107)	103 (87-124)	131 (122-136)	41 (31-50)	7 (5-9)	3497 (1739-4667)	20
44	6	97 (89-109)	105 (86-121)	132 (125-137)	36 (26-52)	7 (6-7)	4201 (1739-6467)	60
45	6	99 (90-109)	85 (77-93)	133 (125-139)	32 (21-54)	7 (7-8)	3384 (1739-4293)	84
46	6	103 (95-114)	89 (72-100)	134 (126-139)	35 (25-54)	6 (6-7)	3248 (1739-4333)	50

47	2	95 (84-103)	97 (76-114)	376 (123-1358)	39 (27-52)	8 (7-10)	3497 (1739-4667)	16
48	2	94 (76-103)	90 (63-109)	132 (123-138)	38 (29-45)	6 (6-7)	4201 (1739-6467)	41
49	2	87 (72-94)	91 (64-105)	128 (122-131)	37 (20-48)	6 (5-7)	3384 (1739-4293)	56
50	2	87 (71-110)	91 (74-109)	128 (121-137)	40 (27-47)	6 (6-7)	3248 (1739-4333)	70
51	2	87 (76-95)	93 (75-113)	130 (121-134)	38 (28-48)	7 (5-9)	3497 (1739-4667)	36
52	2	98 (86-102)	97 (82-109)	132 (123-137)	37 (30-41)	8 (7-10)	4201 (1739-6467)	24
53	2	99 (87-108)	88 (64-100)	132 (121-138)	36 (22-49)	8 (8-9)	3384 (1739-4293)	92
54	2	88 (71-102)	94 (75-110)	130 (123-136)	43 (27-53)	7 (6-8)	3248 (1739-4333)	5
55	2	92 (74-102)	88 (66-106)	131 (124-136)	40 (27-46)	7 (6-8)	3497 (1739-4667)	25
56	2	91 (77-100)	82 (60-103)	133 (127-139)	40 (26-56)	8 (7-8)	4201 (1739-6467)	6
57	2	103 (90-117)	94 (74-107)	134 (125-140)	40 (27-57)	8 (8-9)	3384 (1739-4293)	77
58	2	102 (89-117)	87 (71-109)	133 (123-139)	40 (31-54)	8 (5-9)	3248 (1739-4333)	101
59	2	104 (94-117)	82 (64-94)	134 (123-140)	35 (21-43)	8 (6-10)	3497 (1739-4667)	104
60	6	92 (76-104)	95 (78-113)	131 (125-136)	37 (26-51)	8 (7-9)	4201 (1739-6467)	21
61	6	87 (72-97)	89 (74-110)	129 (124-134)	33 (22-41)	6 (4-7)	3384 (1739-4293)	22
62	6	91 (75-102)	92 (70-110)	129 (124-134)	33 (27-42)	7 (7-8)	3248 (1739-4333)	4
63	6	90 (74-100)	97 (79-117)	129 (123-135)	41 (30-58)	7 (6-8)	3497 (1739-4667)	55
64	6	89 (78-100)	95 (75-114)	129 (123-136)	32 (25-39)	7 (6-8)	4201 (1739-6467)	3
65	6	88 (74-98)	87 (60-107)	129 (124-135)	31 (22-41)	7 (4-8)	3384 (1739-4293)	85
66	6	88 (72-99)	92 (67-112)	130 (122-136)	37 (26-47)	7 (5-8)	3248 (1739-4333)	10
67	*6*	*90 (74-101)*	*88 (68-110)*	*131 (126-136)*	*40 (26-56)*	*7 (4-9)*	*3497 (1739-4667)*	*64*
68	6	89 (73-99)	89 (65-111)	131 (124-135)	32 (25-40)	6 (4-8)	4201 (1739-6467)	52
69	6	93 (76-104)	95 (68-124)	130 (123-136)	32 (26-38)	7 (6-9)	3384 (1739-4293)	61
70	6	97 (82-109)	87 (69-102)	132 (127-137)	35 (28-44)	8 (7-8)	3248 (1739-4333)	72
71	6	93 (77-102)	94 (69-112)	131 (126-136)	37 (25-46)	7 (5-8)	3497 (1739-4667)	11
72	6	95 (79-109)	94 (74-113)	132 (125-138)	32 (25-37)	7 (5-9)	4201 (1739-6467)	46
73	6	97 (83-111)	88 (68-105)	134 (128-139)	33 (23-43)	6 (5-9)	3384 (1739-4293)	65
74	6	93 (76-107)	96 (77-112)	132 (127-136)	37 (24-46)	8 (8-10)	3248 (1739-4333)	47
75	2	93 (76-109)	92 (75-104)	132 (125-138)	42 (30-47)	6 (5-8)	3497 (1739-4667)	30
76	2	88 (71-100)	83 (69-93)	130 (123-135)	37 (24-45)	6 (5-7)	4201 (1739-6467)	32
77	2	105 (96-116)	87 (73-97)	134 (125-140)	35 (25-43)	8 (6-9)	3384 (1739-4293)	102
78	2	92 (78-101)	98 (77-122)	131 (125-136)	40 (30-49)	8 (7-10)	3248 (1739-4333)	48
79	6	99 (85-109)	101 (79-118)	133 (127-138)	36 (24-44)	7 (6-8)	3497 (1739-4667)	2
80	6	89 (73-99)	89 (74-111)	130 (125-135)	31 (21-44)	8 (6-9)	4201 (1739-6467)	26
81	6	87 (73-98)	91 (78-110)	130 (124-134)	32 (25-41)	7 (5-8)	3384 (1739-4293)	28
82	6	85 (67-98)	88 (68-108)	129 (123-134)	30 (25-40)	8 (5-10)	3248 (1739-4333)	103
83	6	90 (72-102)	90 (69-109)	130 (124-136)	29 (22-33)	8 (7-8)	3497 (1739-4667)	40
84	2	92 (78-100)	88 (73-110)	132 (126-136)	41 (35-47)	6 (5-6)	4201 (1739-6467)	88
85	2	93 (77-107)	92 (78-115)	132 (125-137)	45 (39-48)	8 (6-9)	3384 (1739-4293)	37
86	2	92 (81-107)	96 (79-112)	132 (123-137)	41 (31-48)	7 (6-7)	3248 (1739-4333)	68
87	2	89 (79-98)	94 (75-116)	131 (124-135)	42 (32-49)	9 (8-10)	3497 (1739-4667)	86
88	2	90 (78-100)	95 (79-116)	132 (125-136)	43 (28-60)	8 (6-9)	4201 (1739-6467)	33
89	2	90 (76-100)	97 (74-113)	132 (125-136)	41 (33-56)	8 (6-10)	3384 (1739-4293)	9
90	2	100 (91-109)	91 (77-101)	133 (124-137)	33 (22-44)	7 (7-9)	3248 (1739-4333)	99
91	2	91 (81-102)	94 (81-109)	131 (125-136)	43 (32-52)	8 (7-9)	3497 (1739-4667)	74
92	2	90 (74-102)	92 (73-114)	132 (125-136)	40 (29-52)	8 (7-9)	4201 (1739-6467)	51
93	2	87 (72-98)	99 (78-121)	130 (124-135)	44 (31-54)	8 (7-9)	3384 (1739-4293)	18
94	2	93 (78-102)	97 (84-106)	132 (124-137)	37 (24-44)	7 (6-8)	3248 (1739-4333)	82
95	2	86 (69-97)	102 (89-115)	130 (124-134)	44 (31-53)	7 (6-9)	3497 (1739-4667)	34

96	2	91 (76-102)	99 (83-114)	132 (127-135)	43 (32-51)	7 (7-8)	4201 (1739-6467)	93
97	2	89 (76-99)	103 (86-126)	131 (125-135)	49 (35-61)	8 (8-9)	3384 (1739-4293)	44
98	2	94 (79-109)	105 (92-117)	133 (128-138)	39 (26-48)	6 (5-8)	3248 (1739-4333)	57
99	6	95 (84-109)	97 (74-113)	133 (126-138)	37 (26-44)	5 (4-6)	3497 (1739-4667)	39
100	6	96 (85-109)	106 (80-128)	133 (129-138)	43 (35-51)	8 (6-9)	4201 (1739-6467)	8
DWRB 137	6	86 (69-100)	85 (51-118)	131 (123-136)	40 (27-51)	6 (4-8)	3713 (1304-7467)	19
Rihane-03 (102) 6R		100 (92-114)	103 (87-122)	127 (94-138)	36 (25-48)	6 (4-10)	3063 (870-4333)	69
Furat-03 (103) 6R		95 (82-107)	95 (77-112)	125 (97-137)	39 (31-52)	7 (6-8)	3336 (1300-5833)	49
VMorales (104) 6R		90 (73-103)	92 (74-114)	123 (79-136)	34 (22-49)	7 (5-8)	3636 (2174-6000)	27

**Averaged over the blocks*

Elite International Barley Germplasm Nursery (EIBGN-2021-22)

EIBGN was constituted with 45-germplasm lines and six released varieties (BH 946, HUB113, BHS 400, PL891, DWRB 123 and DWRB137) as checks. These 45 promising germplasm lines were selected from different international trials and nurseries based on their performance in *rabi* 2020-21 under respective trials/nurseries. A set of 75 entries including six checks repeated five times at each location was supplied to twelve locations in NWPZ (Chatha, Karnal, Hisar, Durgapura, Ludhiana, Pantnagar), NEPZ (Kanpur, Ayodhya, Varanasi) and NHZ (Khudwani, Shimla, Bajaura). However, this nursery was vitiated at Ayodhya centres, and yield data from Varanasi centre was not included in the statistical analysis to work out adjusted means as the values for checks obtained in different blocks were highly variable. Each entry was sown in a plot of two rows each of 2.5 m length and spaced at 23 cm. The data for grain yield recorded in grams (g) per plot was converted into q/ha and analysed across the 10-locations is presented in the following tables. Similarly, data for ancillary characters is tabulated below trait-wise as mean and range for a character across all the testing locations.

Across the locations of three zones, five entries namely, IBYT-HI-2021-18 (48 q/ha), IBYT-HI-2021-14 (47 q/ha), IBON-HI-2021-17 (44 q/ha), IBYT-HI-2021-13 (43 q/ha), IBON-HI-2021-87 (42 q/ha) have registered significantly higher grain yields. Among the checks HUB113 (45 q/ha) and DWRB137 (42 q/ha) ranked first and second. Information on utilization of lines by breeders of different centres in their local barley improvements programmes is given in the following table.

Parentage of EIBGN (2021-22) entries

Sr No.	Entry	Parentage	Trait	H/N	RT
1	IBYT-HI-2021-10	LOGAN-BAR/MSEL//AZAF/6/MERIT,B/4/AZAF/3 /ARUPO/K8755//MORA/5/MSEL	GY	H	2
2	IBYT-HI-2021-15	ATACO/COMINO//ALELI/6/P.STO/3/LBIRAN/UNA80 //LIGNEE640/4/BLLU/5/PETUNIA 1	GY	H	6
3	IBYT-HI-2021-18	Manal/R.T.RAMAGE	GY	H	6
4	IBYT-HI-2021-6	LOGAN-BAR/MSEL//AZAF/3/WI2291	GY	H	2
5	IBYT-HI-2021-2	Xena/3/LOGAN-BAR/MSEL//AZAF	GY	H	2
6	IBYT-HI-2021-19	Ishi//Morales/22nd IBYT7	GY	H	6
7	IBYT-HI-2021-14	Manal/7/ESMERALDA/LEGACY/6/P.STO/3/LBIRAN /UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	GY	H	6
8	IBYT-HI-2021-13	Manal/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4 /BLLU/5/PETUNIA 1	GY	H	6
9	IBYT-HI-2021-5	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/Canela	TGW, EM	H	2
10	IBYT-HI-2021-9	Atahualpa/Chigwell	TGW	H	2
11	IBYT-HI-2021-1	Reem/TR05671	TGW,PH	H	2
12	IBYT-HI-2021-11	Litani/Chigwell	TGW	H	2
13	IBYT-HI-2021-12	Cerise/Shyri//Aleli/3/Mpyt169.1Y/Laurel//Olmo/4/Canela /5/ACUARIO T95/BCD12DH	TGW	H	2
14	IBON-HI-2021-32	Xena/Litani	GY	H	2
15	IBON-HI-2021-91	PETUNIA 1/Stander	GY	H	6
16	IBON-HI-2021-15	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5 /LOGAN-BAR/MSEL//AZAF	GY	H	2
17	IBON-HI-2021-112	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/ PETUNIA 1/6/Rasmusson	GY	H	6
18	IBON-HI-2021-16	LOGAN-BAR/MSEL//AZAF/3/MSEL//DEFRA/CL128	GY	H	2
19	IBON-HI-2021-19	Cerise/Shyri//Aleli/3/Mpyt169.1Y/Laurel//Olmo/4 /Canela/5/MSEL/FNC1	GY	H	2
20	IBON-HI-2021-97	PENCO/CHEVRON-BAR//Stander	GY	H	6
21	IBON-HI-2021-22	Litani/Chigwell	DM	H	2
22	IBON-HI-2021-42	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/ CANELA/DEFRA	DM	H	2
23	IBON-HI-2021-20	Cerise/Shyri//Aleli/3/Mpyt169.1Y/Laurel//Olmo/4/ Canela/5/BEKA	DH, DM	H	2
24	IBON-HI-2021-1	PETUNIA 1/LACEY	DH, DM	H	2
25	IBON-HI-2021-17	MERIT,B/4/AZAF/3/ARUPO/K8755//MORA/5/MSEL/6 /ACUARIO T95/BCD12DH	DH, DM	H	2
26	IBON-HI-2021-94	MSEL/FNC1//Litani	TGW	H	6
27	IBON-HI-2021-105	UC1231//Morales/Rihane 03	TGW	H	6
28	IBON-HI-2021-87	UC1231//UC1134/Rihane 03	PH	H	6
29	IBON-HI-2021-3	Xena/MSEL/FNC1	SL	H	2
30	IBON-HI-2021-49	Xena/EFES28	SL	H	2
31	8th GSBYT-2021-18	ALISO/CI3909-2//FALCON-BAR/3/HIGO/4 /Petunia1	GY	N	6
32	8th GSBYT-2021-19	ALISO/CI3909-2//FALCON-BAR/3/HIGO/4/Giza130	GY	N	6
33	8th GSBYT-2021-20	ALISO/CI3909-2//FALCON-BAR/3/HIGO/4/Mari/Aths*2	GY	N	6
34	8th GSBYT-2021-21	Giza130/Manel	GY	N	6
35	8th GSBYT-2021-22	ALISO/CI3909-2//FALCON-BAR/3/HIGO/4/Petunia1	GY	N	6
36	8th GSBYT-2021-16	Kulih/Shishai	GY	H	2

37	8th GSBYT-2021-3	Rhn//Bc/Coho/3/DeirAlla106//Api/EB89-8-2-15-4/5/CM67 /3/Apro//Sv02109/Mari/4/Carbo/6/Beecher	GY	H	6
38	8th GSBYT-2021-13	Moroc9-75/Hml/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131 /6/Soufara-02/3/RM1508/Por//WI2269/4/Hml-02/ ArabiAbiad//ER/Apm	GY	H	2
39	8th GSBON-2021-67	Legia/Laurel'S'//Aleli/3/Arta/3/Sls/Lignee640	TGW	H	2
40	8th GSBON-2021-42	Giza126/3/Lignee527/NK1272//Alanda/4/IPA7	TGW	H	6
41	8th GSBON-2021-62	Emtan-1/CANELA	TGW	H	2
42	8th GSBYT-2021-9	CompCr229//As46/Pro/3/Srs/4/Express/6/Rhn-03/Eldorado /5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/ Alanda	TGW, PH	H	2
43	8th GSBYT-2021-17	Rhn//Bc/Coho/3/DeirAlla106//Api/EB89-8-2-15-4/5/CM67 /3/Apro//Sv02109/Mari/4/Carbo/6/ENCINO/TOCTE	DH,DM	H	2
44	8th GSBON-2021-94	Atahualpa/Nawair-01	TGW	H	2
45	8th GSBON-2021-92	ChiCm/An57//Albert/3/Alger/Ceres362-1-1 /4/Arta/5/Mundah	PH	H	2
Checks					
1	BH 946	Check	Check	H	6
2	HUB113	Check	Check	H	6
3	BHS 400	Check	Check	H	6
4	PL891	Check	Check	N	2
5	DWRB 123	Check	Check	H	2
6	DWRB137	Check	Check	H	6

GY = grain yield; TGW = 1000 grains weight; EM = early maturity; PH = plant height; DM; days to maturity; DH = days to heading; SL = spike length; H/N = hulled/naked, RT = row type

Mean and range across the 10-locations for grain yield and ancillary characters of barley genotypes evaluated under EIBGN 2021-22

Sr No.	Entry	Grain yield (adjusted means)			Days to 75% flowering	Days to 75% maturity	Plant height (cm)	Tillers /meter	Spike length (cm)	Grains/ spike	1000 grains weight
		q/ha	Rk	G							
1	IBYT-HI-2021-10	40 (17-64)	9	0	95 (64-160)	141 (118-201)	92 (76-108)	169 (63-319)	8 (6-10)	29 (21-32)	44 (32-56)
2	IBYT-HI-2021-15	36 (14-69)	17	0	100 (75-160)	142 (118-200)	89 (71-105)	139 (62-298)	7 (4-9)	53 (20-72)	40 (22-55)
3	IBYT-HI-2021-18	48 (22-122)	1	1	95 (67-159)	140 (119-198)	96 (70-124)	113 (59-169)	7 (6-9)	53 (35-68)	44 (37-48)
4	IBYT-HI-2021-6	38 (18-77)	13	0	101 (76-160)	143 (121-200)	98 (75-121)	136 (56-199)	8 (5-12)	29 (19-45)	46 (35-52)
5	IBYT-HI-2021-2	30 (20-69)	33	0	109 (79-162)	144 (123-202)	99 (72-171)	144 (43-236)	9 (7-11)	27 (21-31)	39 (24-51)
6	IBYT-HI-2021-19	38 (21-90)	11	0	108 (74-161)	144 (121-202)	102 (82-121)	127 (54-220)	7 (6-10)	54 (35-72)	38 (23-51)
7	IBYT-HI-2021-14	47 (21-86)	2	1	103 (73-162)	143 (122-203)	101 (72-118)	139 (52-234)	7 (5-10)	53 (20-72)	39 (27-48)
8	IBYT-HI-2021-13	43 (17-87)	4	1	100 (73-162)	142 (121-202)	100 (83-113)	111 (40-160)	8 (6-10)	55 (40-72)	44 (32-60)
9	IBYT-HI-2021-5	33 (10-57)	24	0	97 (71-159)	142 (121-200)	93 (77-108)	129 (37-210)	7 (5-9)	29 (21-41)	45 (34-55)
10	IBYT-HI-2021-9	40 (17-65)	10	0	96 (71-159)	141 (118-199)	99 (67-117)	124 (42-226)	9 (6-10)	31 (22-54)	52 (40-60)
11	IBYT-HI-2021-1	28 (16-38)	41	0	99 (73-158)	141 (121-198)	89 (64-105)	148 (40-337)	6 (4-8)	23 (15-29)	52 (40-60)
12	IBYT-HI-2021-11	34 (16-58)	23	0	99 (73-162)	142 (121-202)	95 (73-112)	128 (56-216)	8 (6-10)	24 (19-27)	48 (32-55)
13	IBYT-HI-2021-12	41 (18-67)	7	0	98 (73-160)	141 (124-200)	98 (68-118)	137 (30-252)	9 (7-11)	28 (23-36)	48 (40-56)
14	IBON-HI-2021-32	32 (16-49)	29	0	106 (82-158)	143 (121-197)	105 (74-134)	121 (42-250)	9 (7-11)	51 (26-67)	42 (28-57)
15	IBON-HI-2021-91	36 (15-68)	18	0	98 (72-161)	143 (123-201)	100 (70-124)	135 (43-219)	8 (6-10)	32 (24-53)	44 (35-54)
16	IBON-HI-2021-15	33 (14-57)	25	0	96 (64-159)	142 (118-199)	89 (66-105)	144 (40-230)	8 (6-11)	28 (19-38)	40 (30-53)
17	IBON-HI-2021-112	42 (15-80)	6	0	107 (80-164)	146 (122-205)	100 (80-124)	121 (38-216)	8 (7-9)	57 (42-66)	42 (29-49)
18	IBON-HI-2021-16	29 (9-41)	38	0	113 (91-162)	147 (123-202)	105 (76-127)	109 (48-170)	6 (5-8)	53 (24-78)	42 (28-59)
19	IBON-HI-2021-19	36 (15-80)	16	0	99 (71-162)	142 (119-203)	95 (68-116)	124 (40-220)	8 (4-10)	28 (21-38)	44 (16-56)
20	IBON-HI-2021-97	25 (14-43)	45	0	111 (63-162)	146 (124-202)	102 (79-122)	109 (50-191)	6 (4-8)	56 (30-75)	40 (30-46)
21	IBON-HI-2021-22	29 (7-46)	35	0	96 (61-159)	142 (118-199)	96 (60-124)	121 (48-230)	7 (6-10)	49 (26-62)	41 (15-57)
22	IBON-HI-2021-42	32 (5-56)	28	0	103 (76-159)	143 (120-199)	92 (70-117)	105 (40-220)	7 (5-9)	61 (25-73)	40 (29-49)
23	IBON-HI-2021-20	33 (11-68)	27	0	104 (75-161)	142 (123-201)	102 (78-126)	113 (34-215)	7 (6-10)	50 (24-66)	44 (30-62)
24	IBON-HI-2021-1	38 (11-75)	12	0	100 (62-162)	143 (119-202)	97 (70-129)	103 (36-174)	7 (6-9)	57 (25-78)	43 (31-51)
25	IBON-HI-2021-17	44 (11-86)	3	1	103 (75-162)	143 (121-202)	100 (71-123)	126 (33-198)	7 (6-12)	53 (26-72)	42 (28-52)

26	IBON-HI-2021-94	35 (11-50)	20	0	103 (72-162)	144 (121-202)	95 (71-112)	113 (29-284)	7 (4-9)	59 (30-74)	40 (28-46)
27	IBON-HI-2021-105	36 (11-65)	15	0	100 (71-165)	142 (118-205)	99 (75-118)	132 (34-270)	8 (6-9)	26 (19-48)	47 (41-56)
28	IBON-HI-2021-87	42 (12-71)	5	1	99 (70-158)	143 (120-198)	95 (68-120)	106 (36-159)	8 (6-10)	65 (45-83)	37 (25-49)
29	IBON-HI-2021-3	33 (11-61)	26	0	102 (76-161)	144 (119-201)	89 (63-122)	103 (30-166)	7 (5-9)	50 (26-63)	36 (23-51)
30	IBON-HI-2021-49	34 (10-57)	22	0	98 (73-162)	141 (118-202)	96 (74-124)	109 (29-175)	8 (7-10)	26 (23-28)	47 (36-58)
31	8th GSBYT-2021-18	31 (11-64)	30	0	108 (85-165)	144 (125-205)	101 (73-118)	97 (26-179)	8 (6-10)	58 (47-69)	40 (30-49)
32	8th GSBYT-2021-19	30 (10-63)	32	0	102 (75-166)	143 (121-206)	94 (67-114)	105 (34-192)	8 (5-11)	64 (45-80)	39 (26-60)
33	8th GSBYT-2021-20	29 (-4-53)	37	0	101 (86-128)	138 (122-166)	104 (77-122)	101 (32-168)	7 (4-9)	49 (20-69)	39 (32-46)
34	8th GSBYT-2021-21	35 (10-65)	19	0	102 (76-165)	142 (120-205)	98 (68-122)	113 (35-210)	9 (5-15)	63 (45-84)	38 (18-59)
35	8th GSBYT-2021-22	28 (11-52)	39	0	109 (88-165)	144 (126-206)	99 (75-118)	92 (36-160)	8 (6-9)	60 (45-73)	39 (25-46)
36	8th GSBYT-2021-16	28 (10-54)	40	0	110 (87-159)	144 (125-199)	97 (73-116)	171 (37-372)	8 (6-10)	27 (23-39)	40 (26-48)
37	8th GSBYT-2021-3	41 (11-61)	8	0	104 (78-161)	143 (121-202)	94 (67-118)	147 (46-352)	8 (5-11)	54 (30-66)	38 (25-60)
38	8th GSBYT-2021-13	30 (11-67)	34	0	108 (87-161)	141 (120-201)	94 (62-114)	141 (37-334)	9 (7-12)	28 (24-34)	35 (23-50)
39	8th GSBON-2021-67	26 (10-51)	43	0	114 (93-161)	147 (126-201)	106 (84-128)	110 (41-184)	8 (7-11)	54 (24-72)	45 (28-60)
40	8th GSBON-2021-42	31 (10-57)	31	0	104 (76-160)	240 (124-1211)	93 (69-111)	158 (52-280)	8 (5-11)	28 (17-48)	44 (32-57)
41	8th GSBON-2021-62	29 (13-45)	36	0	103 (72-162)	142 (121-203)	93 (63-111)	164 (53-332)	10 (7-13)	27 (23-29)	44 (26-68)
42	8th GSBYT-2021-9	27 (13-43)	42	0	111 (89-162)	145 (125-202)	96 (68-113)	110 (37-203)	10 (6-12)	26 (22-32)	43 (30-53)
43	8th GSBYT-2021-17	38 (17-61)	14	0	95 (66-162)	141 (120-202)	98 (73-119)	160 (50-332)	9 (7-11)	26 (24-31)	46 (35-55)
44	8th GSBON-2021-94	25 (15-36)	44	0	111 (95-162)	144 (126-203)	91 (75-104)	117 (35-172)	8 (6-9)	29 (20-45)	39 (23-53)
45	8th GSBON-2021-92	35 (11-50)	21	0	111 (90-164)	145 (122-205)	106 (92-123)	102 (56-168)	7 (5-9)	54 (28-72)	43 (30-56)
CD (10%)		**5.71**									
1	BH 946	41 (16-95)	II		101 (73-166)	143 (119-206)	93 (61-122)	116 (41-230)	8 (5-11)	60 (43-84)	42 (28-52)
2	HUB113	45 (12-112)	I		101 (76-160)	143 (117-200)	93 (60-118)	136 (34-251)	7 (5-10)	56 (39-73)	42 (29-53)
3	BHS 400	32 (12-53)	V		107 (75-166)	144 (123-207)	99 (71-125)	115 (45-200)	7 (5-10)	58 (41-79)	39 (24-51)
4	PL891	13 (7-28)	VI		105 (75-126)	140 (123-168)	103 (72-130)	75 (30-199)	10 (7-13)	29 (23-45)	44 (35-62)
5	DWRB 123	39 (17-79)	IV		100 (74-162)	143 (119-202)	91 (66-113)	124 (32-250)	7 (6-9)	26 (19-40)	50 (33-58)
6	DWRB137	42 (15-87)	II		97 (70-160)	142 (119-201)	81 (47-103)	106 (31-250)	8 (5-10)	57 (40-88)	46 (33-54)

Utilization of genotypes of Elite International Barley Germplasm Nursery (EIBGN 2021-22) at different locations

Entry Name	Karnal	Hisar	Chatha	Bajaura	Shimla	Durgapura	Kanpur	Ludhiana
IBYT-HI-2021-10	GY	H		SF	…..	H	SF	
IBYT-HI-2021-15		H		SF	…..			
IBYT-HI-2021-18	GY	H			…..			SF
IBYT-HI-2021-6					…..		SF	
IBYT-HI-2021-2					H			
IBYT-HI-2021-19	GY	H			…..			
IBYT-HI-2021-14	GY		GY		…..			SF
IBYT-HI-2021-13	GY	H			H			SF
IBYT-HI-2021-5		H	EM		…..	H		
IBYT-HI-2021-9	GY		EM		…..		SF	
IBYT-HI-2021-1		H			…..			
IBYT-HI-2021-12	GY	H	GY	SF				SF
IBON-HI-2021-32						H		
IBON-HI-2021-112	GY	H				H		
IBON-HI-2021-19		H	PH&SL			H		
IBON-HI-2021-22						H		
IBON-HI-2021-42		H						
IBON-HI-2021-1								SF
IBON-HI-2021-17	GY							SF
IBON-HI-2021-94		H					SF	SF
IBON-HI-2021-87	GY							SF
IBON-HI-2021-49		H	PH					
8th GSBYT-2021-18						H		
8th GSBYT-2021-19			EM					
8th GSBYT-2021-21		H					SF	
8th GSBYT-2021-3	GY	H						
8th GSBYT-2021-13						H		
8th GSBON-2021-67		H				H		
8th GSBON-2021-62				H				
8th GSBYT-2021-17							SF	SF
8th GSBON-2021-92			EM			H		SF
BH 946 (C)						H		SF
DWRB 123 (C)					H	H		SF
DWRB137 (C)						H		SF
HUB113 (C)						H		

H, used in hybridization; GY, selected for grain yield; EM, selected for early maturity; PH, selected for plant height; SL, selected for spike length; SF, selected for future use

National Barley Genetic Stock Nursery (NBGSN-2021-22)

This nursery comprising of a set of 19 promising genetic stocks endowed with trait(s) of breeding value, received from different cooperating centres was supplied at 12-centres for utilization (Durgapura, Ludhiana, Karnal, Hisar, Chatha, Ayodhya, Varanasi, Pantnagar, Kanpur, Khudwani, Shimla and Bajaura). At Ayodhya this nursery was vitiated. Details of the genetic stocks supplied and their utilization at different centres is given in the following tables.

Utilization of genotypes of National Barley Genetic Stock Nursery at different locations

Genotype	Utilization									
	Bajaura	Chatha	Hisar	Karnal	Shimla	Durgapura	Pantnagar	Kanpur	Khudwani	Ludhiana
KB 1817	H		…..	…..	…..	H		s	H	
UPB 1065			…..	…..	…..	H	H	s	…..	H
UPB 1070	H	H	…..	…..	…..		H	s	…..	H
UPB1097			…..	…..	…..	H		s	…..	
BH 1036,			…..	…..	H	H		s	H	
BH1034		H	…..	…..	…..	H		s	H	H
BH1035			…..	…..	…..			s	…..	H
BHS 474			…..	…..	H			s	…..	
DWRB207			…..	…..	…..	H		s	…..	
BCLA3			…..	…..	…..	H		s	…..	H
BCLA11-6		H	H	H	…..	H		s	H	H
DWRB 221	H	H	…..	…..	…..	H		s	H	
DWRB 218		H	…..	…..	…..			s	H	
DWRFB 58	H	H	H	H	H			s		
PL930			…..	…..	…..			s	…..	
PL931			…..	…..	…..	H		s	H	
RD 2899,	H		H	H	…..		H	s		
RD 3024	H		H	H	…..	H		s		
RD 3028,	H	H	H	H	H	H		s		H

H=Used in hybridization; S = Selected for future use

Details of genotypes of National Barley Genetic Stock Nursery 2021-22 (NBGSN 2021-22)

SR No.	Genotype	Originating Centre	Pedigree	Special feature	Row Type	Source
1.	KB 1817	CSAUA&T, Kanpur	RD 2784 × Jyoti	Resistance to yellow rust (ACI 0.0)	2	Registered Genetic Stocks
2.	UPB 1065	GBPUA&T, Pantnagar	LIMON/BICHY2000//NE167/CLE176	Low Beta glucan content (<3.5%) and high Filtration rate and Kolbach index	6	Registered Genetic Stocks
3.	UPB 1070	GBPUA&T, Pantnagar	DOLMA /BH 947	Resistance to yellow rust (ACI 0.0). High yield potential in NHZ (29.2 q/ha). High bold grain percentage (89.4%) and other good agronomic traits	6	IVT-MB-2020-21 Originated from 6th GSBYT-(2018-19)-11)
4.	UPB1097	GBPUA&T, Pantnagar	CANELA//E.QUEBRACHO/W9338	Protein Content	2	IVT-MB-2020-21
5.	BH 1036,	HAU, Hisar	VLB 130/BH 902	Bold grains	2	IVT-MB-2020-21
6.	BH1034	HAU, Hisar	HBL 712/BH 885	Protein Content	6	IVT-MB-2020-21
7.	BH1035	HAU, Hisar	BH 976/BH 946	Protein Content	2	Registered Genetic Stocks
8.	BHS 474	IARI, RS, Shimla	BLG132/BHS369	Resistant against all the pathotypes of yellow rust and brown rust in seedling and adult plant stage. Seedling resistance against all the pathotypes of black rust except for pathotype 11	2	Registered Genetic Stocks
9.	DWRB207	ICAR-IIWBR, Karnal	CDC Manley/BCU2881	Highly resistant to stripe rust, High 1000 grain weight (47.5g); Low protein content (9.5)	2	Registered Genetic Stocks
10.	BCLA3	ICAR-IIWBR, Karnal	EB921/Alfa93	Resistance to aphids	2	Registered Genetic Stocks
11.	BCLA11-6	ICAR-IIWBR, Karnal	BCU390/Alfa93	Resistance to aphids	2	IVT-MB-2020-21
12.	DWRB 221	ICAR-IIWBR, Karnal	DWRUB52/RD2508	Over all Malt Quality	2	IVT-MB-2020-21
13.	DWRB 218	ICAR-IIWBR, Karnal	DWRUB52/DWRB68	Bold grains, Protein content, FAN content	2	BQSN 2020-21
14.	DWRFB 58	ICAR-IIWBR, Karnal	W260/BCU8	Naked barley with high 1000-gw and bold grains	2	IVT-MB-2020-21
15.	PL930	PAU, Ludhiana	PL807 x *H. spontaneum* Acc. 361	Protein Content	2	IVT-MB-2020-21
16.	PL931	PAU, Ludhiana	PL807 x *H. spontaneum* Acc. 361	Protein Content	6	EBDSN 2020-21
17.	RD 2899	RARI, Durgapura	RD-2592/RD-2035//RD-2715	Resistant to leaf blight	2	EBDSN 2020-21
18.	RD 3024	RARI, Durgapura	RD-2607/RD-2668	Resistant to leaf blight	6	IVT-MB-2020-21
19.	RD 3028	RARI, Durgapura	NBGSN-11/RD-2668	Bold grains, Protein content	2	Registered Genetic Stocks

Breeder and Nucleus Seed Production of Barley during 2021-22

Breeder Seed Indent

A consolidated quantity of 419.85q breeder seed indent for 21 varieties was received from Seed Davison DA&FW, New Delhi for production during Rabi 2021-22 and supply during 2022-23. Seven states *viz*., Rajasthan, Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Madhya Pradesh, and Uttarakhand and four public sector agencies viz., National Seeds Corporation, IFFDC, NAFED & KVSS and private seed companies under the National Seed Association of India indented breeder seed. The highest breeder seed indent was placed by Rajasthan (190q) followed by UP (120q), NSAI (31.60q) and National Seed Corporation (31q).

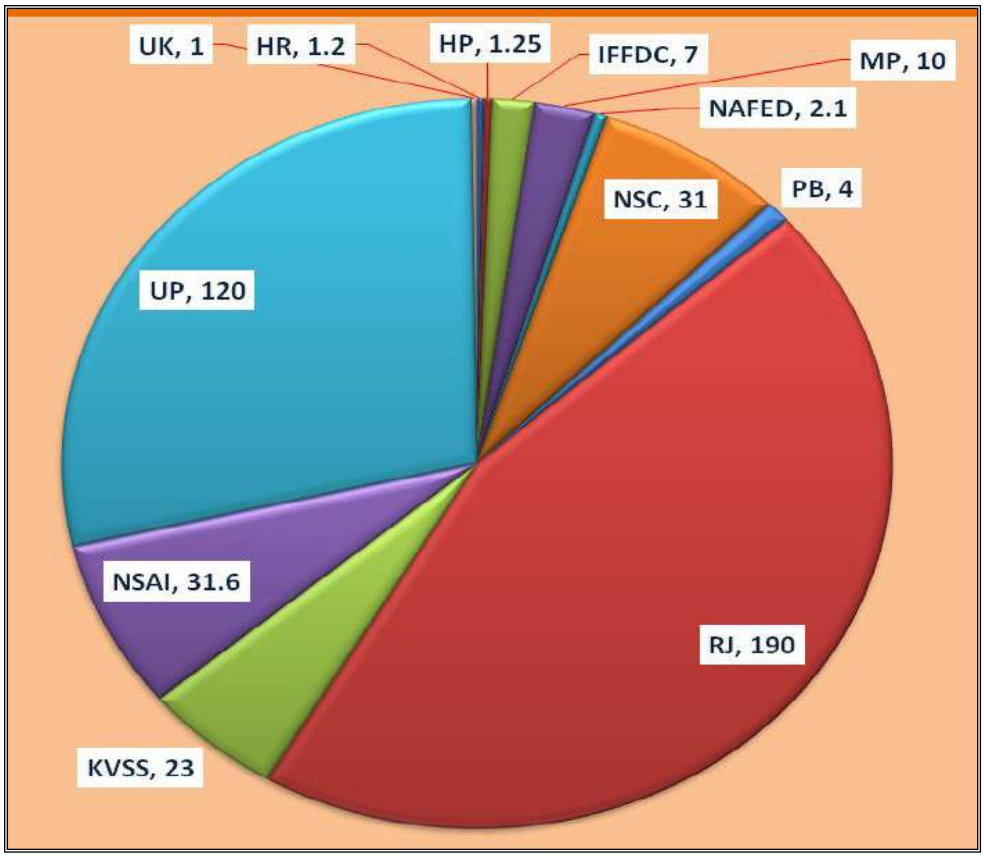


Fig: Breeder seed indent of 12 indenting agencies

Seed Allocation and Production

Total 419.85q breeder seed of 21 varieties was allocated among eight BSP centres. The indent of 0.30q breeder seed of DWRB 64 was not allocated in the BSP-1. Among all 21 varieties maximum breeder seed indent was received for the variety DWRB137 (120.70q) followed by HUB 113 (50.0q), RD 2899 (49.10q) and RD 2907 (44.0q).

A total of 632.31q breeder seed with a surplus of 212.46q over the total allocated quantity (419.85q) of 21 varieties was produced by 8 BSP centres during 2021-22. Among 8 breeder seed production centres, maximum breeder seed was reported from RARI, Durgapura (306.20q) with surplus of 165.70q against allocation followed by CCSHAU, Hisar (139.160q) and IIWBR, Karnal (110.20q). Deficit breeder seed production of DWRB 137 (-28.50) and BH 946 (-8.50q). Breeder seed production of two malt barley varieties (two rowed) *viz*., DWRB 123 and DWRB 110 could not produce due to the availability of new and better malt barley variety *i.e*., DWRB 182. A total of 8.0q additional breeder seed of DWRB 182 has been produced in the replacement of old malt varieties. Top ten breeder seed indented varieties contribute to the tune of 93.27% in total allocation whereas these varieties contribute 95.24% share in total breeder seed production during 2021-22. All the top ten varieties are less than eight years old except RD-2035 which was released in 1994. It is estimated that the varietal replacement rate of less than eight years old varieties is 86.56% during 2021-22.

A total of 36.06q nucleus seed of 19 varieties was produced against 20.10q allocation in BNS-1 with a surplus of 15.96q seed during 2021-22.

Test Stock Multiplication and Grow out Test Report

National Seed Corporation, New Delhi has reported a total of 23.15q carry over test stock seed of variety DWRB 182 notified in 2021. ICAR-IIWBR has conducted grow out test of 16 barley varieties from 06 Breeder Seed production Centres except CSAUT, Kanpur and RS-IARI, Karnal.

Top ten indented varieties of barley for Breeder Seed Production

SN.	Variety	Year of Notification	Breeder Seed Production (BSP) (q)				Basic & Nucleus Seed (BNS) (q)		
			DAFW Indent	Allocation	BSP IV	Surplus/ Deficit	Allocation	Production	Surplus/ Deficit
1	DWRB137	2018	120.70	120.70	92.20	-28.50	3.00	4.00	1.00
2	HUB113	2014	50.00	50.00	41.50	-8.50	2.00	1.10	-0.90
3	RD 2899	2018	49.10	49.10	108.09	58.99	2.00	4.00	2.00
4	RD2907	2018	44.00	44.00	74.16	30.16	2.50	4.00	1.50
5	BH-959	2015	34.90	34.90	97.90	63.00	1.50	1.60	0.10
6	BH-946	2014	26.30	26.30	39.56	13.26	1.40	2.10	0.70
7	RD-2794	2016	25.4	25.4	35.1	9.7	1.5	3.00	1.50
8	K 1055	2018	20.00	20.00	22.50	2.50	1.00	1.50	0.50
9	RD2035	1994	15.00	15.00	81.25	66.25	1.00	2.00	1.00
10	DWRB160	2020	8.10	8.10	10.00	1.90	1.00	1.00	0.00
Total			**393.5**	**393.5**	**602.26**	**208.76**	**16.90**	**24.30**	**7.40**
Per cent Contribution			**93.21**	**93.27**	**95.24**	**99.19**	**80.09**	**67.38**	**49.46**

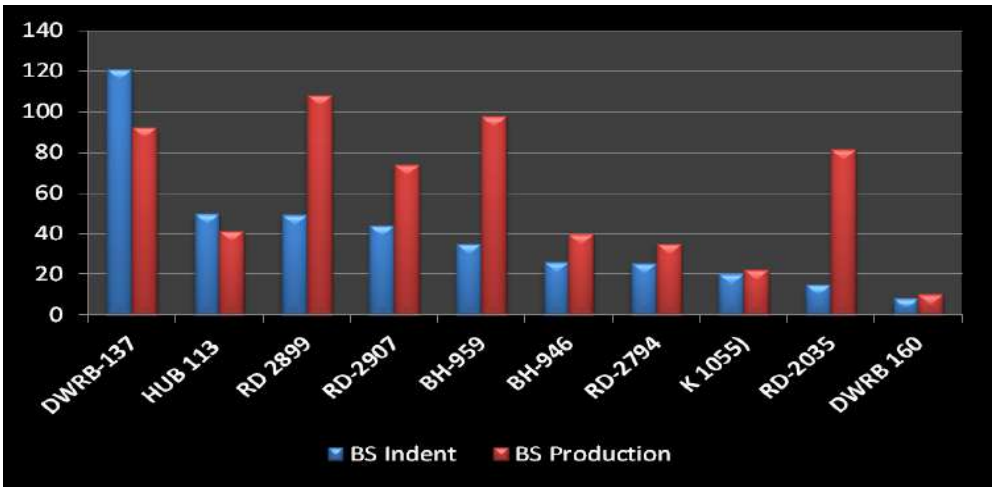


Fig. Breeder seed indent and Production of top ten varieties

Centre -wise Breeder and Nucleus Seed Indent and Production during 2021-22

BSP Centre	Variety	Year of Notification	Breeder Seed Production (BSP) (q)				Basic & Nucleus Seed (BNS) (q)		
			DAFW Indent	Allocation	BSP IV	Surplus/ Deficit	Allocation	Production	Surplus/ Deficit
BHU Varanasi	HUB 113	2014	50.00	50.00	41.50	-8.50	2.00	1.10	-0.90
CCS HAU Hisar	BH-902	2010	0.30	0.30	1.70	1.40	0.10	0.50	0.40
	BH-946	2014	26.30	26.30	39.56	13.26	1.40	2.10	0.70
	BH-959	2015	34.90	34.90	97.90	63.00	1.50	1.60	0.10
	Total		**63.50**	**63.50**	**139.16**	**75.66**	**4.00**	**5.20**	**1.20**
CSAUA&T Kanpur	K 1055	2018	20.00	20.00	22.50	2.50	1.00	1.50	0.50
IARI RS Karnal	BHS-380	2019	0.50	0.50	0.50	0.00	0.20	0.31	0.11
	BHS-400	2014	0.75	0.75	0.75	0.00	0.20	0.45	0.25
	Total			**1.25**	**1.25**	**0.00**	**0.40**	**0.76**	**0.36**
ICAR-IIWBR, Karnal	DWRB 101	2015	3.40	3.40	0.00	-3.40	0.40	0.00	-0.40
	DWRB-123	2017	5.40	5.40	0.00	-5.40	0.60	0.00	-0.60
	DWRB-137	2018	120.70	120.70	92.20	-28.50	3.00	4.00	1.00
	DWRB 160	2020	8.10	8.10	10.00	1.90	1.00	1.00	0.00
	DWRB 182	2021	0.00	0.00	8.00	8.00	0.00	1.00	1.00
	Total			**137.60**	**110.20**	**-27.40**	**5.00**	**5.00**	**0.00**
PAU Ludhiana	PL 891	2020	4.00	4.00	6.00	2.00	0.50	1.50	1.00
	PL-426	1996	2.00	2.00	2.00	0.00	0.20	1.50	1.30
	Total			**6.00**	**8.00**	**2.00**	**0.70**	**3.00**	**2.30**
RARI, SKNAU, Durgapura	RD 2849	2016	5.00	5.00	7.60	2.60	0.25	2.50	2.25
	RD 2899	2018	49.10	49.10	108.09	58.99	2.00	4.00	2.00
	RD-2035	1994	15.00	15.00	81.25	66.25	1.00	2.00	1.00
	RD-2786	2013	2.00	2.00	0.00	-2.00	0.25	4.00	3.75
	RD-2794	2016	25.4	25.4	35.1	9.7	1.5	3.00	1.50
	RD-2907	2018	44.00	44.00	74.16	30.16	2.50	4.00	1.50
	Total		**140.50**	**140.50**	**306.20**	**165.70**	**7.50**	**19.50**	**12.00**
VPKAS Almora	VL Jau 118	2015	3.00	3.00	3.50	0.50	0.50	0.00	-0.50
Grand Total			**419.85**	**419.85**	**632.31**	**212.46**	**20.10**	**36.06**	**15.96**

Variety-wise Breeder and Nucleus Seed Indent and Production during 2021-22

S.N.	Variety	Notification Year	Breeder Seed Production (BSP) (q)				Basic & Nucleus Seed (BNS) (q)		
			DAC Indent	Allocation	Production	Surplus /Deficit	Allocation	Production	Surplus /Deficit
1.	BH902	2010	0.30	0.30	1.70	1.40	0.10	0.50	0.40
2.	BH946	2014	26.30	26.30	39.56	13.26	1.40	2.10	0.70
3.	BH959	2015	34.90	34.90	97.90	63.00	1.50	1.60	0.10
4.	BHS380	2019	0.50	0.50	0.50	0.00	0.20	0.31	0.11
5.	BHS400	2014	0.75	0.75	0.75	0.00	0.20	0.45	0.25
6.	DWRB101	2015	3.40	3.40	0.00	-3.40	0.40	0.00	-0.40
7.	DWRB123	2017	5.40	5.40	0.00	-5.40	0.60	0.00	-0.60
8.	DWRB137	2018	120.70	120.70	92.20	**-28.50**	3.00	4.00	1.00
9.	DWRB160	2020	8.10	8.10	10.00	1.90	1.00	1.00	0.00
10.	DWRB182	2021	0.00	0.00	8.00	8.00	0.00	1.00	1.00
11.	HUB 113	2014	50.00	50.00	41.50	**-8.50**	2.00	1.10	-0.90
12.	K 1055	2018	20.00	20.00	22.50	2.50	1.00	1.50	0.50
13.	PL 891	2020	4.00	4.00	6.00	2.00	0.50	1.50	1.00
14.	PL426	1996	2.00	2.00	2.00	0.00	0.20	1.50	1.30
15.	RD2849	2016	5.00	5.00	7.60	2.60	0.25	2.50	2.25
16.	RD2899	2018	49.10	49.10	108.09	58.99	2.00	4.00	2.00
17.	RD2035	1994	15.00	15.00	81.25	66.25	1.00	2.00	1.00
18.	RD2786	2013	2.00	2.00	0.00	-2.00	0.25	4.00	3.75
19.	RD2794	2016	25.4	25.4	35.1	9.7	1.5	3.00	1.50
20.	RD2907	2018	44.00	44.00	74.16	30.16	2.50	4.00	1.50
21.	VL Jau118	2015	3.00	3.00	3.50	0.50	0.50	0.00	-0.50
	Total		**419.85**	**419.85**	**632.31**	**212.46**	**20.1**	**36.06**	**15.96**

Molecular Report – Barley AVT and IVT Trials (2021-22)

Barley trials entries and checks were characterized at molecular level to analyze genetic variability in all India coordinated barley improvement programme during 2021-22. Total 109 genotypes including entries and check lines of AVT and IVT trials 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 97 alleles were scored for PCR based amplification profiles for screened genotypes. The number of alleles ranged from 1 to 4 with an average of 2.1 alleles per locus. The band fragment size varied from 90 bp to 1500 bp with PIC values ranging from 0.0 to 0.69 for individual molecular markers evenly distributed across seven chromosomes.

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 Entries and check lines were scored to develop binary datasets and analyzed. 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, 000 alleles were treated as missing data to reduce the biased genetic or similarity measures. These genotypes were grouped within similarity coefficient (GS) value around 0.54 to 1.0 and showed sufficient genetic variability at molecular level. All entries are placed at separate nodes thus distinguishing from their check lines, respectively. Entry (UPB1095) and check (DWRUB52) found on single node are also variable at molecular level for couple of molecular markers and can be discriminated using SSR markers.

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.

Molecular Profiles of Barley Trials (2021-22)

Marker	Chr	CCSHAU, Hisar							ICAR-IARI RS, Shimla				
		BH1040	BH1041	BH1042	BH1043	BH1044	BH1045	BH1046	BHS488	BHS489	BHS490	BHS491	BHS492
Bmac154	1H	130	140	130	110	110	110	130	140	130	110	140/ 130	130
Bmac213	1H	168	168	180	168	168	168	180	155	155	180	180	180
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	126	126	110	1126	126	126	126	110	126	110
MGB402	1H	260	260	260	260	260	260	260	260	260	240	260	240
ScSSR10477	1H	140	150	150	150	150	140	150	150	150	140	150	150
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	180	180	180	155	155	155	180	155	180	180	180
EBmac640	2H	000	176	190	190	176	176	190	190	190	176	176	190
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	149	149	149	125	149	149	125	149	149	149	149
EBmac623	2H	168	154	168	154	154	154	154	168	154	168	168	154
cMWG658	2H	580	580	580	580	580	580	600	580	600	580	600	600
Ebmatc39	2H	190	150	190	150	150	190	150	170	190	150	150	190
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	140	140	122	122	122	122	122	140	140	140	122
Bmag877	3H	165	165	165	165	153	153	165	165	153	153	165	165
Ebmac541	3H	120	106	120	140	140	140	106	106	106	140	120	140
MWG 847	3H	150	345	150	345	345	150	345	150	345	345	345	150
Bmag225	3H	165	185	165	185	185	000	165	185	185	185	165	165
HvLTPPB	3H	200	216	200	216	216	216	216	216	216	216	216	216
Bmag841	3H	115	125	125	115	115	125	125	115	115	125	115	125
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	160	150	160	150	150	150	160	150	150	160	160
HVM67	4H	136	136	126	136	136	126	126	126	126	126	126	136
HvMLOH1A	4H	175	185	185	185	185	175	185	175	175	185	175	185
Ksug10	4H	1500	1500	1500	1300	1500	1300	1500	1500	1500	1500	1300	1300
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	90	90	90	119	119	90	119	119	90	119	90
Bmag337	5H	145	145	145	145	165	165	145	165	145	145	145	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	167	167	167	157	147	147	167	147	167	167	167
GMS61	5H	135	145	135	145	135	145	145	145	145	145	145	145
Bmac303	5H	138	119	119	119	138	138	119	119	119	119	138	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	210	236	210	236	220	180	210	220	236	220	210	210
Bmac500	6H	150	190	150	190	150	190	150	190	150	150	190	150
GBM1215	6H	240	240	240	200	240	240	200	200	240	240	240	240
HVM11	6H	150	150	175	175	185	150	185	150	175	185	150	185
MWG2029	6H	260	245	260	245	260	260	245	245	245	260	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	140	155	155	155	155	140	155	155	155	155	155
Bmac162	7H	200	200	200	187	187	187	200	200	200	187	200	200
Bmac167	7H	195	195	184	195	184	195	195	184	195	184	195	195
Bmag110	7H	160	184	160	145	145	145	135	145	135	145	135	160

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

Marker	Chr		ICAR-IIWBR, Karnal											
		DWRB219	DWRB221	DWRB223	DWRB225	DWRB226	DWRB227	DWRB228	DWRB229	DWRB230	DWRB231	DWRB232	DWRB233	DWRB234
Bmac154	1H	130	110	110	140	000	130	140	140	110	130	130	130	130
Bmac213	1H	155	180	155	180	168	180	155	168	155	168	155	155	180
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	110	110	110	110	126	126	126	126	126	110	110
MGB402	1H	260	240	240	240	260	000	260	260	240	260	260	240	240
ScSSR10477	1H	140	150	200	160	150	160	150	200	200	150	150	160	200
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	155	155	180	155	180	180	155	180	155	180	180	155
EBmac640	2H	176	190	190	176	190	190	190	176	190	190	190	190	190
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	125	149	125	149	125	149	125	125	149	149	125	125
EBmac623	2H	154	154	168	154	168	168	168	154	168	154	154	168	168
cMWG658	2H	600	600	600	580	580	600	600	580	580	580	600	580	600
Ebmatc39	2H	190	150	150	150	190	170	150	170	190	190	170	170	170
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	140	140	140	122	140	140	122	122	122	140	140	140	140
Bmag877	3H	153	153	165	165	153	165	153	165	165	165	165	165	165
Ebmac541	3H	140	140	140	120	106	140	106	106	120	140	106	120	120
MWG 847	3H	150	345	345	150	345	150	150	345	150	150	345	150	150
Bmag225	3H	140	165	165	165	165	165	140	165	165	185	165	165	165
HvLTPPB	3H	216	216	216	216	216	200	216	200	200	216	200	200	200
Bmag841	3H	125	115	115	125	115	125	125	115	125	115	125	225	125
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	160	160	160	150	150	160	150	160	150	160	150	150
HVM67	4H	126	126	136	136	126	126	126	136	126	126	126	136	126
HvMLOH1A	4H	185	175	185	185	175	185	185	175	185	185	175	185	185
Ksug10	4H	1300	1300	1500	1300	1500	1500	1500	1300	1500	1500	1300	1500	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	119	119	119	119	119	90	119	90	000	90	90	119
Bmag337	5H	165	165	165	145	145	165	165	165	165	145	145	145	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	157	157	167	157	147	157	157	167	167	157	157	157	157
GMS61	5H	135	145	145	135	145	145	135	145	145	135	135	135	145
Bmac303	5H	119	119	138	138	119	119	138	138	138	138	119	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	236	210	236	236	210	220	236	180	210	210	220	180
Bmac500	6H	150	190	150	110	150	150	190	190	150	150	150	110	150
GBM1215	6H	200	240	240	240	240	240	240	240	240	240	200	240	240
HVM11	6H	185	150	185	150	175	185	175	150	185	175	175	175	185
MWG2029	6H	260	260	245	245	245	260	245	245	245	260	245	260	260
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	140	140	140	155	140	140	155	155	140	140	140	140
Bmac162	7H	200	200	187	187	187	187	187	187	187	200	200	200	187
Bmac167	7H	195	195	000	195	195	184	195	184	195	195	184	195	184
Bmag110	7H	135	160	160	135	135	160	135	135	160	160	135	160	160

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

Marker	Chr	CSKHPKV, RRS, Bajaura					BHU, Varanasi	CSAU&T, Kanpur						
		HBL874	HBL875	HBL876	HBL877	HBL878	HUB281	KB2004	KB2008	KB2013	KB2015	KB2018	KB2019	KB2031
Bmac154	1H	110	140	130	110	110	110	110	130	110	110	110	110	130
Bmac213	1H	168	168	168	168	180	168	180	168	168	155	180	168	155
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	000	126	110	110	126	110	126	126	110	126	110
MGB402	1H	260	260	260	260	240	240	240	260	240	240	260	240	260
ScSSR10477	1H	140	200	150	160	150	200	150	140	150	160	150	150	150
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	180	155	180	180	155	180	155	155	155	000	155	180	180
EBmac640	2H	176	190	176	190	190	176	190	190	190	176	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	149	149	125	125	125	125	149	125	125	149	125	149
EBmac623	2H	154	168	154	168	154	168	154	154	154	168	154	168	168
cMWG658	2H	580	600	580	580	580	580	600	600	580	580	600	600	600
Ebmatc39	2H	150	170	190	150	190	170	150	170	170	190	150	170	150
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	122	140	140	140	140	140	122	140	122	122	122	140
Bmag877	3H	165	165	153	153	153	165	153	165	153	153	165	165	165
Ebmac541	3H	106	140	106	140	120	140	140	106	140	140	140	106	140
MWG 847	3H	345	345	345	150	150	150	345	345	150	150	150	345	150
Bmag225	3H	185	140	165	165	165	165	165	165	165	140	185	185	185
HvLTPPB	3H	216	216	216	216	200	200	216	000	216	200	216	216	200
Bmag841	3H	125	115	115	115	115	115	115	115	225	125	225	115	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	150	160	160	150	160	160	150	160	160	160	160	150
HVM67	4H	136	136	126	136	136	136	126	126	136	126	126	126	126
HvMLOH1A	4H	175	185	185	175	185	175	175	175	175	185	185	175	185
Ksug10	4H	1500	1300	1500	1500	1500	1500	1300	1300	1500	1300	1500	1500	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	90	119	119	119	119	119	90	90	119	119	119	90
Bmag337	5H	145	145	145	145	165	145	165	145	165	165	165	165	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	147	157	167	147	167	157	167	167	157	167	167	157
GMS61	5H	145	145	135	145	145	135	145	145	145	135	135	145	135
Bmac303	5H	119	138	138	119	138	119	119	138	119	119	138	119	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	220	236	210	220	236	236	210	236	220	236	220	220
Bmac500	6H	190	110	190	110	110	190	190	150	150	150	190	190	190
GBM1215	6H	240	240	240	200	240	200	240	240	200	200	240	200	240
HVM11	6H	150	185	175	175	185	150	175	175	185	185	185	150	175
MWG2029	6H	245	245	245	260	260	260	245	245	260	245	260	245	260
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	155	155	155	155	155	140	155	140	155	155	155	140
Bmac162	7H	200	187	187	187	200	200	187	200	187	187	187	200	000
Bmac167	7H	195	195	184	184	195	195	195	195	184	184	195	184	195
Bmag110	7H	184	160	135	160	160	145	160	145	160	135	145	145	145

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

Marker	Chr	NDUA&T, Faizabad									PAU, Ludhiana		
		NDB1756	NDB1776	NDB1782	NDB1783	NDB1784	NDB1785	NDB1789	NDB1793	NDB1800	PL917	PL933	PL934
Bmac154	1H	110	130	130	140	140	130	130	130	140	140	130	110
Bmac213	1H	180	168	168	155	180	180	155	155	155	155	155	168
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	110	126	126	110	110	110	126	110	110	110	110	110
MGB402	1H	260	260	260	240	240	240	260	240	240	240	240	260
ScSSR10477	1H	150	140	160	140	150	150	150	140	150	160	150	200
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	155	155	155	180	180	180	155	155	180	155	180
EBmac640	2H	190	190	190	190	190	176	190	176	176	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	149	149	125	149	125	125	125	125	125	125	125
EBmac623	2H	154	154	000	154	154	154	154	168	154	154	168	168
cMWG658	2H	600	580	600	600	580	580	600	580	580	600	600	580
Ebmatc39	2H	150	150	150	170	170	190	170	10	170	190	150	150
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	140	140	122	140	122	140	122	122	122	140	140
Bmag877	3H	165	153	165	165	165	153	165	153	153	165	153	165
Ebmac541	3H	140	106	106	120	140	140	140	120	140	120	106	140
MWG 847	3H	150	345	345	345	345	345	345	345	345	345	150	150
Bmag225	3H	185	185	165	140	165	185	185	165	165	140	165	165
HvLTPPB	3H	200	216	216	216	216	216	200	216	216	216	200	200
Bmag841	3H	225	115	115	115	125	115	125	115	125	115	225	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	160	150	150	150	150	150	160	160	150	150	160
HVM67	4H	126	136	126	126	126	136	126	126	136	126	136	136
HvMLOH1A	4H	185	175	175	175	185	185	185	175	185	175	175	175
Ksug10	4H	1500	1500	1300	1500	1500	1500	1500	1500	1500	1500	1500	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	119	90	119	90	90	119	119	119	119	90	119
Bmag337	5H	165	145	145	145	165	165	145	165	145	145	165	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	157	167	157	147	157	167	157	157	157	157	167
GMS61	5H	135	145	135	145	135	135	135	145	135	135	135	135
Bmac303	5H	138	119	138	119	119	138	119	119	119	119	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	220	180	210	220	220	220	210	236	236	220	210	210
Bmac500	6H	190	190	150	110	110	110	110	150	110	110	110	110
GBM1215	6H	240	200	240	240	240	240	240	240	200	240	240	240
HVM11	6H	185	185	175	185	175	175	175	175	150	185	150	150
MWG2029	6H	260	245	245	245	245	245	260	245	245	245	260	260
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	140	155	140	155	140	140	155	140	140	140	155
Bmac162	7H	187	200	200	200	187	187	187	187	200	200	200	200
Bmac167	7H	195	184	195	195	195	195	195	184	184	195	184	195
Bmag110	7H	145	000	145	135	145	145	135	160	145	135	135	145

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

Marker	Chr	PAU, Ludhiana						SKNAU, RARI, Durgapura						
		PL935	PL936	PL937	PL938	PL939	PL940	RD3034	RD3037	RD3047	RD3048	RD3049	RD3050	RD3051
Bmac154	1H	140	110	000	110	110	140	130	110	110	110	140	130	110
Bmac213	1H	168	155	155	155	168	168	180	168	168	180	155	155	155
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	126	126	126	126	110	110	126	126	126	126	126
MGB402	1H	240	260	260	240	240	240	240	260	260	260	260	260	260
ScSSR10477	1H	150	160	140	200	200	200	160	140	150	150	150	160	150
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	180	180	155	155	155	180	000	155	180	180	155	180	180
EBmac640	2H	190	176	190	190	176	176	190	176	190	190	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	125	125	125	125	125	125	149	125	149	149	149	125
EBmac623	2H	154	154	154	168	168	154	168	154	168	168	168	168	154
cMWG658	2H	580	580	600	580	580	580	600	580	580	600	600	580	580
Ebmatc39	2H	150	170	190	190	170	150	170	190	170	150	190	170	170
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	140	122	140	140	140	122	140	122	140	122	140	140	122
Bmag877	3H	165	153	153	165	153	153	165	153	165	165	165	153	153
Ebmac541	3H	140	000	140	120	140	120	140	140	140	120	106	120	106
MWG 847	3H	345	150	150	345	150	345	150	345	150	345	345	150	150
Bmag225	3H	140	140	140	140	165	165	165	165	140	185	165	185	140
HvLTPPB	3H	216	200	216	200	216	216	200	216	200	216	216	200	216
Bmag841	3H	125	115	125	225	115	225	125	125	125	125	115	115	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	160	160	150	160	150	150	150	160	150	150	150	160
HVM67	4H	136	136	126	136	126	136	136	126	126	136	126	126	136
HvMLOH1A	4H	175	175	185	175	175	185	185	175	185	185	175	185	175
Ksug10	4H	1500	1300	1300	1300	1500	1500	1500	1300	1500	1300	1500	1500	000
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	119	119	90	119	119	119	119	119	119	119	90	119
Bmag337	5H	165	165	165	145	145	165	165	165	165	165	145	145	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	157	157	157	167	167	157	147	147	157	147	167	157
GMS61	5H	145	000	145	145	135	135	145	135	135	145	145	135	135
Bmac303	5H	138	138	119	138	119	119	119	138	138	119	119	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	210	236	236	236	000	210	180	180	210	210	236	210	000
Bmac500	6H	190	110	150	150	150	150	150	150	150	190	150	190	110
GBM1215	6H	240	200	200	240	240	200	240	240	200	200	240	240	200
HVM11	6H	150	175	185	185	150	185	185	150	175	175	175	175	175
MWG2029	6H	245	245	260	260	260	260	260	260	245	245	245	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	140	140	140	140	140	140	155	140	140	140	155	140
Bmac162	7H	200	200	200	200	200	187	187	187	187	200	200	187	200
Bmac167	7H	195	184	195	184	184	195	184	195	184	195	195	195	195
Bmag110	7H	135	135	135	160	135	145	160	145	160	145	135	160	135

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

Marker	Chr	SKNAU, RARI, Durgapura											
		RD3052	RD3053	RD3054	RD3055	RD3056	RD3057	RD3058	RD3059	RD3060	RD3061	RD3062	RD3063
Bmac154	1H	110	110	110	140	110	130	110	140	110	130	130	110
Bmac213	1H	168	155	168	155	155	168	168	180	168	168	155	155
Bmag382	1H	109	109	000	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	110	110	110	126	126	110	000	110	126	110	110
MGB402	1H	240	240	240	240	240	260	260	240	240	240	240	260
ScSSR10477	1H	200	200	150	140	160	140	150	150	160	150	160	150
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	180	155	180	155	155	180	180	155	155	000	155
EBmac640	2H	176	176	190	176	176	176	190	190	176	176	190	190
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	125	149	125	000	125	125	149	125	125	125	125
EBmac623	2H	154	154	168	154	168	154	168	168	168	154	168	154
cMWG658	2H	580	600	580	600	580	600	580	600	600	580	600	600
Ebmatc39	2H	150	150	150	190	170	170	190	190	150	150	190	150
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	122	140	122	140	140	122	140	122	122	140	140
Bmag877	3H	165	153	153	153	153	153	165	165	153	153	165	165
Ebmac541	3H	140	000	106	140	140	140	140	106	140	140	140	140
MWG 847	3H	345	345	345	345	150	150	150	345	150	345	150	150
Bmag225	3H	140	185	165	185	140	140	185	185	140	165	165	185
HvLTPPB	3H	216	200	216	200	200	216	200	216	216	216	200	200
Bmag841	3H	225	115	115	115	125	125	225	125	125	125	125	225
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	160	150	160	160	160	160	150	150	150	150	160
HVM67	4H	126	000	126	136	126	126	126	126	126	126	136	126
HvMLOH1A	4H	185	175	175	175	185	185	185	175	175	175	185	185
Ksug10	4H	1500	1500	1500	1500	1300	1300	1500	1500	1500	1500	1500	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	119	119	119	119	119	119	119	90	119	119	119
Bmag337	5H	165	165	145	165	165	165	165	145	145	165	165	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	157	157	147	157	157	157	167	157	147	167	157	167
GMS61	5H	135	135	145	135	135	135	135	135	135	135	145	135
Bmac303	5H	119	119	119	119	119	119	138	119	138	138	119	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	220	236	236	236	220	236	236	000	236	236	180	210
Bmac500	6H	150	110	150	110	150	150	150	150	150	150	150	150
GBM1215	6H	200	200	240	200	200	200	240	240	200	240	240	240
HVM11	6H	150	175	175	175	185	185	185	185	175	175	185	185
MWG2029	6H	260	245	245	245	245	260	260	245	260	260	260	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	140	155	140	155	140	155	155	140	140	140	140
Bmac162	7H	200	200	187	200	187	200	200	187	187	200	187	187
Bmac167	7H	195	195	195	195	184	195	195	184	184	184	184	184
Bmag110	7H	160	160	135	145	160	160	135	145	145	135	135	160

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

Marker	Chr	GBPUA&T, Pantnagar										VPKAS, Almora	
		UPB1086	UPB1095	UPB1101	UPB1102	UPB1103	UPB1104	UPB1105	UPB1106	UPB1107	UPB1108	VLB 175	VLB 176
Bmac154	1H	110	110	110	130	130	110	110	130	110	110	110	140
Bmac213	1H	155	180	155	155	168	168	168	155	180	155	155	155
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	110	110	110	110	126	126	110	126	126	126	110	000
MGB402	1H	240	260	240	260	260	240	240	260	240	260	240	260
ScSSR10477	1H	130	150	200	200	140	200	140	000	150	160	160	160
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	180	155	180	180	155	155	155	180	155	180	180	155
EBmac640	2H	190	190	000	176	190	176	176	190	176	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	125	149	149	125	125	125	149	125	125	125	149
EBmac623	2H	154	154	168	154	168	154	168	154	154	154	168	168
cMWG658	2H	600	600	580	600	580	580	580	580	600	580	580	600
Ebmatc39	2H	150	170	150	170	190	170	150	170	150	170	170	170
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	140	140	140	140	122	140	140	140	140	122	122	140
Bmag877	3H	153	165	153	165	165	153	153	153	000	153	165	153
Ebmac541	3H	120	140	140	106	140	140	140	106	140	106	140	140
MWG 847	3H	150	150	345	150	345	150	345	345	345	150	150	345
Bmag225	3H	185	185	185	140	140	165	185	185	165	140	140	140
HvLTPPB	3H	200	200	200	200	200	216	216	200	216	200	216	216
Bmag841	3H	115	225	125	115	115	115	115	125	115	115	125	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	160	160	150	160	160	160	160	160	160	150	160
HVM67	4H	136	126	126	136	136	126	136	126	126	136	126	136
HvMLOH1A	4H	175	185	175	185	175	175	175	175	175	175	175	185
Ksug10	4H	1500	1500	1500	1500	1300	1500	1500	1300	1300	1300	1500	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	119	119	90	119	90	90	90	119	119	119	90
Bmag337	5H	165	165	165	165	145	145	145	145	145	145	145	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	167	147	157	167	167	157	157	157	167	147	167
GMS61	5H	135	135	145	135	145	135	145	135	145	135	135	145
Bmac303	5H	119	138	119	138	138	119	119	119	119	119	138	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	210	210	220	220	236	210	210	236	236	236	210
Bmac500	6H	190	150	150	150	150	150	150	150	190	110	150	150
GBM1215	6H	240	240	240	200	240	240	200	200	240	200	200	200
HVM11	6H	150	185	185	175	175	150	175	175	175	175	175	175
MWG2029	6H	260	245	245	260	245	245	245	245	260	245	260	260
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	140	140	155	155	140	140	140	140	155	140	140
Bmac162	7H	187	187	200	187	200	187	187	187	200	200	200	187
Bmac167	7H	195	184	195	195	184	184	195	184	195	184	184	184
Bmag110	7H	145	145	145	135	135	145	160	135	160	135	160	135

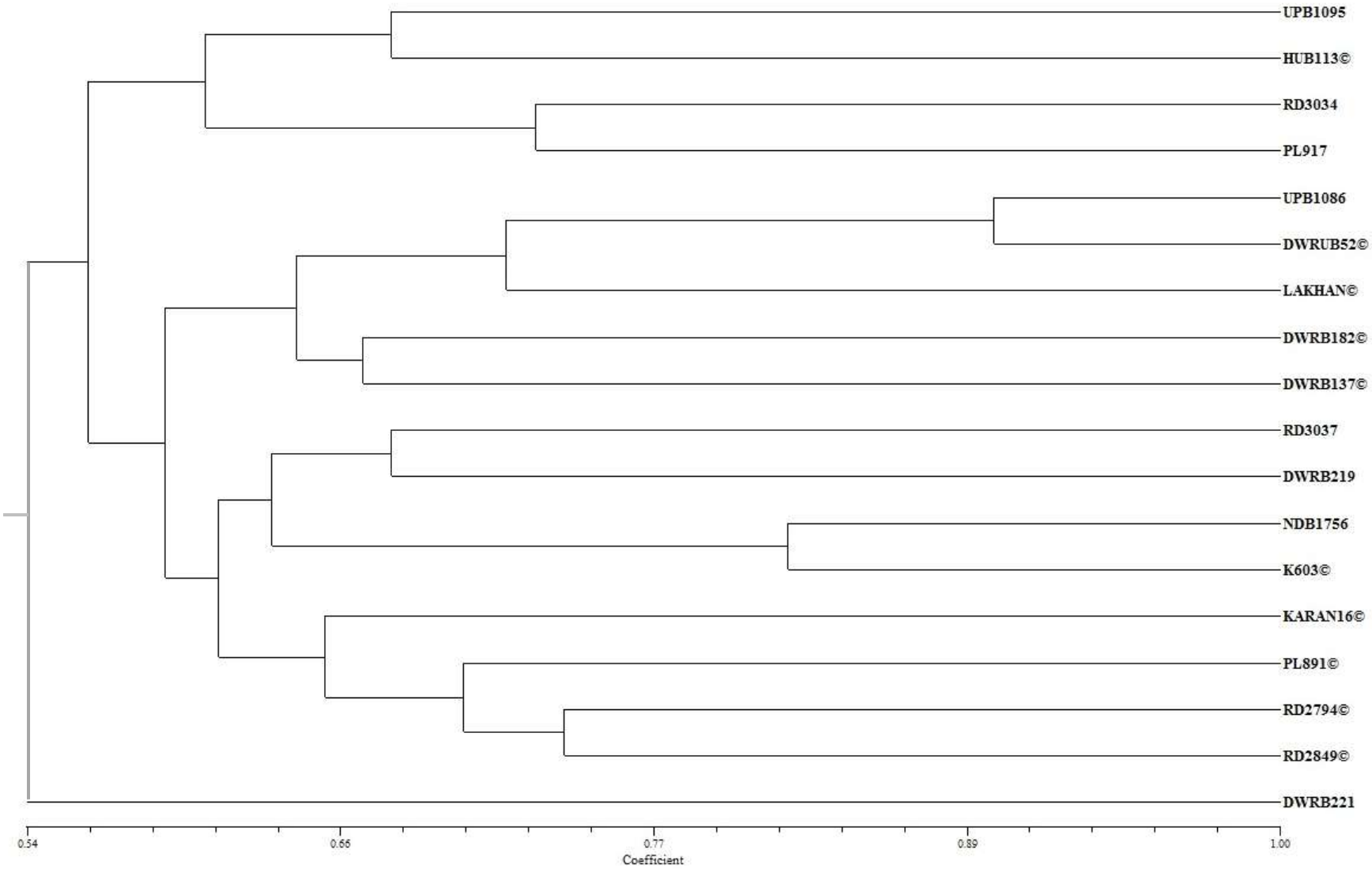
Molecular weight of amplified fragments measured in base pairs and calibrated with 100 & 500 bp Ladder

		VPKAS, Almora			Checks							
Marker	**Chr**	**VLB 177**	**VLB 178**	**VLB 179**	**BH946**	**BHS352**	**BHS380**	**BHS400**	**DWRUB52**	**DWRB137**	**DWRB182**	**HBL113**
Bmac154	1H	110	130	110	140	140	130	140	130	130	130	130
Bmac213	1H	155	155	155	180	168	180	168	180	168	155	168
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	126	126	126	126	126	126	126	126	126
MGB402	1H	260	260	260	260	240	240	240	260	260	260	260
ScSSR10477	1H	200	200	160	150	150	200	150	150	140	150	150
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	180	155	180	180	180	155	180	180	180	180	180
EBmac640	2H	190	190	190	190	190	176	190	190	176	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	000	149	125	149	149	149	149	149	149	149
EBmac623	2H	168	154	154	168	168	154	154	168	154	154	154
cMWG658	2H	600	600	580	600	600	580	600	600	580	580	580
Ebmatc39	2H	170	170	170	170	170	170	170	150	150	170	190
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	122	122	122	140	140	140	122	122	140	140
Bmag877	3H	165	153	153	165	165	165	165	153	165	165	153
Ebmac541	3H	120	120	140	106	106	140	106	120	106	106	106
MWG 847	3H	150	150	150	345	345	150	345	345	345	345	345
Bmag225	3H	165	165	140	185	185	185	185	185	185	165	165
HvLTPPB	3H	216	216	216	216	216	216	216	216	216	200	216
Bmag841	3H	115	125	125	115	125	115	115	125	125	125	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	150	150	160	150	160	160	150	160	160	160
HVM67	4H	136	126	126	126	126	136	126	136	136	126	126
HvMLOH1A	4H	185	185	185	175	175	175	175	185	185	175	185
Ksug10	4H	1500	1500	1500	1500	1500	1500	1500	1300	1500	1300	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	90	90	90	119	119	90	119	119	119	90	90
Bmag337	5H	145	165	165	165	145	145	145	165	145	145	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	000	157	157	167	157	147	157	157	167	157	157
GMS61	5H	135	135	145	145	135	145	135	145	145	135	135
Bmac303	5H	138	138	138	119	119	138	138	119	119	119	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	210	220	220	220	000	220	220	210	236	210	236
Bmac500	6H	150	150	150	190	150	190	150	190	190	150	190
GBM1215	6H	240	240	240	200	240	240	200	200	240	200	240
HVM11	6H	185	185	185	150	185	175	185	150	150	175	175
MWG2029	6H	260	245	245	245	245	260	245	245	245	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	140	140	155	155	155	155	140	140	140	155
Bmac162	7H	187	187	187	200	187	200	187	200	200	187	187
Bmac167	7H	195	184	184	184	184	195	184	195	195	184	184
Bmag110	7H	135	135	135	145	160	160	160	145	184	135	135

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

Marker	Chr	Checks										
		HUB113	K603	KARAN16	LAKHAN	NDB1173	PL891	RD2794	RD2849	RD2899	RD2907	VLB118
Bmac154	1H	130	110	130	140	130	130	130	130	130	140/130	130
Bmac213	1H	155	155	180	155	180	180	180	180	168	180	168
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	126	110	126	126	126	126	126	126	126
MGB402	1H	260	260	260	240	260	260,240	260	260	240	240	240
ScSSR10477	1H	150	160	150	200	150	200	150	150	150	150	140
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	180	155	155	155	180	180	180	180	180	155
EBmac640	2H	190	190	176	190	190	190	190	190	190	190	190
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	149	149	149	149	149	149	149	149	149	149
EBmac623	2H	168	168	154	168	154	168	154	154	154	168	154
cMWG658	2H	600	580	600	600	580	600	600	580	580	600	580
Ebmatc39	2H	190	170	150	150	170	150	150	150	150	150	170
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	140	140	140	140	122	122	122	122	140	140	140
Bmag877	3H	153	153	165	165	153	165	165	165	153	165	153
Ebmac541	3H	106	140	140	140	106	140	106	140	140	120	106
MWG 847	3H	345	150	345	345	345	345	345	345	345	345	345
Bmag225	3H	165	185	185	165	165	185	165	185	140	165	185
HvLTPPB	3H	216	200	200	216	216	216	216	216	216	216	216
Bmag841	3H	115	115	125	115	125	115	125	125	125	115	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	150	160	160	150	160	150	160	150	150	160
HVM67	4H	126	126	136	136	126	136	126	136	136	126	136
HvMLOH1A	4H	175	185	185	185	175	175	175	185	185	175	175
Ksug10	4H	1500	1500	1500	1500	1300	1500	1500	1300	1500	1300	1500
MWG634	4H	800	800	800	800	800	800	800	800	800	800	800
WG622	4H	161	161	161	161	161	161	161	161	161	161	161
Bmag353	4H	119	90	119	90	90	90	90	90	119	119	119
Bmag337	5H	145	145	145	165	145	145	145	145	165	145	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	147	167	157	157	157	167	147	167	167	167	167
GMS61	5H	145	135	145	145	145	135	145	145	145	145	145
Bmac303	5H	119	138	138	138	119	119	138	138	138	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	210	236	210	236	210	210	236	210	210	180
Bmac500	6H	150	190	190	150	190	110	150	190	190	190	190
GBM1215	6H	240	240	240	240	240	240,200	200	200	240	240	200
HVM11	6H	175	175	150	185	175	175	175	175	150	150	185
MWG2029	6H	245	245	245	245	245	245	245	245	245	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	155	155	140	155	140	140	155	140	155	140
Bmac162	7H	200	200	187	187	200	187	200	200	200	200	200
Bmac167	7H	195	195	184	195	195	195	195	195	195	195	184
Bmag110	7H	135	160	135	160	135	145	135	145	135	135	160

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



UPGMA based clustering of entries and check lines of AVT Barley Trials 2021-22

Molecular Markers Used for generating molecular profiles of Barley Trails (2021-22)

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	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1
			CAAAGACCCTAACTCATGTTC	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 cycel 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 with annealing temperatures progressively decreased by 1C every second cycle from 64C to 55C.
26.	HvMLOH1A	4H	CCTCCCCTCTGATATGATAA	1 cycle of 1 min @ 94C, 1 min @ 55C, 1 min @ 72C, 30 cycles of 1 min @ 94C, 1 min @ 55C, 1
			GTACAGACGGTTTAATTGTCC	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 2021-22

Development of Molecular profiles: An equal number of fresh, young leaves (ten days old) of five plants from each of genotype 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 BIORAD S 1000 thermocycler. PCR products were resolved by electrophoresis on 2 % agarose gels (HiMedia) 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 (Invitrogen, USA) depending on the amplified fragments size and corroborated with the reported amplified fragment size of respective molecular marker. The occurrence of '000' alleles was verified by re-amplification using the same primer pair in the same conditions. Gels were stained with ethidium bromide (0.5ug/ml). DNA banding patterns were visualized with UV light and recorded by imagining system (Syngene Synoptics Ltd. USA).

CROP PROTECTION

Summary

- During farmers field surveys conducted by different scientist of cooperative centers, none of the rust was observed in the surveyed areas. Incidence of loose smut, covered smut, leaf stripe and bacterial streak diseases was noted *in traces* to 2 percent on some fields in the Jaipur and Dausa district of Rajasthan.
- Surveys were also conducted to determine the incidence of insect-pests and their natural enemies on barley crop. The main insect pest observed was aphid and its incidence was found to be moderate to high in barley fields at all the locations. Among natural enemies, coccinellid beetles, chrysoperla and syrphid fly were frequently noticed predating on barley aphids.
- Total 548 entries consisting 396, 109 and 43 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 2021-22.
- Out of 396 entries in IBDSN from different breeding centers, 23 entries were found free from yellow rust (ACI = 0) and 182 entries showed resistant reaction having ACI less than 10.
- Total 109 entries evaluated in NBDSN, 19 entries found free from yellow rust, 60 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 22 entries showed moderate level of resistance resistant with an average score (double digit) 14-35 and HS < 57.
- Among 43 EBDSN entries, 4 found free from yellow rust, whereas 18 shown resistant reaction. The 6 entries also showed moderate level of resistance against leaf blight with an average score 14-35 and HS < 57.
- In seedling rust resistance evaluation, among 109 entries of NBDSN were evaluated against the different pathotypes of *Puccinia* spp. None of the lines was resistant to all three rusts of barley. Eight lines BHS352(C), BHS491, HBL875, HBL878, K603(C), KB2008, LAKHAN(C), and VLB177 were resistant to all tested pathotypes/isolates of both leaf and stripe rust pathogens. Moreover, 27 lines were resistant to stripe rust and 23 lines to leaf rust. Resistance to all the pathotypes of *P. graminis* f. sp. *tritici* was observed only in two lines UPB1102 and UPB1104.
- Nineteen EBDSN lines were evaluated for SRT to three rusts of barley. Resistance to all three rusts was not recorded in any EBDSN line. However, 2 lines (HUB272 and RD3039) were resistant to leaf and stripe rusts. Resistance to all the pathotypes/isolates of *Puccinia striiformis* f. sp. *hordei* and *P. hordei* each was observed in 5 lines.
- Among eight different fungicidal treatments, two spray of *viz*., Tebuconazole 50% + Trifloxystrobin 25%, Picoxystrobin 7.05% + Propiconazole 11.7% and Propiconazole 25% was found most effective in management of foliar blight.
- A total of 109 barley NBDSN entries (including checks were screened against foliar aphid at seven locations. On the basis of aphid score recorded location-wise, seven entries at Durgapura viz., BH1040, BH1043, RD2849©, RD3057, DWRB229, K603© and NDB1785 were categorized as moderately resistant having scored 3. Similarly, two entries viz., DWRB225 and KB2013 at Karnal location and one entry (RD3050) at Kanpur were categorized as moderately resistant (Score = 3).
- An another set of 31 barley promising entries along with highly susceptible check (Alfa-93) were tested against aphids at six locations five entries viz., BCLA51, HVS 14, HLR 20, ICARDA-9, ICARDA-11 and ICARDA-27 were found to be in resistant category (Grade 2) at four locations.
- Efficacy of new insecticide molecules and their combinations were tested against foliar aphid in barley. Out of tested chemicals, treatment of Thiamethoxam 25% WG@50 gm/ha, Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha and Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (Alika) @150 ml/ha was found the best treatment followed by Sulfoxaflor 12 % SC @250 ml/ha in managing aphid population in barley.
- Effect of silicon application in the form sodium meta-silicate was tested to determine its effect on aphid abundance and their coccinellid predators in barley. No significant effect of sodium meta-silicate was observed on aphid population on one and two foliar applications.
- A total 109 entries of NBDSN and 43 of EBDSN were screened against the Cereal Cyst Nematode (CCN) at two locations viz. Durgapura, and Hisar. Most of the entries fall in the category of susceptible or highly susceptible.

BARLEY PATHOLOGY

Status of barley diseases and insect pests

To know the health status of barley crops, the survey was conducted by the scientists from RARI, Durgapura on the farmer's on 18th & 19th February and 15th March, 2022 in the areas of Jaipur, Dausa and Tonk districts of Rajasthan. None of the rust was observed in barley crop except leaf rust (5S) was observed late in the season in a field on variety RD2552. The incidence of leaf stripe (in traces-5%), loose smut (in traces- 2%), covered smut (in traces- 3%), Net blotch (in traces- 40%) and

Incidence of barley rusts and pathotype distribution during 2021-22

During 2021-22, there was no report of yellow, stem and leaf rusts of barley from the farmer's fields. Eight barley stripe rust samples were received from barley screening nurseries at Durgapura, Rajasthan. These samples were pathotyped on differentials and only one pathotype 57 (0S0) was identified in all samples.

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 2021-22.

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 548 barley breeding lines were screened during the crop season 2021-22 under various nurseries (IBDSN, NBDSN and EBDSN) for resistance against various diseases, aphid and CCN at different cooperating centers. There were 396 entries under IBDSN, 109 were for NBDSN and 43 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.

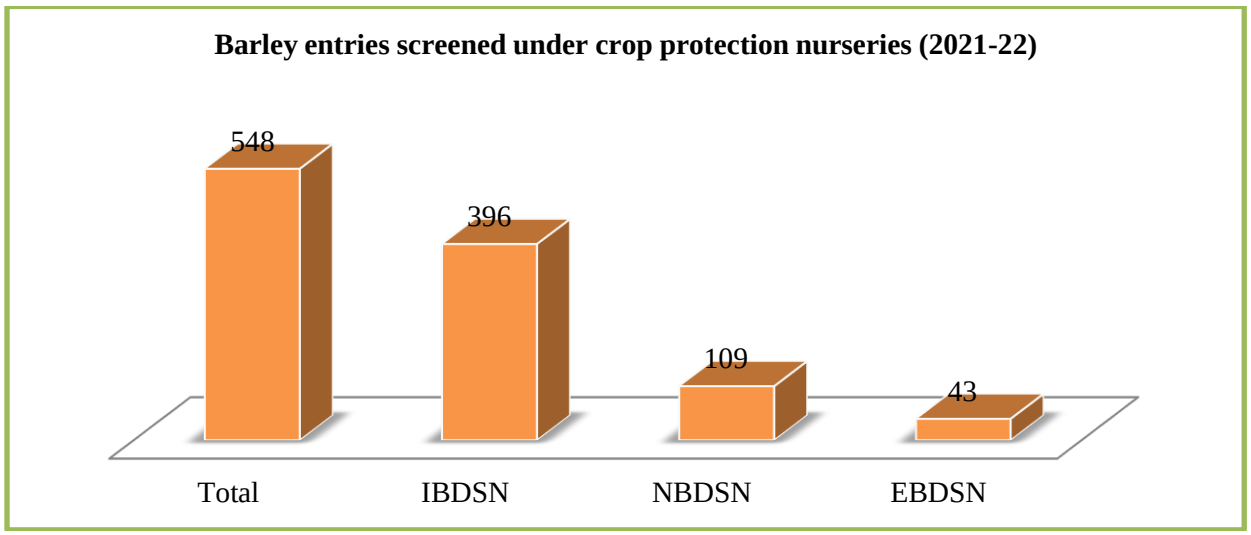


Fig.1: Barley entries screened under crop protection nurseries (2021-22)

Initial Barley Disease Screening Nursery (IBDSN) 2021-22

During the season 2021-22 a total 396 entries were contributed by 11 breeding centers 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 Durgapura, Ludhiana, Almora, Bajaura, Jammu and Karnal. The

screening for leaf blight was done at Pantnagar, Varanasi, Kanpur and Ayodhya. The blight score at Varanasi center was too high hence score at II dough stage was considered. The incidence of foliar blight was very low at Kanpur center hence data were not considered.

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 the rusts, 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 57 were considered moderately resistant (MR).

Among 383 entries evaluated during 2021-22 (Table 3.1), 23 entries were found free from yellow rust (ACI = 0) and 182 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 182 entries were found moderately resistant against leaf blight with an average score (double digit) 14-35 and HS < 57.

Yellow rust, ACI = 0, Entries – 23	BD 1935, BD 1938, BD 1940, BD 1944, BD 1946, BD 1947, BD 1948, BD 1951, BD 1958, BH 21-03, BH 21-10, BH 21-38, BBM 902, BBM 923, PKB 2150, PKB 2155, PKB 2160, VB 2110, UPBM 8, UPBM 17, UPBM 18, BL 2016 and BK 2136
Yellow rust, ACI > 0 to 10, Entries – 182	BD 1913, BD 1915, BD 1931, BD 1932, BD 1933, BD 1934, BD 1937, BD 1939, BD 1941, BD 1942, BD 1943, BD 1945, BD 1949, BD 1950, BD 1952, BD 1953, BD 1954, BD 1956, BD 1957, BD 1959, BD 1960, BH 21-01, BH 21-02, BH 21-04, BH 21-06, BH 21-07, BH 21-08, BH 21-12, BH 21-14, BH 21-16, BH 21-17, BH 21-19, BH 21-20, BH 21-21, BH 21-22, BH 21-23, BH 21-24, BH 21-25, BH 21-26, BH 21-33, BH 21-36, BH 21-37, HUBL 2109, HUBL 2110, HUBL 2112, HUBL 2115, BBM 895, BBM 896, BBM 897, BBM 898, BBM 900, BBM 901, BBM 903, BBM 904, BBM 905, BBM 907, BBM 908, BBM 911, BBM 912, BBM 913, BBM 915, BBM 916, BBM 920, BBM 921, BBM 924, BBM 925, BBM 926, BBM 927, PKB 2121, PKB 2127, PKB 2128, PKB 2131, PKB 2132, PKB 2133, PKB 2142, PKB 2151, PKB 2158, PKB 2159, VB 2102, VB 2103, VB 2104, VB 2106, VB 2108, VB 2111, VB 2112, VB 2113, VB 2114, VB 2115, VB 2116, VB 2117, VB 2119, VB 2120, VB 2121, VB 2122, VB 2124, VB 2125, VB 2127, UPBM 3, UPBM 4, UPBM 5, UPBM 7, UPBM 10, UPBM 11, UPBM 12, UPBM 13, UPBM 14, UPBM 15, UPBM 16, UPBM 19, HB 2101, HB 2102, HB 2103, HB 2104, HB 2105, HB 2106, HB 2107, HB 2108, HB 2109, HB 2110, HB 2111, HB 2112, HB 2113, HB 2114, HB 2119, BL 1856, BL 1857, BL 1858, BL 1876, BL 1891, BL 1919, BL 1922, BL 1925, BL 1927, BL 1959, BL 1961, BL 1962, BL 1963, BL 1977, BL 1982, BL 1987, BL 2008, BL 1915, BL 1928, BL 1933, BL 2114, BL 2117, NDB 1801, NDB 1804, NDB 1806, NDB 1807, NDB 1812, NDB 1813, NDB 1816, BK 2101, BK 2108, BK 2111, BK 2121, BK 2122, BK 2123, BK 2125, BK 2126, BK 2129, BK 2131, BK 2132, BK 2133, BK 2134, BK 2135, BK 2137, BK 2138, BK 2139, BK 2140, BK 2141, BK 2142, BK 2143, BK 2144, BK 2146, BK 2147, BK 2148, BK 2149, BK 2150, BK 2152 and BK 2153
Leaf blight, Avg. 14-35 with HS < 57, Entries - 108	BD 1914, BD 1916, BD 1917, BH 21-01, BH 21-03, BH 21-04, BH 21-13, BH 21-14, BH 21-17, BH 21-18, BH 21-21, BH 21-22, BH 21-25, BH 21-26, BH 21-27, BH 21-28, BH 21-29, BH 21-30, BH 21-32, BH 21-33, BH 21-34, BH 21-35, BH 21-37, HUBL 2103, HUBL 2104, HUBL 2105, HUBL 2106, HUBL 2107, HUBL 2113, HUBL 2114, BBM 909, BBM 918, BBM 927, PKB 2108, PKB 2126, PKB 2130, PKB 2131, PKB 2140, PKB 2142, PKB 2143, PKB 2148, PKB 2153, PKB 2155, PKB 2160, VB 2106, VB 2111, VB 2117, VB 2118, VB 2125, UPBM 8, UPBM 15, UPBM 18, UPBM 19, HB 2106, HB 2118, HB 2119, HB 2121, BL 1855, BL 1870, BL 1873, BL 1876, BL 1886, BL 1887, BL 1891, BL 1899, BL 1900, BL 1904, BL 1919, BL 1925, BL 1927, BL 1957, BL 1959, BL 1961, BL 1987, BL 1994, BL 2001, BL 2037, BL 2040, BL 2041, BL 2047, BL 2048, BL 2057, BL 2058, BL 2059, BL 2060, BL 2063, BL 1915, BL 1928, NDB 1812, NDB 1813, NDB 1814, BK 2118, BK 2119, BK 2126, BK 2130, BK 2131, BK 2132, BK 2133, BK 2134, BK 2135, BK 2136, BK 2137, BK 2138, BK 2139, BK 2142, BK 2144, BK 2145 and BK 2151

Table 3.1: Reactions of different entries of barley in Initial Barley Disease Screening Nursery, 2021-22

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
RARI, Durgapura					
1	BD 1911	19.3	60S	57	99
2	BD 1912	14.7	40S	36	47
3	BD 1913	3.3	10S	57	99
4	BD 1914	21.7	80S	35	47
5	BD 1915	2.7	10S	67	99
6	BD 1916	17.2	60S	35	57
7	BD 1917	38.3	80S	35	35
8	BD 1918	37.2	60S	46	57
9	BD 1919	21.7	40S	57	89
10	BD 1920	14	40S	45	57
11	BD 1931	4.1	20MS	89	99
12	BD 1932	1.5	5S	89	99
13	BD 1933	0.9	5S	89	99
14	BD 1934	0.4	5MR	89	99
15	BD 1935	0	0	78	99
16	BD 1936	17.3	60S	79	99
17	BD 1937	5	30S	89	99
18	BD 1938	0	0	89	99
19	BD 1939	0.8	5MS	89	99
20	BD 1940	0	0	79	89
20A	Infector	80	100S	89	99
21	BD 1941	1.4	10MS	89	99
22	BD 1942	0.8	5MS	89	99
23	BD 1943	1.7	10S	89	99
24	BD 1944	0	0	89	99
25	BD 1945	1.4	10MS	89	99
26	BD 1946	0	0	89	89
27	BD 1947	0	0	78	89
28	BD 1948	0	TR	57	89
29	BD 1949	2.7	20MS	56	99
30	BD 1950	6.5	10S	68	99
31	BD 1951	0	0	79	99
32	BD 1952	0.3	TMS	79	99
33	BD 1953	4.1	20S	67	99
34	BD 1954	2	10MS	46	47
35	BD 1955	33.7	100S	78	99
36	BD 1956	2.7	20MS	78	99
37	BD 1957	1.4	5MS	78	99
38	BD 1958	0	0	78	99
39	BD 1959	1.6	10MS	78	99
40	BD 1960	3.2	5S	78	99
40A	Infector	83.3	100S	89	79
HAU, Hisar					
41	BH 21-01	6.4	20S	35	36
42	BH 21-02	5.4	20S	46	46
43	BH 21-03	0	0	35	46
44	BH 21-04	0.7	5MS	35	57
45	BH 21-05	12.2	40S	35	68
46	BH 21-06	8.3	20S	46	68
47	BH 21-07	3.3	10S	46	58
48	BH 21-08	1	5S	47	47
49	BH 21-09	12.5	40S	36	68
50	BH 21-10	0	TR	68	79
51	BH 21-11	40	80S	57	89

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
52	BH 21-12	0.7	5MS	57	68
53	BH 21-13	11.4	40S	35	46
54	BH 21-14	0.7	5MS	35	46
55	BH 21-15	35	80S	36	58
56	BH 21-16	1.3	10MS	47	58
57	BH 21-17	1.7	10S	35	47
58	BH 21-18	14	40S	35	46
59	BH 21-19	3.8	10S	36	57
60	BH 21-20	3.4	10S	46	46
60A	Infector	83.3	100S	68	79
61	BH 21-21	6.9	20S	35	47
62	BH 21-22	9.2	30S	24	47
63	BH 21-23	3.7	20S	46	68
64	BH 21-24	4	10S	35	58
65	BH 21-25	3.2	10S	35	47
66	BH 21-26	5.9	20MS	35	57
67	BH 21-27	25.2	60S	35	57
68	BH 21-28	13.3	30S	35	47
69	BH 21-29	27.5	60S	35	46
70	BH 21-30	17.7	40S	35	57
71	BH 21-31	30.2	80S	56	99
72	BH 21-32	30	80S	35	47
73	BH 21-33	2.5	10S	35	57
74	BH 21-34	18.2	40S	24	35
75	BH 21-35	11.5	20S	24	35
76	BH 21-36	6.8	20S	57	78
77	BH 21-37	0.9	5S	35	47
78	BH 21-38	0	TR	57	68
BHU, Varanasi					
79	HUBL 2101	83.3	100S	46	58
80	HUBL 2102	76.7	100S	46	57
80A	Infector	86.7	100S	68	79
81	HUBL 2103	59.3	100S	35	46
82	HUBL 2104	29.7	60S	35	47
83	HUBL 2105	50.7	80S	34	46
84	HUBL 2106	14.2	40S	24	35
85	HUBL 2107	46.7	80S	35	47
86	HUBL 2108	20.7	40S	46	68
87	HUBL 2109	8.3	20S	57	99
88	HUBL 2110	7.5	20S	36	58
89	HUBL 2111	25.7	80S	46	68
90	HUBL 2112	6.7	20S	46	68
91	HUBL 2113	13.5	40S	35	46
92	HUBL 2114	11.7	40S	35	57
93	HUBL 2115	7.2	20S	56	99
94	HUBL 2116	70	100S	47	58
95	HUBL 2117	70	100S	46	46
IARI, RS, Shimla					
96	BBM 895	6.7	20S	67	89
97	BBM 896	1.5	10MS	68	89
98	BBM 897	1.4	5MS	78	99
99	BBM 898	8.2	20S	46	57
100	BBM 899	13.5	40S	57	58
100A	Infector	83.3	100S	68	78
101	BBM 900	5	20S	56	99
102	BBM 901	1.5	5MS	78	99

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
103	BBM 902	0	0	78	99
104	BBM 903	4.1	20S	68	99
105	BBM 904	3.2	15S	57	68
106	BBM 905	3.4	20S	57	99
107	BBM 906	15.9	60S	36	58
108	BBM 907	2.6	10S	56	99
109	BBM 908	4.5	20S	57	58
110	BBM 909	16.7	60S	35	46
111	BBM 910	48.3	80S	58	99
112	BBM 911	0.7	5MS	68	99
113	BBM 912	1.7	10S	67	99
114	BBM 913	9.2	30S	56	99
115	BBM 914	12.5	40S	56	78
116	BBM 915	5.5	20S	56	99
117	BBM 916	8.8	20S	45	46
118	BBM 917	16	40S	35	58
119	BBM 918	40.8	80S	35	57
120	BBM 919	37	80S	57	99
120A	Infector	83.3	100S	68	89
121	BBM 920	4	10S	57	99
122	BBM 921	1.5	5S	78	99
123	BBM 922	26.7	40S	57	99
124	BBM 923	0	0	78	99
125	BBM 924	3.2	10S	78	99
126	BBM 925	0.7	5MS	78	99
127	BBM 926	3.3	20MS	45	99
128	BBM 927	0.4	5MR	35	46
129	BBM 928	10.9	40S	36	58
CSAU, Kanpur					
130	PKB 2101	80	100S	56	89
131	PKB 2102	80	100S	67	99
132	PKB 2103	66.7	100S	45	57
133	PKB 2104	37.5	100S	57	68
134	PKB 2105	41.7	100S	58	68
135	PKB 2106	66.7	100S	36	68
136	PKB 2107	53.4	100S	37	47
137	PKB 2108	56.7	100S	35	57
138	PKB 2109	66.7	100S	46	68
139	PKB 2110	56.7	100S	46	58
140	PKB 2111	73.3	100S	56	99
140A	Infector	83.3	100S	68	89
141	PKB 2112	76.7	100S	45	68
142	PKB 2113	66.7	100S	56	99
143	PKB 2114	48	80S	46	99
144	PKB 2115	51.3	100S	67	99
145	PKB 2116	51.3	80S	56	99
146	PKB 2117	80	100S	57	99
147	PKB 2118	73.3	100S	67	99
148	PKB 2119	40.2	80S	36	58
149	PKB 2120	14.2	30S	46	57
150	PKB 2121	0.1	TR	78	99
151	PKB 2122	46.7	100S	35	58
152	PKB 2123	53.3	100S	57	99
153	PKB 2124	35	80S	46	58
154	PKB 2125	30	60S	35	58
155	PKB 2126	18.8	40S	24	46

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
156	PKB 2127	0.1	TMR	36	58
157	PKB 2128	0.7	5MS	89	99
158	PKB 2129	70	80S	57	99
159	PKB 2130	60	80S	35	35
160	PKB 2131	10	20S	35	46
160A	Infector	83.3	100S	89	99
161	PKB 2132	0.7	5MS	89	99
162	PKB 2133	6.9	20S	56	99
163	PKB 2134	66.7	100S	46	78
164	PKB 2135	60	100S	67	89
165	PKB 2136	73.3	100S	56	99
166	PKB 2137	60	100S	67	99
167	PKB 2138	73.3	100S	46	68
168	PKB 2139	66.7	100S	46	58
169	PKB 2140	16.9	40S	24	35
170	PKB 2141	42	100S	36	57
171	PKB 2142	2.5	10S	35	47
172	PKB 2143	43	100S	35	46
173	PKB 2144	34.7	60S	46	99
174	PKB 2145	17.6	40S	57	99
175	PKB 2146	63.3	100S	56	99
176	PKB 2147	40.1	80S	56	99
177	PKB 2148	12.3	20S	24	35
178	PKB 2149	43.3	60S	46	99
179	PKB 2150	0	0	67	99
180	PKB 2151	0.9	5S	89	99
180A	Infector	86.7	100S	78	99
181	PKB 2152	51.3	80S	57	99
182	PKB 2153	36.7	80S	34	46
183	PKB 2154	69.3	100S	46	68
184	PKB 2155	0	0	35	57
185	PKB 2156	16.3	60S	47	68
186	PKB 2157	20	60S	35	58
187	PKB 2158	10	40S	36	57
188	PKB 2159	9.5	30S	46	99
189	PKB 2160	0	0	35	46
VPKAS, Almora					
190	VB 2101	30.2	80S	56	99
191	VB 2102	6.2	20MS	56	99
192	VB 2103	5	20S	46	78
193	VB 2104	4.9	20S	46	68
194	VB 2105	11.7	40S	36	58
195	VB 2106	5.2	10S	35	47
196	VB 2107	11.4	60S*	56	99
197	VB 2108	8.3	20S	56	99
198	VB 2109	10.1	20S	56	99
199	VB 2110	0	TR	45	99
200	VB 2111	7.5	20S	35	57
200A	Infector	76.7	100S	79	89
201	VB 2112	3.7	20S	46	58
202	VB 2113	3.7	10MS	56	78
203	VB 2114	4	20S	57	99
204	VB 2115	1.5	10MS	57	78
205	VB 2116	9	20S	35	68
206	VB 2117	1.4	10MS	34	35
207	VB 2118	37.5	80S	35	47

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
208	VB 2119	4.2	20MS	57	99
209	VB 2120	6.8	20MS	47	68
210	VB 2121	10	20S	56	99
211	VB 2122	5.8	20MS	46	68
212	VB 2123	21.7	40S	46	68
213	VB 2124	4.2	10S	56	99
214	VB 2125	3.5	10S	35	57
215	VB 2126	19.2	40S	46	68
216	VB 2127	5.5	15S	46	68
217	VB 2128	11.7	40S	46	58
218	VB 2129	26.3	60S	35	58
219	VB 2130	11.7	40S	46	68
GBPUAT, Pantnagar					
220	UPBM 1	46.7	80S	35	68
220A	Infector	80	100S	78	78
221	UPBM 2	15.7	40S	57	99
222	UPBM 3	3.3	10S	67	99
223	UPBM 4	9.2	20S	56	99
224	UPBM 5	5.2	10S	56	99
225	UPBM 6	15.5	40S	57	99
226	UPBM 7	2	10MS	46	68
227	UPBM 8	0	0	35	57
228	UPBM 9	13.3	40S	46	99
229	UPBM 10	2.7	10S	46	68
230	UPBM 11	2.2	10MS	46	58
231	UPBM 12	2.5	10S	56	99
232	UPBM 13	5	20S	46	68
233	UPBM 14	1.7	10S	46	68
234	UPBM 15	1	5MS	35	46
235	UPBM 16	8.2	20S	46	46
236	UPBM 17	0	TR	35	58
237	UPBM 18	0	TR	35	46
238	UPBM 19	6.9	20S	34	46
CSKHPKV, Bajaura					
239	HB 2101	5	20MS	57	68
240	HB 2102	7.5	20S	57	68
240A	Infector	83.3	100S	89	99
241	HB 2103	1.5	10MS	78	99
242	HB 2104	9.3	30S	68	89
243	HB 2105	0.9	5S	47	68
244	HB 2106	3.7	10S	35	47
245	HB 2107	3	10S	58	99
246	HB 2108	0.9	5S	67	99
247	HB 2109	3.6	20MS	56	99
248	HB 2110	0.3	5MR	56	99
249	HB 2111	0.2	TS	56	99
250	HB 2112	1.3	5S	35	68
251	HB 2113	3.2	10MS	36	58
252	HB 2114	3.8	10S	46	68
253	HB 2115	35.8	60S	57	99
254	HB 2116	34.5	80S	46	68
255	HB 2117	31.7	80S	45	99
256	HB 2118	35	60S	35	46
257	HB 2119	3.7	20S	24	35
258	HB 2120	40.3	60S	36	47
259	HB 2121	33.3	60S	34	46

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
260	HB 2122	16.2	30S	46	57
260A	Infector	80	100S	68	78
261	HB 2123	31.7	40S	35	78
262	HB 2124	34.3	60S	46	89
PAU, Ludhiana					
263	BL 1832	15.2	40S	45	78
264	BL 1855	20.8	60S	35	47
265	BL 1856	1	5S	36	58
266	BL 1857	2	10S	56	99
267	BL 1858	2.6	10S	46	99
268	BL 1870	15	40S	35	46
269	BL 1873	20.9	40S	24	24
270	BL 1876	8.7	20S	24	35
271	BL 1886	23.7	40S	24	47
272	BL 1887	20	40S	24	46
273	BL 1891	9.2	20S	35	46
274	BL 1899	38.3	60S	35	47
275	BL 1900	26	40S	24	36
276	BL 1904	15	20S	35	57
277	BL 1919	2.2	10MS	35	47
278	BL 1922	1.9	5S	35	58
279	BL 1925	2.6	10S	24	46
280	BL 1927	1.7	10S	25	36
280A	Infector	76.7	100S	89	99
281	BL 1952	16.7	40S	57	99
282	BL 1955	28.3	60S	46	58
283	BL 1957	20	40S	35	57
284	BL 1959	0.7	5MS	34	46
285	BL 1961	0.8	5S	35	57
286	BL 1962	0.5	TMS	56	99
287	BL 1963	2.4	5S	56	99
288	BL 1977	8.3	20S	45	99
289	BL 1982	3.5	10S	56	99
290	BL 1987	9.2	20S	34	46
291	BL 1994	13.2	40S	34	46
292	BL 2001	24	40S	35	57
293	BL 2008	3.7	10S	67	99
294	BL 2016	0	0	45	57
295	BL 2028	25	40S	35	68
296	BL 2029	23.3	40S	46	99
297	BL 2037	33.3	60S	24	35
298	BL 2040	31.3	60S	35	47
299	BL 2041	30.7	60S	34	46
300	BL 2047	22.8	60S	35	57
300A	Infector	83.3	100S	89	99
301	BL 2048	27.8	60S	35	46
302	BL 2057	41.7	100S	35	57
303	BL 2058	43.3	100S	34	46
304	BL 2059	39.3	80S	35	46
305	BL 2060	51.2	80S	35	57
306	BL 2062	27.5	60S	35	58
307	BL 2063	45	100S	35	57
308	BL 2066	22.5	40S	56	99
309	BL 2067	16.7	40S	45	68
310	BL 2068	19.5	40S	56	99
311	BL 1915	2.5	10S	35	57

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
312	BL 1928	9.3	20S	35	47
313	BL 1933	10	40S	56	99
314	BL 2024	13.2	40S	67	99
315	BL 2025	22.5	60S	67	99
316	BL 2046	28.3	60S	35	68
317	BL 2111	31.3	80S	57	99
318	BL 2112	30.2	60S	56	99
319	BL 2113	12.5	20S	56	99
320	BL 2114	6.4	20S	56	99
320A	Infector	80	100S	79	89
321	BL 2115	19	40S	67	99
322	BL 2116	15.7	40S	67	99
323	BL 2117	9.2	20S	56	99
NDUAT, Ayodhya					
324	NDB 1801	8.8	20S	57	99
325	NDB 1802	31.8	80S	56	99
326	NDB 1803	13.3	20S	57	99
327	NDB 1804	2.8	10S	45	99
328	NDB 1805	19.2	40S	46	99
329	NDB 1806	5.3	20S	56	99
330	NDB 1807	7.3	30S	67	99
331	NDB 1808	55	100S	46	99
332	NDB 1809	46.7	80S	56	99
333	NDB 1810	11.5	30S	56	99
334	NDB 1811	30	60S	56	99
335	NDB 1812	0.1	TMR	35	46
336	NDB 1813	2	10S	35	46
337	NDB 1814	43.3	80S	35	46
338	NDB 1815	29.7	60S	35	68
339	NDB 1816	9.2	20S	45	99
340	NDB 1817	20	40S	56	99
340A	Infector	80	100S	89	99
341	NDB 1818	56.7	80S	56	99
IIWBR, Karnal					
342	BK 2101	9	20S	46	99
343	BK 2102	22.7	40S	45	57
344	BK 2103	18.3	40S	67	99
345	BK 2104	26.3	40S	67	99
346	BK 2105	31.7	60S	56	99
347	BK 2106	20	40S	56	99
348	BK 2107	18.3	40S	57	99
349	BK 2108	6.5	20S	46	57
350	BK 2109	35	80S	57	99
351	BK 2110	20.7	40S	57	99
352	BK 2111	0.7	5MS	67	99
353	BK 2112	25.8	60S	56	99
354	BK 2113	34.7	80S	57	99
355	BK 2114	70	80S	67	99
356	BK 2115	51.3	80S	57	99
357	BK 2116	50.7	80S	67	99
358	BK 2117	45	80S	68	89
359	BK 2118	10.7	20S	35	36
360	BK 2119	12.4	40S	35	57
360A	Infector	86.7	100S	78	99
361	BK 2120	17.4	40S	46	58
362	BK 2121	2.2	5S	68	99

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg	HS
363	BK 2122	1.3	10MS	78	99
364	BK 2123	0.2	TS	36	46
365	BK 2124	16.5	40S	57	99
366	BK 2125	4	10S	56	99
367	BK 2126	6	20MS	35	47
368	BK 2127	13	40S	36	38
369	BK 2128	17.7	40S	36	58
370	BK 2129	1.2	5MS	36	47
371	BK 2130	45	100S	35	46
372	BK 2131	0.7	5MS	35	46
373	BK 2132	0.7	5MS	35	47
374	BK 2133	8.3	20S	35	47
375	BK 2134	0.7	5MS	24	36
376	BK 2135	2.5	10S	35	46
377	BK 2136	0	0	34	46
378	BK 2137	0.7	5MS	35	46
379	BK 2138	3.2	10S	35	47
380	BK 2139	5.8	10S	35	57
380A	Infector	83.3	100S	89	99
381	BK 2140	5	20S	67	99
382	BK 2141	5	20S	46	68
383	BK 2142	4	20MS	35	47
384	BK 2143	2.6	10S	45	46
385	BK 2144	2.2	10MS	35	57
386	BK 2145	11.8	40S	35	57
387	BK 2146	1.6	5S	45	57
388	BK 2147	2.3	10S	45	58
389	BK 2148	0.7	5MS	57	89
390	BK 2149	0.7	5MS	35	68
391	BK 2150	6.7	20S	46	68
392	BK 2151	23.5	80S	35	46
393	BK 2152	8.3	20S	47	57
394	BK 2153	0.8	5MS	46	57
395	BK 2154	40.7	80S	45	89
396	BK 2155	53.3	100S	46	78

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) 2021-22

During the crop season 2021-22, under the NBDSN trial a total 109 entries from IVT yield trials including checks were screened against stripe rust, leaf rust, stem rust, leaf blight, aphids and cereal cyst nematode (CCN) at hot spot locations.

The NBDSN entries were screening for stripe rust resistance at hot spot centers that include Durgapura, Ludhiana, Hisar, Almora, Bajaura, Jammu and Karnal. Stripe rust severity remained low so only data from Hisar were considered. Leaf rust screening was done at Ludhiana and Jammu, so HS is reflected in table. The leaf blight screening was done at Dharwad, Kallolli, Pantnagar, Varanasi, Kanpur and Ayodhya. The data of Kanpur center were not considered due to low severity of boliar blight. CCN screening was done at Hisar, Durgapura and Ludhiana centers. For CCN, the number of nematode cysts / plant 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 109 entries evaluated during 2021-22 (Table 3.2), 19 entries found free from stripe rust, 60 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 22 entries found moderately resistant against leaf blight with an average score (double digit) 14-35 and HS less than 57. The center wise responses are presented in Table 3.4. The resistant entries identified against yellow rust and blight are given below:

Yellow rust, ACI = 0, Entries – 19	BH1042, BH1045, BHS352©, K603©, KB2004, KB2013, KB2015, NDB1776, NDB1785, NDB1800, PL936, PL940, RD3034, RD3051, RD3054, RD3055, RD3059, RD3063 and UPB1105
Yellow rust, ACI > 0 to 10, Entries – 60	BH1040, BH946©, BHS380©, BHS400©, BHS488, BHS489, BHS490, BHS491, BHS492, DWRB137 ©, DWRB182©, DWRB219, DWRB221, DWRB223, DWRB226, DWRB228, DWRB229, DWRB230, DWRB231, DWRB232, DWRB233, DWRB234, DWRUB52©, HBL113©, HBL874, HBL875, HBL877, HBL878, HUB281, KB2008, KB2031, LAKHAN©, NDB1756, NDB1782, NDB1783, NDB1784, NDB1793, PL933, PL934, PL935, PL937, PL938, RD2899, RD2907©, RD3049, RD3050, RD3052, RD3058, RD3060, RD3061, UPB1095, UPB1101, UPB1102, UPB1107, UPB1108, VLB118©, VLB175, VLB176, VLB177 and VLB179
Leaf blight, Avg. 13-35 with HS < 57 Entries – 22	BH1040, BH1041, BH1043, BHS380©, BHS488, DWRB229, DWRB230, DWRB233, DWRUB52©, HBL874, KB2019, NDB1789, PL917*, RD3037, RD3047, RD3049, RD3053, RD3055, RD3056, RD3058, UPB1108 and VLB175

Table 3.2: Reactions of different entries of barley in National Barley Disease Screening Nursery, 2021-22

S. No.	Entry	Yellow rust		Leaf rust	Foliar blight		CCN
		ACI	HS	HS	Avg.	HS	HS
1.	BH1040	3.0	10S	10MS	35	46	S
2.	BH1041	20.0	40S	0	24	46	S
3.	BH1042	0.0	TR	0	46	68	S
4.	BH1043	46.7	100S	TS	35	47	S
5.	BH1044	28.0	40S	10MS	67	99	HS
6.	BH1045	0.0	0	TMS	67	99	HS
7.	BH1046	10.1	40S	TR	45	57	S
8.	BH946©	5.1	20S	0	56	99	S
9.	BHS352©	0.0	0	TMS	78	99	S
10.	BHS380©	0.7	5MS	5S	24	46	S
11.	BHS400©	1.3	5MS	0	46	89	HS
12.	BHS488	0.2	TMS	TS	34	47	S
13.	BHS489	1.3	10MS	0	46	68	HS
14.	BHS490	1.5	5S	0	56	99	S
15.	BHS491	0.3	5MR	TS	67	99	HS
16.	BHS492	6.2	20S	5S	46	78	S
17.	DWRB137 ©	4.2	20S	10S	56	99	HS
18.	DWRB182©	1.4	10MS	5S	46	47	S
19.	DWRB219	0.8	5S	5S	46	57	S
20.	DWRB221	1.7	5S	0	46	68	HS
21.	DWRB223	8.6	30S	0	56	99	HS
22.	DWRB225	70.0	100S	5S	46	68	HS
23.	DWRB226	0.1	TMS	0	57	99	S
24.	DWRB227	41.3	80S	TS	57	99	HS
25.	DWRB228	0.1	TMS	0	35	58	S
26.	DWRB229	3.5	20MS	TS	24	35	S
27.	DWRB230	0.1	TMS	TMS	35	46	S
28.	DWRB231	3.5	15S	TS	46	68	S
29.	DWRB232	2.0	10S	TS	46	78	S
30.	DWRB233	1.5	5MS	5S	35	57	S
31.	DWRB234	1.2	5S	0	56	68	HS
32.	DWRUB52©	8.5	20S	5MS	35	56	S
33.	HBL113©	5.0	20S	0	68	99	HS
34.	HBL874	1.5	5S	0	24	57	HS
35.	HBL875	3.0	10S	0	67	99	HS
36.	HBL876	10.7	40S	TMR	46	57	S
37.	HBL877	3.7	20S	10S	57	99	S
38.	HBL878	9.2	20S	TS	67	99	S
39.	HUB113©	29.7	60S	5MS	67	99	S
40.	HUB281	0.1	TMR	0	56	99	S
41.	K603©	0.0	0	5S	56	67	HS
42.	KARAN16©	10.3	60S*	5S	46	58	S
43.	KB2004	0.0	0	10S	67	99	S
44.	KB2008	1.3	10MS	0	78	99	HS
45.	KB2013	0.0	0	10MS	45	57	HS
46.	KB2015	0.0	TR	0	67	99	HS
47.	KB2018	69.3	100S	0	47	58	S
48.	KB2019	12.3	40S	0	35	57	HS
49.	KB2031	4.0	10S	5S	67	99	HS
50.	LAKHAN©	1.7	10S	5S	67	99	S
51.	NDB1173©	40.0	80S	TR	57	99	S
52.	NDB1756	0.7	5MS	TS	35	58	HS
53.	NDB1776	0.0	0	0	56	99	S
54.	NDB1782	2.5	10S	TMS	46	57	HS
55.	NDB1783	0.7	5MS	0	46	57	HS

S. No.	Entry	Yellow rust		Leaf rust	Foliar blight		CCN
		ACI	HS	HS	Avg.	HS	HS
56.	NDB1784	10.0	60S*	5MS	46	69	HS
57.	NDB1785	0.0	0	10S	45	68	HS
58.	NDB1789	31.8	60S	10MS	24	35	S
59.	NDB1793	4.3	10S	5S	56	99	S
60.	NDB1800	0.0	0	TR	68	99	S
61.	PL891©	11.8	20S	0	56	99	HS
62.	PL917*	23.3	40S	TMS	35	46	HS
63.	PL933	2.2	10MS	5S	46	78	S
64.	PL934	3.5	10S	TMS	46	68	S
65.	PL935	3.2	10S	0	46	68	S
66.	PL936	0.0	0	0	67	99	HS
67.	PL937	0.1	TMR	5MR	79	99	S
68.	PL938	2.0	10MS	10MS	46	78	S
69.	PL939	45.0	60S	10S	46	68	HS
70.	PL940	0.0	0	0	67	99	S
71.	RD2794©	26.7	60S	0	46	46	HS
72.	RD2849©	18.3	40S	0	46	68	HS
73.	RD2899	2.3	10S	0	78	99	HS
74.	RD2907©	2.7	10S	0	67	99	HS
75.	RD3034	0.0	0	TS	35	58	S
76.	RD3037	17.7	40S	10MS	24	46	HS
77.	RD3047	24.7	60S	0	35	46	S
78.	RD3048	25.8	60S	0	57	78	S
79.	RD3049	8.7	40S	0	35	46	HS
80.	RD3050	0.3	5MR	0	46	57	S
81.	RD3051	0.0	0	0	46	67	S
82.	RD3052	2.8	10MS	5MR	56	67	S
83.	RD3053	11.3	20S	5S	35	47	S
84.	RD3054	0.0	0	TS	57	99	S
85.	RD3055	0.0	TR	TMS	35	47	S
86.	RD3056	15.8	40S	0	35	47	S
87.	RD3057	13.2	30S	0	45	47	S
88.	RD3058	0.3	TS	TMR	34	56	S
89.	RD3059	0.0	0	5MS	35	68	HS
90.	RD3060	8.0	20S	0	36	47	HS
91.	RD3061	0.1	TMR	TMS	36	48	S
92.	RD3062	15.2	40S	0	46	99	S
93.	RD3063	0.0	0	TMS	57	99	HS
94.	UPB1086	14.9	40S	TS	56	56	S
95.	UPB1095	5.0	20S	0	46	99	S
96.	UPB1101	3.3	10S	TS	57	99	S
97.	UPB1102	2.0	10S	5S	57	99	S
98.	UPB1103	15.2	60S	0	46	68	S
99.	UPB1104	14.7	40S	10MS	35	68	S
100.	UPB1105	0.0	0	5R	56	78	HS
101.	UPB1106	12.5	40S	5S	56	99	S
102.	UPB1107	1.2	5S	5S	46	67	R
103.	UPB1108	8.0	20S	10MS	35	57	S
104.	VLB118©	9.0	20S	0	46	99	S
105.	VLB175	0.3	5MR	10MS	34	35	S
106.	VLB176	3.4	10S	5S	56	99	HS
107.	VLB177	0.7	5MS	0	68	89	S
108.	VLB178	22.5	40S	TS	47	89	HS
109.	VLB179	5.8	20S	10MS	57	68	S
	Infector	80.0	100S	80S	89	99	-

 # Out of 119 entries, few check varieties and entries were found place in many trials and only one check is retained in NBDSN thus resulting 109 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 score less than 100 may categories as resistant and from 101 to 500 may categories as moderately resistant. NBDSN entries are categories as follows:

AUDPC	**Entries**
Up to 100	Nil
101 - 500	BH1041, RD3058, BH1043, DWRB229, BH1040, DWRB233, VLB175, BHS488, BHS380©, HBL874, RD3037, NDB1789, RD3049, DWRB137©, UPB1104 and KB2019

Elite Barley Disease Screening Nursery (EBDSN, 2021-22)

The nursery was constituted with entries showed resistance to different disease in previous years in NBDSN and EBDSN. During the crop season 2021-22, total 43 entries were screened in EBDSN. The screening of stripe rust was done at Durgapura, Ludhiana, Hisar, Almora, Bajaura, Jammu and Karnal. Leaf rust screening was done at Ludhiana and Jammu. The leaf blight screening was done at Pantnagar, Varanasi, Kanpur and Faizabad. Data of Kanpur center was not considered due to low disease. CCN screening was done at Hisar and Durgapura centers.

Confirmed sources of resistance:

Out of 43 entries screened in EBDSN (Table 3.3), the following entries were confirmed for resistance against the particular disease under AICW&BIP. Four entry found free from yellow rust, whereas 18 shown resistant reaction. Out of 43 entries screened for leaf blight, 6 entries also showed moderate level of resistance against leaf blight with an average score (double digit) 14-35 and HS < 57. The center wise data are presented in Table 3.5. The resistant entries identified against yellow rust and blight are given below:

Yellow rust, ACI = 0, Entries – 4	HUB113 (C), RD2794 (C), RD2899 (C) and RD3039
Yellow rust, ACI > 0 to 10, Entries – 18	BH1029, BH1034, BH1035, BHS380(C), BHS485, HBL113(C), HBL869, HBL870 (LB), HUB272, HUB275 (LB), RD3033, RD3034, RD3038, HLR 103, HLR 135, HLR 146, HLR 173 and HLR 310
Leaf blight, Avg. 13-35 with HS < 57, Entries - 6	BH1035, BHS380(C), HUB275 (LB), HLR 131, HLR 135 and HLR 147

Table 3.3: Reactions of different entries of barley in Elite Barley Disease Screening Nursery, 2021-22

S. No.	Entry	Yellow rust		Leaf rust	Foliar blight		CCN
		ACI	HS	HS	Avg.	HS	HS
1	BH1029	0.6	5MS	TMS	46	79	S
2	BH1034	2.9	20S	TMS	35	68	S
3	BH1035	4.9	20S	5S	35	57	S
4	BHS380 (C)	0.1	TMR	10MS	35	47	S
5	BHS485	0.1	TMS	0	46	68	S
6	HBL113 (C)	0.2	TMS	5S	57	89	S
7	HBL869	0.1	TMR	0	68	99	S
8	HBL870 (LB)	0.1	TMR	TMS	46	58	S
9	HUB113 (C)	0	0	0	47	79	S
10	HUB272	5.1	30S	5S	47	69	S
11	HUB275 (LB)	7.7	40S	0	35	57	S
12	HUB280	17	60S	TMR	57	89	S
13	KB1940	20	40S	TS	46	79	S
14	RD2794 (C)	0	0	TS	57	89	S
15	RD2899 (C)	0	TR	TMS	57	99	S
16	RD3033	2.6	10S	TR	89	99	S
17	RD3034	1.4	10S	10MS	46	79	S
18	RD3038	0.7	5S	TS	78	99	S
19	RD3039	0	0	0	67	99	S
20	HLR 8	32.9	40S	5MS	36	58	HS
20A	Infector	82.9	100S	60S	78	99	-
21	HLR 14	57.1	100S	20S	46	68	S
22	HLR 32	17.3	40S	5S	57	89	S
23	HLR 33	22.4	60S	TMS	46	58	S
24	HLR 72	45.7	80S	5MS	46	79	HS
25	HLR 102	35.7	60S	5S	46	58	S
26	HLR 103	8.6	40S	0	47	69	S
27	HLR 106	20	60S	10MS	56	99	S
28	HLR 131	16.6	60S	TS	35	47	HS
29	HLR 135	0.6	5MS	TMS	35	57	HS
30	HLR 146	4	20S	TMS	46	69	S
31	HLR 147	16.3	60S	5S	35	57	S
32	HLR 172	51.4	100S	TS	47	79	S
33	HLR 173	8	40S	5S	46	58	S
34	HLR 218	47.1	80S	0	67	99	S
35	HLR 269	51.7	80S	5MS	57	68	HS
36	HLR 270	45.7	80S	TMS	57	79	HS
37	HLR 310	2.4	10S	5S	47	58	HS
38	HLR 347	30.4	80S	0	46	57	S
39	HLR 349	40	80S	0	46	68	S
40	HLR 352	38.9	80S	10MS	36	57	S
40A	Infector	82.9	100S	60S	78	99	-
41	HLR 353	47.1	80S	0	57	89	HS
42	DWR 47	NG	NG	NG	NG	NG	NG
43	DWRB 190	30.1	80S	TMS	45	68	S

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 3.4: Center wise reactions of different entries of barley in National Barley Disease Screening Nursery (NBDSN), 2021-22

S. No.	Entry	Yellow rust						Leaf rust		Foliar blight					CCN	
		Almora	Bajaura	Jammu	Ludhiana	Karnal	Durgapura	Jammu	Ludhiana	Pantnagar	Ayodhya	Varanasi	Dharwad	Kallolli	Durgapura	Hisar
1	BH1040	0	0	0	0	10S	10MS	10MS	0	13	36	24	46	34	S	MR
2	BH1041	20S	20S	0	20S	20S	40S	0	0	12	46	12	34	24	S	S
3	BH1042	0	0	0	0	0	TR	0	0	13	68	47	56	24	S	S
4	BH1043	40S	40S	0	40S	100S	60S	0	TS	23	47	47	34	34	S	S
5	BH1044	40S	20S	10MS	20S	40S	40S	10MS	0	35	68	99	78	67	HS	S
6	BH1045	0	0	0	0	0	0	TMS	0	56	58	99	56	67	S	HS
7	BH1046	0	0	TMR	20S	0	40S	TR	0	13	57	47	56	34	S	S
8	BH946©	20S	0	TMS	0	0	10S	0	0	25	35	99	46	67	S	S
9	BHS352©	0	0	0	0	0	0	TMS	0	79	79	99	67	78	S	S
10	BHS380©	0	0	0	0	5MS	0	0	5S	24	46	24	24	24	S	S
11	BHS400©	0	0	5MR	0	5MS	5MR	0	0	23	46	46	89	34	HS	R
12	BHS488	0	0	TMS	0	0	TMR	TMR	TS	23	47	24	24	34	S	S
13	BHS489	0	0	10MS	0	0	0	0	0	46	68	68	24	34	S	HS
14	BHS490	5S	0	TR	0	0	5MS	0	0	25	58	99	46	34	S	S
15	BHS491	0	0	0	0	0	5MR	0	TS	57	79	99	56	56	HS	S
16	BHS492	20S	0	0	TS	10MS	10MS	0	5S	23	57	46	78	34	S	S
17	DWRB137 ©	0	20S	0	0	0	5S	0	10S	23	46	99	67	46	HS	S
18	DWRB182©	0	0	10MS	0	0	TMR	TMS	5S	23	47	46	46	46	S	S
19	DWRB219	0	0	0	0	0	5S	0	5S	24	35	57	56	67	S	S
20	DWRB221	5S	0	0	0	0	5S	0	0	24	47	68	46	56	S	HS
21	DWRB223	0	30S	TMS	TS	10S	10S	0	0	34	58	99	24	46	HS	S
22	DWRB225	60S	60S	60S	60S	100S	80S	5S	TS	24	35	68	46	78	HS	S
23	DWRB226	0	0	TMS	0	0	0	0	0	23	46	99	46	89	S	S
24	DWRB227	60S	40S	10MS	20S	80S	40S	0	TS	34	47	99	46	67	HS	MR
25	DWRB228	0	0	TMS	0	0	0	0	0	34	58	35	46	24	S	MR
26	DWRB229	0	0	0	5S	0	20MS	0	TS	12	35	12	34	46	S	S
27	DWRB230	0	0	0	0	0	TMS	TMS	0	13	46	46	46	34	S	S
28	DWRB231	0	15S	0	TS	0	5S	0	TS	24	46	68	56	34	S	S
29	DWRB232	0	0	0	0	10S	5MR	0	TS	25	57	57	78	24	S	S
30	DWRB233	0	0	TMS	0	5MS	10MR	TMS	5S	24	35	57	34	34	S	S

31	DWRB234	0	0	5S	0	0	5MR	0	0	36	57	68	68	34	S	HS
32	DWRUB52©	5S	20S	0	5S	5S	20MS	5MS	TS	23	47	35	56	24	S	S
33	HBL113©	0	0	0	10S	0	20S	0	0	89	58	99	48	56	HS	S
34	HBL874	5S	0	0	0	0	10MR	0	0	13	57	24	24	12	HS	HS
35	HBL875	0	10S	10MS	0	0	0	0	0	89	78	99	34	56	S	HS
36	HBL876	20S	0	0	0	40S	10MR	TMR	0	35	57	46	46	34	S	S
37	HBL877	0	0	0	0	20S	5MR	10S	5S	37	35	99	46	89	S	NC
38	HBL878	5S	0	10S	10S	10S	20S	TMS	TS	89	47	99	56	46	S	S
39	HUB113©	10S	40S	10MS	20S	40S	60S	TMS	5MS	46	47	99	99	46	S	S
40	HUB281	0	0	0	0	0	TMR	0	0	24	35	99	56	56	S	S
41	K603©	0	0	0	0	0	0	0	5S	67	46	47	34	78	S	HS
42	KARAN16©	0	0	0	0	60S	5MR	0	5S	24	36	58	46	56	S	S
43	KB2004	0	0	0	0	0	0	0	10S	57	36	99	99	46	S	S
44	KB2008	0	0	10MS	0	0	0	0	0	89	79	99	78	34	S	HS
45	KB2013	0	0	0	0	0	0	10MS	0	35	46	57	34	34	S	HS
46	KB2015	0	0	TR	0	0	0	0	0	46	46	99	56	78	S	HS
47	KB2018	60S	100S	20MS	60S	100S	80S	0	0	36	58	35	46	78	S	MR
48	KB2019	10S	20S	0	0	40S	5MS	0	0	24	57	24	24	34	HS	S
49	KB2031	TS	0	10MS	TS	10S	10MR	5MS	5S	45	46	99	89	34	HS	S
50	LAKHAN©	0	0	10S	0	0	0	0	5S	58	47	99	78	34	S	S
51	NDB1173©	60S	80S	0	20S	40S	40S	TR	0	68	68	99	34	34	S	S
52	NDB1756	0	0	0	0	5MS	0	0	TS	24	58	35	34	34	HS	HS
53	NDB1776	0	0	0	0	0	0	0	0	35	58	99	56	46	S	S
54	NDB1782	0	0	TMS	0	5MS	10S	TMS	0	35	35	57	56	67	S	HS
55	NDB1783	0	0	5MS	0	0	0	0	0	35	57	46	46	24	HS	S
56	NDB1784	60S	0	0	0	0	0	5MS	0	69	46	35	46	24	HS	MR
57	NDB1785	0	0	0	0	0	0	10S	TS	23	47	35	68	34	S	HS
58	NDB1789	60S	30S	TMS	20S	40S	40S	10MS	TS	25	35	24	24	12	S	S
59	NDB1793	10S	0	10MS	0	5MS	10MR	0	5S	36	46	99	67	34	S	S
60	NDB1800	0	0	0	0	0	0	TR	0	46	68	99	78	67	S	S
61	PL891©	20S	20S	TMS	5S	5S	20S	0	0	23	47	99	56	56	HS	HS
62	PL917*	10S	30S	0	20S	40S	40S	TMS	0	34	35	46	34	34	HS	S
63	PL933	TS	0	0	0	5MS	10MS	TMS	5S	24	46	46	78	46	S	S
64	PL934	0	10S	TR	TS	0	10S	TMS	0	24	47	68	68	34	S	S
65	PL935	TS	0	TR	0	10S	10MS	0	0	25	46	68	46	56	S	R
66	PL936	0	0	0	0	0	0	0	0	24	68	99	67	56	HS	S
67	PL937	0	0	0	0	0	TMR	5MR	0	69	68	99	89	78	S	S

68	PL938	0	0	5MS	0	0	10MS	10MS	0	23	36	35	78	46	S	S
69	PL939	60S	30S	20S	40S	60S	60S	0	10S	34	57	68	34	46	HS	S
70	PL940	0	0	0	0	0	0	0	0	35	47	99	67	89	S	S
71	RD2794©	40S	30S	0	10S	60S	20S	0	0	25	46	46	46	67	HS	S
72	RD2849©	0	30S	0	20S	20S	40S	0	0	13	46	46	68	46	HS	S
73	RD2899	0	0	10S	0	0	5MS	0	0	89	89	99	46	78	HS	S
74	RD2907©	5S	0	0	TS	0	10S	0	0	24	46	99	67	78	HS	S
75	RD3034	0	0	0	0	0	0	0	TS	23	58	46	34	24	S	S
76	RD3037	40S	0	0	10S	40S	20MS	10MS	0	25	35	24	46	12	HS	HS
77	RD3047	60S	10MS	0	20S	20S	40S	0	0	24	36	46	46	34	S	S
78	RD3048	60S	30S	0	5S	40S	20S	0	0	57	47	78	78	24	S	S
79	RD3049	40S	15MS	0	0	0	0	0	0	25	35	35	46	34	HS	S
80	RD3050	0	0	0	0	0	5MR	0	0	24	57	46	34	78	S	R
81	RD3051	0	0	0	0	0	0	0	0	67	47	35	46	34	S	S
82	RD3052	5S	0	10MS	0	0	10MR	5MR	0	45	35	46	67	99	S	S
83	RD3053	10S	30S	0	0	20S	10MS	0	5S	25	47	35	34	46	S	S
84	RD3054	0	0	0	0	0	0	TR	TS	24	57	99	79	34	S	S
85	RD3055	0	0	0	0	0	TR	TMS	0	34	47	46	34	24	S	S
86	RD3056	5S	20S	0	10S	40S	20S	0	0	34	47	35	46	24	S	S
87	RD3057	20S	30S	0	5S	10MS	20MS	0	0	23	47	35	46	56	S	S
88	RD3058	TS	0	TMR	0	0	TMR	TMR	0	12	35	35	56	34	S	S
89	RD3059	0	0	0	0	0	0	0	5MS	24	68	47	34	24	S	HS
90	RD3060	0	20S	10MS	0	20S	0	0	0	25	47	46	46	24	HS	MR
91	RD3061	0	0	TMR	0	0	0	0	TMS	25	47	35	48	34	S	S
92	RD3062	20S	20S	0	TS	40S	10S	0	0	35	58	99	46	12	S	R
93	RD3063	0	0	0	0	0	0	TMS	0	25	36	99	68	46	S	HS
94	UPB1086	40S	30S	TR	TS	10MS	10S	0	TS	35	35	35	56	99	S	S
95	UPB1095	20S	0	TR	0	10S	0	0	0	36	58	99	34	24	S	S
96	UPB1101	5S	0	TMS	0	10S	5MS	0	TS	35	58	99	46	46	S	S
97	UPB1102	0	0	0	0	10S	5MR	5MS	5S	25	57	99	68	34	S	MR
98	UPB1103	20S	0	0	TS	60S	10S	0	0	24	68	46	34	46	S	S
99	UPB1104	40S	30S	0	0	10S	10MS	10MS	0	23	36	68	24	34	S	S
100	UPB1105	0	0	0	0	0	0	5R	0	25	68	57	78	34	S	HS
101	UPB1106	40S	0	0	5S	10S	20S	0	5S	24	46	99	56	34	S	MR
102	UPB1107	5S	0	0	0	0	5MR	0	5S	13	35	46	67	56	S	R
103	UPB1108	0	0	5MS	10MS	20S	20MS	10MS	5MS	24	57	35	56	24	S	S
104	VLB118©	20S	0	0	5MS	20S	10S	0	0	24	47	99	24	56	S	NG

105	VLB175	0	0	0	0	0	5MR	10MS	0	23	35	35	24	34	S	S
106	VLB176	10S	0	0	0	10S	TMR	TMS	5S	37	35	99	34	56	HS	S
107	VLB177	0	0	5MS	0	0	0	0	0	68	89	68	56	78	S	S
108	VLB178	40S	20S	TMS	10S	40MS	40MS	0	TS	24	47	47	89	46	HS	S
109	VLB179	0	0	0	5S	20S	10S	0	10MS	47	47	68	56	67	S	S
	Infector	80S	80S	60S	60S	100S	100S	80S	40S	68	79	99	89	89	-	-

Table 3.5: Center wise reactions of different entries of barley in Elite Barley Disease Screening Nursery (EBDSN), 2021-22

S. No.	Entry	Yellow rust							Leaf rust		Foliar blight			CCN
		Almora	Bajaura	Jammu	Ludhiana	Karnal	Hisar	Durgapura	Jammu	Ludhiana	Pantnagar	Ayodhya	Varanasi	Durgapura
1	BH1029	0	0	0	0	0	0	5MS	TMS	0	24	46	79	S
2	BH1034	0	20S	0	0	0	0	TMR	TMS	0	13	35	68	S
3	BH1035	20S	0	5MR	0	10S	0	5MR	5S	0	24	35	57	S
4	BHS380 (C)	0	0	0	0	0	0	TMR	10MS	0	12	46	47	S
5	BHS485	0	0	0	0	0	0	TMS	0	0	24	46	68	S
6	HBL113 (C)	0	0	TMR	0	0	0	TMS	0	5S	36	57	89	S
7	HBL869	0	0	TMR	0	0	0	TMR	0	0	57	58	99	S
8	HBL870 (LB)	0	0	0	0	0	0	TMR	TMS	0	24	47	58	S
9	HUB113 (C)	0	0	0	0	0	0	0	0	0	25	47	79	S
10	HUB272	0	30S	5R	5S	0	0	0	0	5S	24	57	69	S
11	HUB275 (LB)	0	10S	0	0	40S	0	5MS	0	0	12	46	57	S
12	HUB280	5S	30S	0	0	60S	20S	5MS	TMR	0	13	58	89	S
13	KB1940	20S	30S	0	10S	40S	0	40S	0	TS	23	46	79	S
14	RD2794 (C)	0	0	0	0	0	0	0	0	TS	13	79	89	S
15	RD2899 (C)	0	0	TR	0	0	0	0	TMS	0	24	57	99	S
16	RD3033	0	10S	10MS	0	0	0	0	TR	0	79	89	99	S
17	RD3034	10S	0	0	0	0	0	0	10MS	0	13	57	79	S
18	RD3038	5S	0	0	0	0	0	0	0	TS	68	58	99	S
19	RD3039	0	0	0	0	0	0	0	0	0	35	57	99	S
20	HLR 8	40S	40S	40S	20S	40S	10S	40S	5MS	TS	12	47	58	HS
20A	Infector	80S	100S	60S	60S	100S	80S	100S	60S	40S	67	58	99	-

21	HLR 14	80S	80S	0	40S	100S	40S	60S	0	20S	23	57	68	S
22	HLR 32	40S	40S	0	5S	10S	10S	20MS	5S	5S	24	47	89	S
23	HLR 33	40S	60S	TMS	0	10MS	40S	10MS	TMS	0	12	58	58	S
24	HLR 72	60S	80S	0	60S	60S	20S	40S	5MS	0	24	46	79	HS
25	HLR 102	40S	60S	TR	60S	40S	10S	40S	5S	0	23	58	57	S
26	HLR 103	0	40S	TR	0	5S	5S	10S	0	0	25	46	69	S
27	HLR 106	10S	60S	0	20S	10S	0	40S	10MS	0	24	46	99	S
28	HLR 131	10S	60S	0	10S	20S	0	20MS	0	TS	12	46	47	HS
29	HLR 135	0	0	0	0	0	0	5MS	TMS	0	12	35	57	HS
30	HLR 146	0	0	5MS	0	0	20S	5MS	TMS	0	24	46	69	S
31	HLR 147	20S	30S	0	0	0	60S	5MS	5S	0	12	35	57	S
32	HLR 172	60S	80S	0	60S	100S	0	60S	0	TS	24	47	79	S
33	HLR 173	NG	5MR	TR	5MS	0	40S	5MR	0	5S	12	57	58	S
34	HLR 218	80S	80S	0	60S	60S	10S	40S	0	0	34	57	99	S
35	HLR 269	80S	80S	5MR	40S	60S	60S	40S	5MS	0	35	68	57	HS
36	HLR 270	60S	80S	0	40S	60S	40S	40S	TMS	0	34	47	79	HS
37	HLR 310	10S	0	0	5S	0	0	5MR	0	5S	24	58	48	HS
38	HLR 347	80S	60S	5R	20S	20S	0	40MS	0	0	35	36	57	S
39	HLR 349	80S	60S	0	40S	40S	20S	40S	0	0	24	57	68	S
40	HLR 352	80S	60S	5MR	40S	40S	10S	40S	10MS	0	24	36	57	S
40A	Infector	80S	80S	80S	60S	100S	80S	100S	60S	40S	68	68	99	-
41	HLR 353	60S	80S	0	40S	60S	30S	60S	0	0	25	57	89	HS
42	DWR 47	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
43	DWRB 190	80S	30S	TMR	20S	40S	0	40S	TMS	TS	12	46	68	S

Evaluation for seedling rust resistance against three rusts of barley

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 six pathotypes of *Puccinia striiformis* f. sp. *hordei* (M, 57, 24, G, Q and 6S0), five pathotypes of *P. graminis* f. sp. *tritici* (11, 21A-2, 40A, 117-6 and 122), and 5 isolates of *P. hordei* (H1, H2, H3, H4 and H5). None of the NBDSN and EBDSN entries was resistant to all the tested pathotypes of *Psh*, *Ph* and *Pgt*. The detailed report is presented below.

Seedling rust resistance in NBDSN lines

A total 109 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 BHS352(C), BHS491, HBL875, HBL878, K603(C), KB2008, LAKHAN(C), and VLB177 were resistant to all tested pathotypes/isolates of both leaf and stripe rust pathogens. Moreover, 27 lines were resistant to stripe rust and 23 lines to leaf rust. Resistance to all the pathotypes of *P. graminis* f. sp. *tritici* was observed only in two lines UPB1102 and UPB1104 (Table 3.6). Detailed response of the NBDSN entries to the pathotypes of three *Puccinia* spp on barley are presented in Table 3.8.

Table 3.6: Seedling rust resistance in NBDSN lines during 2021-22

Rust/s	No. of lines	Lines
Leaf and stripe	08	BHS352(C), BHS491, HBL875, HBL878, K603(C), KB2008, LAKHAN(C), VLB177
Stripe	27	BH1046, BHS489, DWRB137(C), DWRB182(C), DWRB226, DWRB228, HUB113(C), KB2004, KB2013, KB2015, NDB1756, NDB1783, NDB1784, NDB1785, NDB1800, PL937, PL940, RD2899, RD3034, RD3049, RD3054, RD3059, RD3061, RD3063, UPB1095, UPB1105, UPB1107
Leaf	23	BH1041, BH1043, BHS400(C), BHS490, BHS492, DWRB230, DWRB232, DWRB234, HBL113(C), HBL874, HBL876, HUB281, KARAN16(C), NDB1789, PL935, PL938, RD3050, RD3055, RD3056, RD3062, VLB118(C), VLB175, VLB176
Stem	02	UPB1102, UPB1104

Seedling rust resistance in EBDSN lines

Nineteen entries under EBDSN were evaluated for resistance to three rusts of barley. Resistance to all three rusts was not recorded in any EBDSN line. However, 2 lines (HUB272 and RD3039) were resistant to leaf and stripe rusts. Resistance to all the pathotypes/isolates of *Puccinia striiformis* f. sp. *hordei* and *P. hordei* each was observed in 5 lines (Table 3.7). None of the lines conferred resistance to all the pathotypes of *P. graminis* f. sp. *tritici*. Detailed response of the EBDSN entries to the pathotypes of three *Puccinia* spp on barley are presented in Table 3.9.

Table 3.7: Seedling rust resistance in EBDSN lines during 2021-22

Rust/s	No. of lines	Lines
Leaf and stripe	02	HUB272, RD3039
Stripe	05	HUB113(C), RD2899(C), RD3033, RD3034, RD3038
Leaf	05	BH1034, BH1035, HBL113(C), HBL869, KB1940

Table 3.8: Seedling response of NBDSN lines to the pathotypes of three rust pathogens of barley during 2021-22

S. No.	Line/Variety	Black rust pathogen						Brown rust pathogen						Yellow rust pathogen					
		11	21A-2	40A	117-6	122		H1	H2	H3	H4	H5		M	57	24	G	Q	6S0
1.	BH1040	R	MR	R	R	R		S	MS	S	R	R		S	R	MS	S	R	R
2.	BH1041	MS	S	R	MR	R		R	R	R	R	R		S	S	MS	S	S	R
3.	BH1042	S	S	MS	MR	R		R	MIX	S	R	R		MS	MR	MS	S	MS	MS
4.	BH1043	S	S	R	MS	R		R	R	R	R	R		S	S	MS	S	MR	S
5.	BH1044	S	S	MR	R	R		MS	MS	S	S	S		S	S	S	S	S	S
6.	BH1045	MS	MR	R	MR	R		S	R	S	S	S		R	R	R	R	R	MS
7.	BH1046	S	S	MR	MS	R		R	R	MS	R	S		R	R	R	R	R	R
8.	BH946(C)	S	S	MR	R	R		R	R	MS	S	MS		S	S	MS	R	S	S
9.	BHS352(C)	S	S	R	R	MS		R	R	R	R	R		R	R	R	R	R	R
10.	BHS380(C)	MS	MS	R	R	S		R	MS	S	MS	MS		MS	S	R	R	S	S
11.	BHS400(C)	S	S	R	MS	S		R	R	R	R	R		S	R	S	S	MS	S
12.	BHS488	S	MR	MR	MR	MR		S	R	R	R	R		S	R	S	S	MS	MR
13.	BHS489	MR	MS	R	S	MR		S	R	S	R	R		R	R	R	R	R	R
14.	BHS490	MR	MS	MR	MR	MS		R	R	R	R	R		S	S	S	S	MS	S
15.	BHS491	MR	R	NG	R	NG		R	R	R	R	R		R	R	R	R	R	R
16.	BHS492	S	R	R	R	MS		R	R	R	R	R		MS	R	S	S	S	S
17.	DWRB137 (C)	S	S	S	MR	R		S	S	S	S	S		R	R	R	R	R	R
18.	DWRB182(C)	S	R	S	R	R		S	S	S	MS	S		R	R	R	R	R	R
19.	DWRB219	MS	R	R	R	R		S	S	MS	R	MS		S	R	R	S	R	R
20.	DWRB221	MR	MR	MR	R	R		S	S	S	R	S		S	S	R	MS	R	R
21.	DWRB223	S	MS	MS	R	R		R	R	MS	S	MS		S	R	S	R	MS	S
22.	DWRB225	S	S	MR	S	S		S	S	S	MS	S		S	S	S	S	S	S
23.	DWRB226	S	S	S	S	MS		R	R	MS	MS	S		R	R	R	R	R	R
24.	DWRB227	MS	S	R	R	NG		R	S	R	S	S		S	R	S	R	S	S
25.	DWRB228	S	MS	R	MR	MR		S	R	S	S	R		R	R	R	R	R	R
26.	DWRB229	S	MS	MR	R	R		S	S	MS	R	S		MS	MS	R	MS	R	R
27.	DWRB230	MR	MS	R	MR	R		R	R	R	R	R		S	MS	R	S	R	S
28.	DWRB231	MS	R	R	R	R		S	S	MS	MS	S		R	R	R	S	R	S
29.	DWRB232	MS	S	R	R	R		R	R	R	R	R		S	S	S	S	R	MS
30.	DWRB233	S	MR	R	MS	R		R	S	MS	MS	S		S	S	S	S	R	R
31.	DWRB234	MS	S	R	R	R		R	R	R	R	R		S	S	R	R	S	S
32.	DWRUB52(C)	S	S	S	R	R		R	MS	S	R	S		S	S	R	S	R	R
33.	HBL113(C)	S	MS	R	R	MR		R	R	R	R	R		MS	R	R	R	S	R
34.	HBL874	S	R	MR	MS	NG		R	R	R	R	R		MR	S	R	MS	S	S
35.	HBL875	S	MS	R	S	MR		R	R	R	R	R		R	R	R	R	R	R
36.	HBL876	S	R	MR	MS	MR		R	R	R	R	R		S	R	MR	S	R	S

37.	HBL877	MS	R	R	MR	NG		S	S	S	S	S		S	R	MS	S	R	MR
38.	HBL878	MS	S	R	R	NG		R	R	R	R	R		R	R	R	R	R	R
39.	HUB113(C)	S	S	R	MS	S		MS	MS	S	S	MS		R	R	R	R	R	R
40.	HUB281	S	S	R	MR	R		R	R	R	R	R		S	S	R	R	S	MS
41.	K603(C)	S	S	R	S	S		R	R	R	R	R		R	R	R	R	R	R
42.	KARAN16(C)	MR	R	S	R	MR		R	R	R	R	R		S	R	R	R	S	R
43.	KB2004	S	MR	R	R	R		R	MS	S	MS	R		R	R	R	R	R	R
44.	KB2008	S	S	R	R	S		R	R	R	R	R		R	R	R	R	R	R
45.	KB2013	S	MS	MR	MR	MR		R	R	R	S	S		R	R	R	R	R	R
46.	KB2015	S	MS	R	MR	R		R	R	R	MS	R		R	R	R	R	R	R
47.	KB2018	S	S	R	R	S		MS	S	S	S	S		S	S	S	S	S	S
48.	KB2019	R	R	R	R	NG		NG	NG	NG	R	NG		NG	NG	R	R	NG	R
49.	KB2031	S	S	R	MR	S		S	S	S	S	S		S	S	S	S	S	S
50.	LAKHAN(C)	S	MS	R	MR	S		R	R	R	R	R		R	R	R	R	R	R
51.	NDB1173(C)	S	S	MR	S	MR		MS	S	R	S	S		S	S	S	S	S	S
52.	NDB1756	S	S	R	S	R		R	R	R	S	MS		R	R	R	R	R	R
53.	NDB1776	MR	S	R	R	R		S	S	S	S	S		R	R	S	R	R	R
54.	NDB1782	S	MS	R	R	R		S	MS	S	S	S		S	S	S	S	S	MS
55.	NDB1783	S	S	R	R	MS		S	S	S	S	S		R	R	R	R	R	R
56.	NDB1784	S	S	MR	R	S		S	S	S	S	MS		R	R	R	R	R	R
57.	NDB1785	S	S	MR	MR	MS		S	S	S	R	S		R	R	R	R	R	R
58.	NDB1789	S	MR	R	MR	S		R	R	R	R	R		S	S	S	S	MS	S
59.	NDB1793	MR	S	MR	R	R		S	S	S	S	S		S	S	S	MR	S	R
60.	NDB1800	MR	S	NG	MS	NG		R	MS	MS	S	R		R	R	R	R	R	R
61.	PL891(C)	S	R	R	S	S		R	R	R	R	NG		S	R	MS	MS	S	R
62.	PL917*	S	S	R	MR	MR		S	R	R	S	S		S	S	S	S	S	S
63.	PL933	R	R	R	R	MR		R	R	MS	R	R		S	R	S	MS	R	R
64.	PL934	MR	MR	R	MR	R		MS	MS	S	R	MS		S	R	R	R	R	R
65.	PL935	MR	R	R	R	R		R	R	R	R	R		S	MS	R	MS	S	S
66.	PL936	S	MS	R	MS	R		R	R	R	MS	R		S	R	R	R	R	R
67.	PL937	S	S	R	R	R		R	R	S	S	R		R	R	R	R	R	R
68.	PL938	S	S	R	R	R		R	R	R	R	R		S	R	R	S	R	R
69.	PL939	S	S	R	MR	MR		S	R	S	S	S		S	S	S	S	S	S
70.	PL940	S	S	MR	MS	R		MS	S	R	R	R		R	R	R	R	R	R
71.	RD2794(C)	MS	S	MR	MR	S		S	S	S	S	S		S	S	S	S	S	S
72.	RD2849(C)	S	MS	R	MS	R		MS	S	S	MS	S		S	S	S	S	R	S
73.	RD2899	S	S	S	S	MS		S	S	R	R	MS		R	R	R	R	R	R
74.	RD2907(C)	MS	S	R	MS	R		S	S	S	S	S		S	R	S	R	S	S

75.	RD3034	S	S	S	MS	S		R	S	S	S	S		R	R	R	R	R	R
76.	RD3037	S	MR	MR	MS	S		MS	MS	S	NG	MS		S	S	S	S	S	S
77.	RD3047	S	S	R	R	MR		R	R	R	S	MIX		S	S	S	S	S	MS
78.	RD3048	S	S	MR	R	R		S	R	S	MS	MS		S	S	S	S	S	S
79.	RD3049	MS	MS	R	R	S		MS	S	S	R	R		R	R	R	R	R	R
80.	RD3050	S	S	R	R	MR		R	R	R	R	R		MS	S	R	S	R	S
81.	RD3051	S	MS	R	MR	R		R	R	S	R	R		S	S	S	MS	S	S
82.	RD3052	S	MS	R	R	MR		S	S	S	R	R		S	R	MR	S	S	S
83.	RD3053	S	S	MR	R	R		S	R	S	S	S		S	S	S	R	S	S
84.	RD3054	MS	S	MR	R	R		MS	R	MS	MS	R		R	R	R	R	R	R
85.	RD3055	MR	S	R	R	R		R	R	R	R	R		MS	MS	R	R	R	S
86.	RD3056	S	R	R	R	R		R	R	R	R	R		S	S	S	S	R	S
87.	RD3057	S	MS	MR	MS	R		S	MS	MS	R	R		S	S	S	S	MS	S
88.	RD3058	MS	MS	MR	MS	R		R	MS	MS	R	S		R	R	R	S	R	MS
89.	RD3059	S	S	R	MR	R		MS	R	S	S	S		R	R	R	R	R	R
90.	RD3060	S	S	R	R	R		R	R	R	S	R		S	S	S	S	S	S
91.	RD3061	S	S	MR	R	MR		MS	S	S	S	R		R	R	R	R	R	R
92.	RD3062	MS	S	R	R	R		R	R	R	R	R		S	S	S	S	S	S
93.	RD3063	S	MR	R	MR	MR		R	MS	R	R	R		R	R	R	R	R	R
94.	UPB1086	R	NG	NG	NG	NG		R	R	R	R	MS		S	S	S	R	S	MR
95.	UPB1095	R	S	R	R	R		MS	S	S	S	S		R	R	R	R	R	R
96.	UPB1101	MR	MR	R	R	MS		NG	R	R	R	S		NG	MS	MR	R	R	R
97.	UPB1102	R	R	R	R	R		S	MS	S	MS	R		R	R	S	S	R	R
98.	UPB1103	MS	S	R	MS	R		S	S	S	S	S		S	S	S	S	S	S
99.	UPB1104	R	R	R	R	R		R	R	R	S	MS		S	R	MR	R	S	S
100.	UPB1105	S	MS	MS	S	R		R	R	S	MS	R		R	R	R	R	R	R
101.	UPB1106	MS	MS	MR	R	R		R	R	S	S	R		S	S	S	S	S	S
102.	UPB1107	MR	R	R	R	R		R	S	MS	R	R		R	R	R	R	R	R
103.	UPB1108	MR	MR	R	R	R		R	MS	R	S	R		MS	S	R	S	S	S
104.	VLB118(C)	MR	R	R	MS	MS		R	R	R	R	R		S	R	MS	S	MS	MS
105.	VLB175	MS	R	R	MR	MS		R	R	R	R	R		S	MS	MS	MS	MS	S
106.	VLB176	S	S	NG	S	MS		R	R	R	R	R		S	S	S	S	S	S
107.	VLB177	MR	R	R	MR	NG		R	R	R	R	R		R	R	R	R	R	R
108.	VLB178	MS	MR	MR	R	S		R	R	R	R	MS		S	S	S	S	S	S
109.	VLB179	S	MS	S	S	NG		S	S	S	R	S		MS	S	S	MS	R	R

Table 3.9: Seedling response of EBDSN lines to the pathotypes of three rust pathogens of barley during 2021-22

S. No.	Line/Variety	Black rust pathogen						Brown rust pathogen						Yellow rust pathogen					
		11	**21A-2**	**40A**	**117-6**	**122**		**H1**	**H2**	**H3**	**H4**	**H5**		**M**	**57**	**24**	**G**	**Q**	**6S0**
1.	BH1029	MS	NMR	MR	MS	MR		MS	MS	MS	R	R		R	R	MR	R	MS	R
2.	BH1034	S	MS	R	MR	MR		R	R	R	R	R		MS	MS	MR	S	S	S
3.	BH1035	S	S	MR	R	MR		R	R	R	R	R		S	MS	R	S	S	S
4.	BHS380 (C)	MS	MS	R	R	S		R	MS	S	MS	MS		MS	S	R	R	S	S
5.	BHS485	MR	MR	NG	R	NG		R	NG	R	R	S		R	R	R	R	S	MS
6.	HBL113 (C)	S	MS	R	R	MR		R	R	R	R	R		MS	R	R	R	S	R
7.	HBL869	S	R	R	R	S		R	R	R	R	R		R	R	R	R	S	R
8.	HBL870 (LB)	S	R	R	MR	R		R	S	MS	R	MS		MS	S	R	R	MS	S
9.	HUB113 (C)	S	S	R	MS	S		MS	MS	S	S	MS		R	R	R	R	R	R
10.	HUB272	S	R	MR	R	S		R	R	R	R	R		R	R	R	R	R	R
11.	HUB275 (LB)	S	R	R	MR	MR		S	S	S	S	S		R	R	R	R	S	MS
12.	HUB280	S	MS	R	R	S		NG	R	MIX	NG	MIX		S	MS	R	MS	R	S
13.	KB1940	S	MR	R	MR	MR		R	R	R	R	R		S	S	S	MS	S	S
14.	RD2794 (C)	MS	S	MR	MR	S		S	S	S	S	S		S	S	S	S	S	S
15.	RD2899 (C)	S	S	S	S	MS		S	S	R	R	MS		R	R	R	R	R	R
16.	RD3033	MR	MS	R	S	S		S	S	R	S	R		R	R	R	R	R	R
17.	RD3034	S	S	S	MS	S		R	S	S	S	S		R	R	R	R	R	R
18.	RD3038	S	S	S	MS	R		R	MIX	S	S	S		R	R	R	R	R	R
19.	RD3039	S	MR	MS	R	S		R	R	R	R	R		R	R	R	R	R	R

Management of foliar blight of barley through chemicals

The experiment was conducted in RBD with three replications at Ayodhya, Varanasi and Pantnagar. 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 3.10). The maximum disease was created in the plots at tested locations with no fungicidal spray. At Ayodhya centre application of three fungicides *viz*., Tebuconazole 50% + Trifloxystrobin 25%, Picoxystrobin 7.05% + Propiconazole 11.7% and Propiconazole 25% resulted in maximum disease control of barley leaf blight with average disease score of 35, whereas the most effective fungicide in managing the leaf blight disease of barley. Similar trend was observed at Pantnagar. Propiconazole 25% (average double digit blight score 24) was found most effective followed by Tebuconazole 50% + Trifloxystrobin 25% (average double digit blight score 35) at Varanasi.

Table 3.10: Chemical management of foliar blight of barley during 2021-22

Treatment (s)	**Dose (%)**	**Ayodhya**		**Pantnagar**		**Varanasi**	
		DS	**Yield (q/h)**	**DS**	**Yield (q/h)**	**DS**	**Yield (q/h)**
Tebuconazole 50% + Trifloxystrobin 25%,	0.06%	35	37.59	23	44.6	35	18.63
Propiconazole 13.9% + Difenconazole 13.9%	0.10%	45	33.85	35	39.2	46	18.20
Azoxystrobin 12.5% + Tebuconazole 12.5%	0.10%	57	33.05	46	35.7	57	17.00
Picoxystrobin 7.05% + Propiconazole 11.7%	0.10%	35	34.92	37	37.3	47	17.93
Kresoxim Methyl 44.3% SC	0.10%	78	31.72	56	31.8	78	16.63
Propiconazole 25%	0.10%	35	33.85	25	40.9	24	21.23
Tebuconazole 25.9%	0.10%	46	33.59	47	33.2	46	18.40
Mancozeb 75%	0.20%	68	31.72	67	31.8	57	17.50
Control	-	78	30.65	79	30.4	99	15.77
CD (p=0.05)		9.22	0.22	4.31	1.30	5.88	0.23
SE(m)		3.05	0.07	1.42	0.41	1.94	0.08

**DS = Disease severity*

ENTOMOLOGY

During the cropping season of 2021-22, experiments allotted for barley entomology which are listed as below:

S. No.	Experiment	Centres
1	Survey and surveillance of insect-pests and their natural enemies in barley	All centres
2.	Screening of NBDSN barley entries against foliar aphids	Ludhiana, Karnal, Kanpur, Khudwani, Vijapur, Dharwad, Durgapura
3.	Management of aphids through foliar application of new bio-chemical molecules	Ludhiana, Kanpur and Karnal
4.	Effect of silicon on the incidence of foliar aphids and natural enemies	Karnal

Experiment 1: Survey and surveillance of insect-pests and their natural enemies in barley

During the 2021-22, survey was conducted to determine the incidence of insect-pests and their natural enemies on barley crop. At Ludhiana, Kanpur and Karnal locations, aphid infestation was observed to be low to moderate throughout the crop season on barley crop. The aphid population first appeared on January on barley crop and it started rising and reached its peak March. Thereafter aphid population started declining and became very low after first week of April. The natural enemies viz. grubs and adults of coccinellid beetles, syrphid fly and chrysoperla were observed in some of the fields infested with aphids. The population of coccinellid beetles remained low up to first week of February and thereafter it stated rising and reached its peak during mid-March. At Vijapur, survey of barley fields was carried out in the state during the crop season. The termite damage in barley fields remained low to moderate throughout the crop season. Besides, in barley fields the aphid population was moderate to high. Among natural enemies, predators like coccinellid beetles, chrysoperla and syrphid fly were frequently noticed predating on barley aphids.

Experiment 2: Screening of NBDSN barley entries (2021-22) against foliar aphids

A total of one hundred nine barley NBDSN entries (including checks and infector) were screened against aphids at six locations viz. Ludhiana, Karnal, Durgapura, Kanpur, Khudwani, Vijapur and Dharwad during 2021-22. The seeds were supplied by IIWBR, Karnal. Aphid population per shoot was recorded at weekly interval from all theses 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 Vijapur and Dharwad 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 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 109 tested entries, none of the entry showed the moderately resistance (grade 3) or resistance (grade 2) reaction based on average score of five locations i.e. Karnal, Ludhiana, Kanpur, Durgapura and Khudwani. All entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category (Table 3.11). On the basis of aphid score recorded per entry location-wise, seven entries at Durgapura viz., BH1040, BH1043, RD2849©, RD3057, DWRB229, K603© and NDB1785 were categorized as moderately resistant and scored 3. Similarly, two entries viz., DWRB225 and KB2013 at Karnal location and one entry (RD3050) at Kanpur were categorized as moderately resistant (Score = 3) (Table 3.11).

Table 3.11: Screening of National Barley Disease Screening Nursery entries against foliar aphids during 2021-22

NBDSN No.	Entry	Foliar aphid score (1-5 scale)					Avg.	HS
		Karnal	Ludhiana	Kanpur	Durgapura	Khudwani		
1	BH1040	5	5	5	3	5	4.6	5
2	BH1041	5	5	5	5	5	5.0	5
3	BH1042	4	4	5	5	5	4.6	5
4	BH1043	5	5	5	3	5	4.6	5
5	BH1044	4	4	5	4	4	4.2	5
6	BH1045	4	5	5	4	5	4.6	5
7	BH1046	5	5	5	4	4	4.6	5
8	BH946©	5	5	5	5	5	5.0	5
9	BHS352©	5	5	5	4	5	4.8	5
10	BHS380©	5	5	5	5	4	4.8	5
11	BHS400©	5	5	5	5	5	5.0	5
12	BHS488	5	5	5	4	4	4.6	5
13	BHS489	5	5	5	4	5	4.8	5
14	BHS490	5	5	5	5	5	5.0	5
15	BHS491	5	5	5	5	4	4.8	5
16	BHS492	5	5	5	5	5	5.0	5
17	DWRB137 ©	5	5	5	4	5	4.8	5
18	DWRB182©	4	4	5	5	5	4.6	5
19	DWRB219	4	4	5	5	5	4.6	5
20	DWRB221	4	5	5	4	5	4.6	5
21	DWRB223	4	5	5	5	5	4.8	5
22	DWRB225	3	4	5	4	5	4.2	5
23	DWRB226	5	5	5	5	5	5.0	5
24	DWRB227	4	5	5	4	4	4.4	5
25	DWRB228	5	5	5	5	5	5.0	5
26	DWRB229	5	5	5	3	5	4.6	5
27	DWRB230	5	5	5	5	5	5.0	5
28	DWRB231	4	4	5	5	4	4.4	5
29	DWRB232	5	5	5	5	5	5.0	5
30	DWRB233	4	5	5	4	5	4.6	5
31	DWRB234	4	5	5	4	5	4.6	5
32	DWRUB52©	5	5	4	5	5	4.8	5
33	HBL113©	5	4	5	5	4	4.6	5
34	HBL874	5	5	5	4	4	4.6	5
35	HBL875	5	4	5	4	5	4.6	5
36	HBL876	4	5	5	4	5	4.6	5
37	HBL877	5	5	5	5	5	5.0	5
38	HBL878	5	5	5	4	5	4.8	5
39	HUB113©	5	5	5	4	4	4.6	5
40	HUB281	5	5	5	4	5	4.8	5
41	K603©	5	5	5	3	5	4.6	5
42	KARAN16©	4	4	5	5	4	4.4	5
43	KB2004	5	5	5	4	5	4.8	5
44	KB2008	5	5	5	4	4	4.6	5
45	KB2013	3	4	5	4	5	4.2	5
46	KB2015	5	5	5	4	5	4.8	5
47	KB2018	5	5	5	4	4	4.6	5
48	KB2019	5	5	5	4	5	4.8	5
49	KB2031	5	5	5	4	5	4.8	5
50	LAKHAN©	5	5	5	4	4	4.6	5
51	NDB1173©	5	5	5	4	4	4.6	5

52	NDB1756	5	5	5	5	4	4.8	5
53	NDB1776	5	5	5	4	4	4.6	5
54	NDB1782	5	5	5	4	4	4.6	5
55	NDB1783	5	5	5	4	5	4.8	5
56	NDB1784	5	5	5	4	5	4.8	5
57	NDB1785	5	5	5	3	5	4.6	5
58	NDB1789	5	5	5	4	4	4.6	5
59	NDB1793	4	4	5	4	5	4.4	5
60	NDB1800	5	5	5	4	5	4.8	5
61	PL891©	5	5	5	4	5	4.8	5
62	PL917*	5	5	5	4	4	4.6	5
63	PL933	5	4	5	5	5	4.8	5
64	PL934	5	4	5	4	4	4.4	5
65	PL935	5	5	5	5	5	5.0	5
66	PL936	5	5	5	5	5	5.0	5
67	PL937	5	5	5	5	5	5.0	5
68	PL938	5	5	5	4	5	4.8	5
69	PL939	4	4	5	4	4	4.2	5
70	PL940	5	5	5	4	5	4.8	5
71	RD2794©	5	5	5	5	5	5.0	5
72	RD2849©	4	4	5	3	5	4.2	5
73	RD2899	4	5	5	5	5	4.8	5
74	RD2907©	5	5	5	4	4	4.6	5
75	RD3034	5	5	5	5	4	4.8	5
76	RD3037	5	5	5	3	5	4.6	5
77	RD3047	5	5	5	5	4	4.8	5
78	RD3048	5	5	5	4	4	4.6	5
79	RD3049	5	5	5	4	5	4.8	5
80	RD3050	5	5	3	4	5	4.4	5
81	RD3051	5	5	5	4	5	4.8	5
82	RD3052	5	5	5	3	5	4.6	5
83	RD3053	5	5	5	5	4	4.8	5
84	RD3054	5	5	5	4	5	4.8	5
85	RD3055	5	5	5	5	4	4.8	5
86	RD3056	5	5	5	5	5	5.0	5
87	RD3057	5	5	5	3	5	4.6	5
88	RD3058	5	5	5	4	5	4.8	5
89	RD3059	5	5	5	4	5	4.8	5
90	RD3060	5	5	5	4	5	4.8	5
91	RD3061	5	5	5	5	5	5.0	5
92	RD3062	5	5	5	4	5	4.8	5
93	RD3063	5	4	5	5	5	4.8	5
94	UPB1086	5	5	5	5	5	5.0	5
95	UPB1095	5	5	5	4	4	4.6	5
96	UPB1101	5	5	5	4	5	4.8	5
97	UPB1102	5	5	5	4	5	4.8	5
98	UPB1103	5	5	5	5	5	5.0	5
99	UPB1104	5	4	5	5	5	4.8	5
100	UPB1105	5	5	5	4	4	4.6	5
101	UPB1106	5	5	5	3	5	4.6	5
102	UPB1107	5	5	5	5	5	5.0	5
103	UPB1108	5	5	5	5	4	4.8	5
104	VLB118©	4	4	5	4	5	4.4	5

105	VLB175	4	5	5	5	5	4.8	5
106	VLB176	5	5	5	5	4	4.8	5
107	VLB177	5	5	5	5	4	4.8	5
108	VLB178	5	5	5	5	5	5.0	5
109	VLB179	4	4	5	4	5	4.4	5
	Infector	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**

 # Out of 119 entries, few check varieties and entries were found place in many trials and only one check is retained in NBDSN thus resulting 109 entries under NBDSN

In addition to NBDSN lines, 31 barley promising entries along with highly susceptible check (Alfa-93) were tested against aphids at six locations (Karnal, Kanpur, Khudwani, Durgapura Vijapur & Dharwad) during 2021-22. Out of 31 entries five tested entries viz., BCLA51, HVS 14, HLR 20, ICARDA-9, ICARDA-11 and ICARDA-27 were found to be in resistant category (Grade 2) at four locations (Table 3.12). Due to low infestation of aphids at Vijapur and Dharwad locations, the data obtained was not included.

Table 3.12: Screening of promising barley entries against foliar aphids during 2021-22

SN	Entry name	Parentage/identity No.	Foliar aphid score (1-5 scale)				Average score	Maximum Score
			Karnal	Kanpur	Khudwani	Durgapura		
1	BCLA51	DWRB101/BCU390	2	2	2	2	**2.0**	**2**
2	HVS 14	IG 144123	2	2	2	2	**2.0**	**2**
3	HLR 20	IC118689	2	2	2	2	**2.0**	**2**
4	ICARDA-9	J09049 F3 10/030552	2	2	2	2	**2.0**	**2**
5	ICARDA-11	SEN/5/LEGACY/4/TOCTE//GOB/ HUMAI10/3/ATAH92/ALELI	2	2	2	2	**2.0**	**2**
6	ICARDA-27	BISON 217//ATAH92/GOB	2	2	2	2	**2.0**	**2**
7	ALFA–93 (Susceptible check)	AURORA/QUEEN//BEKA	5	5	5	5	**5.0**	**5**

Experiment 3: Management of aphids through foliar spray of new chemical molecules

Objective: To find out the most effective new insecticide against foliar aphids infesting barley.

Methodology: The experiment was conducted during 2021-22 field season at three locations; Ludhiana, Karnal and Kanpur with eight treatments and three replications. Five tillers were tagged from each plot. 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 wheat variety PL 807 was sown on 10th Nov. 2021 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 tiller were ear marked in each plot and from these plants observations were recorded 1 day before spray and then 1, 2, 7 and 15 days after spray.

Aphid population did not differ significantly among all treatments one day before treatment. It was observed one day after spray, thiamethoxam 25 WG (2.11 aphids/tiller) recorded minimum aphids/tiller

and was at par with all other treatments and better than untreated control (28.38 aphids/tiller). Similar results were recorded on 2 and 7 days after treatment, however, 15 days after treatment, Sulfoxaflor 12% SC and thiamethoxam recorded lowest aphid population (1.96 aphids/tiller).

Maximum Grain yield of 42.84 q/ha was recorded from thiamethoxam 25 G treated plots followed by thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (Alika) (42.75 q/ha) treated plots. However, all the foliar insecticidal treatments recorded higher grain yield than untreated check (39.91 q/ha) (Table 3.13).

Location: Karnal

An experiment on management of aphids through foliar application of new molecules was conducted at Research farm of ICAR-IIWBR Karnal under irrigated condition. There were eight treatments including untreated check and each was replicated three times. For recording observations, five tiller were ear marked in each plot and from these plants observations were recorded 1 day before spray and then 1, 2, 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, Beta-Cyfluthrin 9%+ Imidacloprid 21% (2.03 aphids/tiller) recorded minimum aphids/tiller and was at par with all other treatments and better than untreated control (22.76 aphids/tiller). Similar results were recorded 2 days after treatment however Beta-cyfluthrin (1.27 aphids/tiller) and Sulfoxaflor (2.05 aphids/tiller) were the best treatments 7 and 15 days after spray.

Grain yield (q/ha) obtained was maximum (53.20 q/ha) from Lambda cyhalothrin 5% EC treated plots followed by Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) (52.44 q/ha) treated plots. However, all the foliar insecticidal treatments recorded higher grain yield than untreated check (43.64 q/ha) (Table 3.14).

Location: Kanpur

The experiment was conducted under irrigated condition at research farm Nawabganj C.S.A. Univ., Kanpur. The barley variety K 551 was sown on 07.12.2021 in plot of 23 rows of 3m length. These were total of 8 treatments including untreated check and each was replicated thrice. For recording the observation, five shoots were randomly selected in each plot and observation were recorded 24 hr before spray and thereafter at 1, 2, 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 Lambda cyhalothrin 5% EC @500ml and thiomethoxam 30% FS @100 ml spray after one day recorded 6.08 and 6.93 aphid population. After 2 days these insecticides recorded the lowest population of 6.08 and 6.93 aphids/tiller. After 15 days after spray there were no aphids recorded in all tested treatments except control (66.50 aphids/tiller).

Grain yield q/ha was maximum (46.91 q/ha) is recorded in treatment of Lambda cyhalothrin 5% EC @500ml as compared to control which recorded the lowest yield of 28.66 q/ha (Table 3.15).

Table 3.13: Management of aphids through foliar application of new molecules (2021-22) (Location: Ludhiana)

S. No	Treatments	Dose ml or g / ha	Aphid population per earhead					Grain Yield (q/ha)
			Before spray	After spray				
				1 day	2 days	7 days	15 days	
1	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (Alika)	150 ml	27.96	2.17 (1.78)	1.90 (1.70)	1.55 (1.59)	1.99 (1.72)	42.75
2	Thiamethoxam 25% WG	50	2.7.67	2.11 (1.76)	1.92 (1.70)	1.52 (1.58)	1.96 (1.72)	42.84
3	Lambda cyhalothrin 5% EC	500	27.87	2.31 (1.81)	2.07 (1.75)	1.60 (1.61)	2.01 (1.73)	42.57
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	28.13	2.13 (1.76)	1.97 (1.72)	1.48 (1.57)	1.94 (1.71)	42.48
5	Imidacloprid 17.8 SL	400	27.82	2.25 (1.80)	2.05 (1.74)	1.56 (1.60)	2.02 (1.73)	42.62
6	Beta-cyfluthrin 25 SC	1450	28.06	2.20 (1.78)	2.08 (1.75)	1.53 (1.59)	2.05 (1.74)	42.40
7	Sulfoxaflor 12% SC	250 ml	28.16	2.16 (1.77)	2.04 (1.74)	1.45 (1.56)	1.96 (1.72)	42.53
8	Untreated control	-	27.99	28.38 (5.42)	28.00 (5.38)	29.45 (5.51)	30.80 (5.63)	39.91
CD (p=0.05)			NS	(0.17)	(0.10)	(0.12)	(0.08)	1.48

**Figures within parentheses arc transformed means*

Date of sowing : 10.11.2021 Plot size : 7.5 m^2 Variety : PL 807
Date of insecticidal application : 02.03.2022 Date of harvest : 14.04.2022 Replications : Three

Table 3.14: Management of aphids through foliar application of new molecules (2021-22) (Location: Karnal)

S. No.	Treatments	Dose ml or g/ha	Aphid population per earhead					Grain Yield (q/ha)
			Before spray	After spray				
				1 day	2 days	7 days	15 days	
1	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (Alika)	150 ml	27.00	2.20 (1.78)	1.91 (1.70)	1.49 (1.57)	2.20 (1.78)	52.35
2	Thiamethoxam 25% WG	50	27.16	2.17 (1.77)	1.93 1.71)	1.45 (1.56)	2.26 (1.80)	51.77
3	Lambda cyhalothrin 5% EC	500	26.33	2.09 (1.75)	1.90 (1.70)	1.40 (1.54)	2.27 (1.80)	53.20
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	25.86	2.03 (1.73)	1.89 (1.70)	1.35 (1.53)	2.19 (1.78)	52.44
5	Imidacloprid 17.8 SL	400	25.93	2.10 (1.75)	1.83 1.68)	1.29 (1.51)	2.10 (1.76)	48.04
6	Beta-cyfluthrin 25 SC	1450	26.30	2.12 (1.76)	1.94 (1.71)	1.27 (1.50)	2.07 (1.75)	46.22
7	Sulfoxaflor 12% SC	250 ml	25.76	2.15 (1.77)	1.86 1.69)	1.29 (1.51)	2.05 (1.74)	47.91
8	Untreated control	-	26.33	22.76 (4.87)	19.92 (4.57)	18.71 (4.44)	16.06 (4.13)	43.46
CD (p=0.05)			NS	(0.16)	(0.11)	NS	(0.13)	(0.07)

*Figures within parentheses arc transformed means

Date of sowing : 13-11-2021 Plot size : 6 row of 6m Variety : DWRUB64
Date of insecticidal application : 10-02-2022 Date of harvest : 14.04.2022 Replications : Three

Table 3.15: Management of aphids through foliar application of new molecules (2021-22). (Location: Kanpur)

S. No.	Treatments	Actual dose ml/g/ha	Aphid population per main shoot					Grain yield (q/ha)
			Before spray	After spray				
				1 day	2 days	7 days	15 days	
1.	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (Alika)	150 ml.	9.46	8.00 (16.43)	7.40 (15.79)	3.00 (9.98)	1.13 (6.55)	39.10
2.	Thiamethoxam 25% WG	50 g	10.86	7.60 (16.00)	5.56 (13.69)	1.46 (7.27)	0.46 (3.85)	43.51
3.	Lambda cyhalothrin 5% EC	500ml	11.46	6.08 (15.12)	3.73 (11.09)	0.86 (5.32)	0.00 (0.00)	46.91
4.	Beta-Cyfluthrin 9%+ Imidacloprid 21%	400ml	11.20	7.80 (16.22)	7.13 (15.68)	1.93 (7.92)	0.86 (5.36)	43.13
5.	Imidacloprid 17.8 EC	400ml	10.40	7.73 (16.11)	6.20 (14.42)	1.86 (7.71)	0.74 (4.93)	43.17
6.	Beta-cyfluthrin 25 SC	1450ml	10.53	7.24 (15.79)	5.20 (13.18)	1.26 (7.27)	0.40 (3.63)	43.66
7.	Thiamethoxam 30% FS	100ml	10.40	6.93 (15.23)	4.86 (12.66)	1.20 (6.29)	0.00 (0.00)	44.85
8.	Untreated control	-	10.50	18.93 (25.77)	24.00 (29.33)	51.60 (45.92)	66.50 (54.63)	28.66
S.Em ±		-	NS	NS	0.420	0.590	1.100	0.781
CD 5%		-	NS	NS	1.287	1.807	3.367	2.392

*Figures within parentheses arc transformed means

Date of sowing	: 07.12.2021	Plot size	: 3 x 5 m	Variety	: K551
Date of insecticidal application	: 25.01.2022	Date of harvest	: 25.04.2022	Replications	: Three

Experiment 4: Effect of silicon application on the incidence of major insect pest and natural enemies

Impact of silicon application in the form of sodium meta-silicate was evaluated to determine its effect on aphid abundance and their coccinellid predators in barley. Single and two foliar application of sodium meta-silicate @ 10, 30 and 50 g/litre were tested along with one and two sprays of Actara (thiamethoxam 25WG) @ 50 g/ha as standard check for comparison (Table 3.16). First spray of sodium meta-silicate and thiamethoxam was made at 120 days and second spray was made 10 days after the first spray. Thiamethoxam 25 WG @ 50 g/ha were applied as standard check. Observations were recorded on population of aphids/tillers, coccinellid predators (adult and grubs) and grain yield at the time of harvest. No significant clear effect of sodium meta-silicate was observed on aphid population when one or two foliar applications of sodium meta-silicate was done. However, little reduction in aphid population was observed in plots treated with sodium meta-silicate. But the population remained above economic threshold level of 5 aphid/earhead. However, significant reduction in aphid application was recorded in plots treated with thiamethoxam. Coccinellid population was statistically at par with each other in all sodium meta-silicate application and it was significantly lower than foliar application of thiamethoxam. The grain yield recorded in all silicon treatments was also significantly lower than yield obtained in plots treated with foliar application of thiamethoxam 25WG.

Table 3.16: Effect of sodium metasilicate application on aphid incidence in barley during 2021-22 (Location-Karnal)

Treatments	Number of aphids/ earhead								Grain yield (q/ha)
	Before spray	After 1st spray			After 2nd spray			Coccinellid/ sq m	
		1 day	3 day	7 day	1 day	3 day	7 day	7 days after 2nd spray	
One spray of sodium meta-silicate @ 10g/litre at 120 days after sowing	12.43	10.76	10.62	11.29	10.65	10.7	11.81	1.63	44.25
Two sprays of sodium meta-silicate @ 10g/litre at 120 days after sowing and 130 days after first spray	11.6	10.82	10.51	11.18	10.3	10.21	11.09	1.61	43.20
One spray of sodium meta-silicate @ 30g/litre at 120 days after sowing	12.27	10.37	10.14	10.81	9.93	10.1	11.21	1.69	44.39
Two sprays of sodium meta-silicate @ 30g/litre at120 days after sowing and 130 days after first spray	11.66	10.33	9.75	10.42	9.54	9.72	10.6	1.52	44.20
One spray of sodium meta-silicate @ 50g/litre at 90 days after sowing	11.87	10.2	9.62	10.8	9.92	10	11.32	1.66	44.72
Two sprays of sodium meta-silicate @ 50g/litre at 120 days after sowing and 130 days after first spray	12.2	10.53	9.59	10.55	9.67	9.39	10.31	1.59	43.24
One spray of Actara (thiamethoxam 25 WG) @ 50g/ha at 120 days after sowing	12.57	4.11	3.75	2.50	1.57	1.41	2.48	0.88	47.27
Two sprays of Actara (thiamethoxam 25 WG) @ 50g/ha at 120 days after sowing and 130 days after first spray	12.48	3.17	2.62	2.42	1.08	1.23	1.09	0.56	48.45
Untreated Check	12.73	11.86	11.44	12.2	11.32	11.45	12.56	0.91	42.22
CD (p =0.05)	NS	1.25	0.62	0.72	0.79	0.49	0.80	0.29	1.28

Date of sowing	: 13-11-2021	Plot size	: 6 row of 6m	Variety	DWRUB64
Date of insecticidal application	: 13.03.2022 & 23.03.22	Date of harvest	: 25.04.2022	Replications	Three

NEMATOLOGY

A total 109 entries of NBDSN and 43 of EBDSN were screened against the Cereal Cyst Nematode (CCN) at two locations viz. Durgapura and Hisar. Most of the entries fall in the category of susceptible or highly susceptible. In NBDSN entries no entry fall in resistant or moderately resistant across location, however, at Hisar location RD3050 and RD3062 categorized as resistant and DWRB227, DWRB228, KB2018, NDB1784, RD3060, UPB1102 and UPB1106 as moderately resistant.

CO-OPERATORS

Pathology		
SN	**Centre**	**Cooperators**
1	Karnal	Dr. Sudheer Kumar and Ravindra Kumar
2	Ludhiana	Dr. Jaspal Kaur
3	Durgapura	Dr. P. S. Shekhawat
4	Bajaura	Dr. Rakesh Devlash
5	Hisar	Dr. R.S. Beniwal
6	Almora	Dr. K. K. Mishra
7	Jammu	Dr. M. K. Pandey
8	Pantnagar	Dr. Deepshikha
9	Kanpur	Dr. Javed Bahar
10	Ayodhya	Dr. S.P. Singh
11	Varanasi	Dr. S.S. Vaish
12	Flowerdale, Shimla	Dr. S.C. Bhardwaj Dr. O.P. Gangwar Dr. P. Prasad

Entomology		
SN	**Centre**	**Cooperators**
1	Karnal	Dr. Poonam Jasrotia
2	Vijapur	Mr. R. V. Thakkar
3	Ludhiana	Dr. Beant Singh
4	Kanpur	Dr. J. Kumar
5	Khudwani	Dr. Shabir Hussain Wani
6	Dharwad	Dr. Gurudatt M. Hegde
7		

Nematology		
SN	**Centre**	**Cooperators**
1	Durgapura	Dr. S. P Bishnoi
2	Ludhiana	Dr. Ramanna Koulagi
3	Hisar	Dr. Saroj Yadav

RESOURCE MANAGEMENT

Resource Management group of AICRP Wheat and Barley are engaged in agronomic evaluation of new genotypes and for updating the package and practices under different agro climatic conditions. Input management *viz.* Nutrients and water under resource scarce conditions, sowing timings in different zones under changing climatic conditions, micro nutrient supply, nano fertiliser application and other crop management practices for yield maximisation 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 recent years and the newly developed improved technologies contributes in the increased productivity.

The details of the trials (proposed and conducted) are reported in Table 1. A total of 54 trials were proposed and conducted at different locations and 53 were reported, one trial was rejected by monitoring team.

Details of barley trials proposed and conducted during 2021-22

Trial Name	Number of trials			
	Proposed locations	**Not conducted/ Failed**	**Data Received**	**Data Reported**
AVT trials				
Nitrogen Levels x Sowing time x Varieties (NEPZ	3	1	2	2
Special trials				
Date of sowing (NWPZ, NEPZ, CZ NHZ)	11	-	11	11
N and Zn scheduling (NWPZ)	5	-	5	5
Yield Maximisation (NWPZ, NEPZ, CZ NHZ)	10	-	10	10
Nano fertiliser application (NWPZ)	5	-	5	5
Zn application x varieties (NWPZ, NEPZ, CZ, NHZ)	11	-	11	11
Irrigation levels and silicon (NWPZ, CZ)	4	-	4	4
Method of sowing x Seed rate (NWPZ)	5	-	5	5
Total	54	1	53	53

Response of new barley genotypes to different N levels and production conditions (NEPZ)

The trial was conducted at Varanasi and Kanpur. The test entry PL 917 (33.44 q ha^{-1}) was inferior to recently released checks; it produced 15.8 % less as compared to best Check DWRB137 (Table 1). The genotypes responded up to 75 kg Nitrogen/ha. Similarly in date of sowing, trial, the new genotypes produced less (11.1%) compared to best check DWRB137 and in late sowing, the production reduced by 14.4% (Table 1a).

Table 1 **AVT NEPZ** **POOLED** **2021-22**

N levels x Varieties

Code/Varieties	N (Kg ha^{-1}) 45		60		75		Mean	
	Yld.	Rk.	Yld.	Rk.	Yld.	Rk.	Yld.	Rk.
Yield, q/ha								
V1 PL917	30.74	3	33.93	2	35.64	3	33.44	3
V2 DWRB137	33.29	1	37.91	1	41.72	1	37.64	1
V3 HUB113	31.48	2	32.07	3	37.67	2	33.74	2
MEAN	31.84		34.64		38.34		34.94	
CD (0.05)	N(A)		Varieties (B)		B within A		A within B	
	1.42		1.25		NS		NS	
Earhead/ m^2								
V1 PL917	298	2	320	3	320	2	313	2
V2 DWRB137	293	3	326	1	305	3	308	3
V3 HUB113	317	1	326	2	349	1	331	1
MEAN	417		433		442		430	
CD (0.05)	N(A)		Varieties (B)		B within A		A within B	
	9.79		15.1		NS		NS	
Grains/Earhead								
V1 PL917	35.21	3	36.38	3	38.16	2	36.58	3
V2 DWRB137	36.68	1	38.19	1	42.71	1	39.20	1
V3 HUB113	36.63	2	37.11	2	37.92	3	37.22	2
MEAN	36.17		37.23		39.60		37.67	
CD (0.05)	N (A)		Varieties (B)		B within A		A within B	
	1.22		NS		NS		NS	
1000 Grain Weight, g								
V1 PL917	41.18	1	41.98	1	41.70	1	41.62	1
V2 DWRB137	38.64	2	41.74	2	40.91	2	40.43	2
V3 HUB113	37.61	3	40.18	3	40.00	3	39.26	3
MEAN	39.14		41.30		40.87		40.44	
CD (0.05)	N (A)		Varieties (B)		B within A		A within B	
	0.69		1.06		NS		NS	

Centres: Kanpur, Varanasi

Table 1a **AVT NEPZ** **Pooled** **2021-22**

DOS x Varieties

Varieties	Sowing Time Timely		Late		Mean	
	Yld.	Rk.	Yld.	Rk.	Yld.	Rk.
Yield, q/ha						
V1 PL917	33.93	2	29.64	3	31.79	2
V2 DWRB137	37.91	1	32.04	1	34.97	1
V3 HUB113	32.07	3	29.70	2	30.89	3
MEAN	34.64		30.46		32.55	
CD (0.05)	S (A)	Varieties (B)	B within A	A within B		
	2.23	1.05	1.49	NS		
Earhead/ m^2						
V1 PL917	320	3	336	2	328	3
V2 DWRB137	326	1	335	3	331	2
V3 HUB113	326	2	343	1	334	1
MEAN	324		338		331	
CD (0.05)	S (A)	Varieties (B)	B within A	A within B		
		NS	NSNSNS			

			Grains/Earhead			
V1 PL917	36.38	3	31.36	3	33.87	3
V2 DWRB137	38.19	1	31.66	2	34.93	2
V3 HUB113	37.11	2	34.42	1	35.77	1
MEAN	37.23		32.48		34.85	
CD (0.05)	S (A)	Varieties (B)	B within A	A within B		
		1.33NS	NS	NS		
			1000 Grain Weight, g			
V1 PL917	41.98	1	41.18	1	41.58	1
V2 DWRB137	41.74	2	38.57	2	40.16	2
V3 HUB113	40.18	3	35.03	3	37.60	3
MEAN	41.30		38.26		39.78	
CD (0.05)	S (A)	Varieties (B)	B within A	A within B		
	1.15	1.02	1.45	NS		

Centres: Kanpur, Varanasi

Location Wise Data

Table 1.1 Response of new genotypes to Nitrogen levels **Varanasi**

			N Levels, kg/ha					
Varieties	N45	Rank	N60	Rank	N75	Rank	Mean	Rank
V1 PL917	25.25	3	27.10	3	32.03	3	28.13	3
V2 DWRB137	27.33	2	30.53	1	35.13	2	31.00	2
V3 HUB113	28.23	1	30.33	2	36.70	1	31.76	1
MEAN	26.94		29.32		34.62		30.29	
		F. Test	S.E.m	C.D.	C.V.(%)			
N levels	(A)	**	0.092	0.28	0.91			
Varieties	(B)	**	0.23	0.59	2.33			
B within A		N.S.	0.41	1.03				
A within B			0.34	0.87				
						Kanpur		
Varieties	N45	Rank	N60	Rank	N75	Rank	Mean	Rank
V1 PL917	36.23	2	40.76	2	39.25	2	38.74	2
V2 DWRB137	39.25	1	45.28	1	48.30	1	44.28	1
V3 HUB113	34.72	3	33.81	3	38.64	3	35.72	3
MEAN	36.73		39.95		42.06		39.58	
		F. Test	S.E.m	C.D.	C.V.(%)			
N levels	(A)	N.S.	1.17	3.52	8.84			
Varieties	(B)	**	0.92	2.32	6.99			
B within A		N.S.	1.60	4.02				
A within B			1.75	4.41				

Table 1a.1 Response of new genotypes to Production conditions						
			Date of sowing			**Varanasi**
Varieties	Normal	Rank	Late	Rank	Mean	Rank
V1 PL917	27.1	3	24.57	3	25.83	3
V2 DWRB137	30.53	1	26.33	2	28.43	2
V3 HUB113	30.33	2	27.70	1	29.02	1
MEAN	29.32		26.20		27.76	
		F. Test	S.E.m	C.D.	C.V.(%)	
Sowing date	(A)	**	0.17	0.72	1.87	
Varieties	(B)	**	0.28	0.75	2.51	
B within A		N.S.	0.40	1.06		
A within B			0.37	0.98		
						Kanpur
Varieties	Normal	Rank	Late	Rank	Mean	Rank
V1 PL917	40.76	2	34.72	2	37.74	2
V2 DWRB137	45.28	1	37.74	1	41.51	1
V3 HUB113	33.81	3	31.70	3	32.76	3
MEAN	39.95		34.72		37.33	
		F. Test	S.E.m	C.D.	C.V.(%)	
Dateof sowing	(A)	N.S.	1.47	6.07	11.81	
Varieties	(B)	**	0.80	2.11	5.27	
B within A		N.S.	1.14	2.99		
A within B			1.74	4.57		

Updation of Package of Practices

To increase the production, productivity and profitability of the barley growing farmers, updating of package of practices of barley crop is continuous process and the need of the hour. Seven special trials were conducted in different zones to achieve this objective. The results from these trials are presented below.

SPL 1: Productivity enhancement through adjusting sowing dates in barley

Objective: To optimise sowing dates for increasing the feed and malt barley productivity in different zones

Four sowing dates starting from November in plains and October in hills were tried with two recently released popular varieties of the zone in a split plot design. It was conducted at five locations in NWPZ, three places in NEPZ, one location in CZ and two locations at NHZ.

Pooled data revealed that there was no significant difference in two sowing dates (first November to 15th November) but significantly superior to after 20th November and December sowing in NWPZ (Table 2). In NEPZ, The yield was highest in 11-15 November sowing and thereafter yield decreased significantly (Table 2a). In Central zone (Udaipur), the yield was highest in 1-5 November sowing significantly decreased thereafter (Table 2b). In NHZ, the yield increased till 1-5 November and thereafter it decreased significantly (Table 2c).

Table 2 **NORTH WESTERN PLAINS ZONE** **Pooled** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	November1-5	November 11-15	November20-25	December 1-5	Mean
			Yield, q/ha		
BH 946	48.86	49.57	42.93	34.97	44.09
DWRB 160	43.67	44.03	36.62	32.75	39.27
MEAN	46.27	46.80	39.78	33.86	41.68
CD (0.05)	DOS(A) 1.18	Variety(B) 0.69	B within A 1.38	A within B 1.53	
			Earhead/ m^2		
BH 946	376	370	327	285	339
DWRB 160	391	365	347	308	353
MEAN	383	368	337	296	346
CD (0.05)	DOS(A) 8.49	Variety(B) 4.41	B within A 8.82	A within B 10.5	
			Grains/Earhead		
BH 946	44.37	49.14	47.75	43.23	46.12
DWRB 160	30.59	31.46	29.97	31.81	30.96
MEAN	37.48	40.30	38.86	37.52	38.54
CD (0.05)	DOS(A) 1.77	Variety(B) 1.79	B within A NS	A within B NS	
			1000 Grain Weight, g		
BH 946	42.77	39.79	38.48	35.61	39.16
DWRB 160	49.99	48.50	45.61	42.44	46.64
MEAN	46.38	44.14	42.05	39.02	42.90
CD (0.05)	DOS(A) 1.17	Variety(B) 1.45	B within A NS	A within B NS	

Three year average Yield, q/ha					
BH 946	48.21	49.12	45.50	43.25	45.34
DWRB 160	44.45	44.58	41.00	35.28	41.32
MEAN	46.33	46.83	43.25	36.92	
CD (0.05)	DOS(A) 2.95	Variety(B) 0.73	B within A NS	A within B NS	

Table 2.1 **NORTH WESTERN PLAINS ZONE** **Ludhiana** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	November1-5	November 11-15	November20-25	December 1-5	Mean
BH 946	40.59	38.89	23.96	17.21	30.16
DWRB 160	40.16	39.25	20.73	19.91	30.01
MEAN	40.37	39.07	22.35	18.56	30.09

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.90	3.12	7.33
Variety	(B)	N.S.	0.71	2.33	8.22
B within A		N.S.	1.43	4.65	
A within B			1.35	4.41	

Karnal

BH 946	40.4	48.39	47.16	38.79	43.68
DWRB 160	39.8	45.64	40.59	38.17	41.05
MEAN	40.1	47.01	43.87	38.48	42.37

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	1.21	4.18	6.99
Variety	(B)	*	0.74	2.40	6.02
B within A		N.S.	1.47	4.80	
A within B			1.60	5.20	

Hisar

BH 946	46.05	48.03	48.62	42.44	46.28
DWRB 160	44.35	48.82	47.29	39.71	45.04
MEAN	45.20	48.42	47.95	41.07	45.66

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.70	2.43	3.77
Variety	(B)	N.S.	0.67	2.20	5.11
B within A		N.S.	1.35	4.39	
A within B			1.18	3.86	

Durgapura

BH 946	70.00	69.07	53.03	37.67	57.44
DWRB 160	52.43	48.37	38.63	30.43	42.47
MEAN	61.22	58.72	45.83	34.05	49.95

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	1.69	5.84	8.28
Variety	(B)	**	0.64	2.08	4.43
B within A		**	1.28	4.17	
A within B			1.92	6.25	

				Agra	
BH 946	47.28	43.49	41.9	38.75	42.86
DWRB 160	41.62	38.10	35.86	35.52	37.77
MEAN	44.45	40.79	38.88	37.14	40.32

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.69	2.37	4.16
Variety	(B)	**	0.43	1.40	3.69
B within A		N.S.	0.86	2.80	
A within B			0.92	2.99	

Table 2a **NORTH EASTERN PLAINS ZONE** **Pooled** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	November11-15	November 21-25	December 1-5	December 11-15	Mean
			Yield, q/ha		
DWRB137	35.98	32.98	29.77	22.80	30.38
HUB113	36.64	32.80	29.69	22.94	30.52
MEAN	36.31	32.89	29.73	22.87	30.45
CD (0.05)	DOS(A) 0.86	Variety(B) NS	B within A NS	A within B NS	
			Earhead/ m^2		
DWRB137	303	321	316	265	301
HUB113	341	339	345	279	326
MEAN	322	330	331	272	314
CD (0.05)	DOS(A) 6.28	Variety(B) 5.71	B within A 9.42	A within B 9.78	
			Grains/Earhead		
DWRB137	37.30	34.36	32.07	32.38	34.03
HUB113	45.16	43.31	39.55	40.22	42.06
MEAN	41.23	38.83	35.81	36.30	38.04
CD (0.05)	DOS(A) 1.43	Variety(B) 0.73	B within A 1.45	A within B 1.76	
			1000 Grain Weight, g		
DWRB137	38.15	36.60	32.68	29.34	34.19
HUB113	34.38	33.09	31.09	26.63	31.29
MEAN	36.26	34.84	31.89	27.98	32.74
CD (0.05)	DOS(A) 0.37	Variety(B) 0.91	B within A NS	A within B NS	
			Three Year Yield, q/ha		
DWRB137	38.78	36.20	32.31	25.90	33.30
HUB113	39.78	36.75	32.54	26.76	33.86
MEAN	39.28	36.47	32.42	26.14	30.45
CD (0.05)	DOS(A) 0.61	Variety(B) 0.25	B within A NS	A within B NS	

Table 2a.1 **NORTH EASTERN PLAINS ZONE** **Varanasi** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	November11-15	November 21-25	December 1-5	December 11-15	Mean
DWRB137	38.97	41.78	36.83	33.47	37.76
HUB113	39.77	41.33	37.50	34.60	38.30
MEAN	39.37	41.55	37.17	34.03	38.03

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.43	1.48	2.75
Variety	(B)	N.S.	0.22	0.72	2.00
B within A		N.S.	0.44	1.43	
A within B			0.53	1.72	

Faizabad

DWRB137	31.51	27.12	22.57	16.89	24.52
HUB113	34.54	30.38	25.52	19.73	27.54
MEAN	33.03	28.75	24.04	18.31	26.03

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.32	1.12	3.05
Variety	(B)	**	0.18	0.58	2.36
B within A		N.S.	0.35	1.16	
A within B			0.41	1.34	

Kanpur

DWRB137	37.47	30.04	29.90	18.04	28.86
HUB113	35.62	26.70	26.05	14.48	25.72
MEAN	36.54	28.37	27.98	16.26	27.29

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.90	3.13	8.12
Variety	(B)	**	0.62	2.02	7.88
B within A		N.S.	1.24	4.05	
A within B			1.26	4.11	

Table 2b **CENTRAL ZONE** **Udaipur** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	November1-5	November 11-15	November20-25	December 1-5	Mean
			Yield, q/ha		
DWRB137	50.83	47.42	46.43	41.37	46.51
RD2899	58.50	55.17	54.30	47.70	53.92
MEAN	54.67	51.30	50.37	44.53	50.22
CD (0.05)	DOS(A) 5.72	Variety(B) 3.82	B within A 7.64	A within B 7.63	
			Grains/Earhead		
DWRB137	45.43	42.47	41.27	40.63	42.45
RD2899	55.47	51.88	47.40	42.07	49.20
MEAN	50.45	47.18	44.33	41.35	45.83
CD (0.05)	DOS(A) 5.33	Variety(B) 2.67	B within A 5.34	A within B 6.29	

			1000 Grain Weight, g		
DWRB137	45.67	44.33	43.67	40.35	43.50
RD2899	47.33	45.67	45.33	42.00	45.08
MEAN	46.50	45.00	44.50	41.18	44.29
CD (0.05)	DOS(A) 3.25	Variety(B) 1.07	B within A 2.14	A within B 3.42	
			Three year Yield, q/ha		
DWRB137	30.71	29.39	30.55	29.38	30.01
RD2899	33.40	32.39	32.48	29.12	31.94
MEAN	32.06	30.89	31.51	29.25	
CD (0.05)	DOS(A) NS	Variety(B) NS	B within A NS	A within B NS	

Table 2c **NORTHERN HILLZONE** **POOLED** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	October20-25	November 1-5	November20-25	December 1-5	Mean
			Yield, q/ha		
BHS400	43.70	44.19	41.50	36.43	41.45
VLB118	40.26	41.23	36.46	33.78	37.93
MEAN	41.98	42.71	38.98	35.10	39.69
CD (0.05)	DOS(A) 2.50	Variety(B) 1.05	B within A NS	A within B NS	
			Earhead/ m^2		
BHS400	422	437	429	368	414
VLB118	353	373	356	313	349
MEAN	388	405	393	340	381
CD (0.05)	DOS(A) 14.4	Variety(B) 7.53	B within A NS	A within B NS	
			Grains/Earhead		
BHS400	27.90	27.47	25.30	26.87	26.88
VLB118	26.96	25.81	22.85	26.14	25.44
MEAN	27.43	26.64	24.08	26.51	26.16
CD (0.05)	DOS(A) 1.55	Variety(B) 1.01	B within A NS	A within B NS	
			1000 Grain Weight, g		
BHS400	43.42	42.91	42.26	41.02	42.40
VLB118	43.59	43.01	42.71	41.22	42.63
MEAN	43.51	42.96	42.48	41.12	42.52
CD (0.05)	DOS(A) 0.87	Variety(B) NS	B within A NS	A within B NS	
			Three year Yield, q/ha		
BHS400	41.82	42.65	39.56	34.74	39.69
VLB118	38.22	39.91	35.08	31.89	36.27
MEAN	40.02	41.28	37.32	33.32	
CD (0.05)	DOS(A) 0.36	Variety(B) 0.18	B within A 0.35	A within B 0.42	

Table 2c.1 **NORTHERN HILL ZONE** **Malan** **2021-22**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	October25-30	November 5-10	November15-20	November25-30	Mean
BHS400	39.65	38.35	36.11	31.95	36.52
VLB118	36.39	36.01	32.507	28.78	33.42
MEAN	38.02	37.18	34.308	30.37	34.97

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	*	1.42	3.91	9.95
Variety	(B)	**	0.53	1.40	5.28
B within A		N.S.	1.07	2.81	
A within B			1.61	4.23	

Bajaura

BHS400	47.75	50.02	46.89	40.90	46.39
VLB118	44.13	46.45	40.42	38.78	42.45
MEAN	45.94	48.23	43.66	39.84	44.42

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	*	1.38	3.80	7.62
Variety	(B)	**	0.66	1.75	5.18
B within A		N.S.	1.33	3.49	
A within B			1.67	4.40	

SPL 2: Productivity and quality enhancement of barley through Nitrogen and Zinc scheduling

Objective: To enhance quality and productivity of barley through different N and Zinc scheduling

The trial was conducted at five locations in NWPZ with nine treatments of N scheduling and among these, in three treatments Zn was also added. The productivity was superior and at par in 4, 5 and 7 treatments when nitrogen was in three split, also apply urea alone and urea and Zn as foliar spray. Although there was no significant difference in protein content when two splits or thrice or with foliar spray of urea and Zn but highest was obtained when nitrogen was in two split (1/2 at basal+1/2 at tillering (35-40 DAS) +5.0% urea) sprayed at anthesis stage (80-90DAS).

Table 3 NORTH WESTERN PLAIN ZONE DWRB 160 2021-22
N and Zn Scheduling

	Earhead/ m^2	Grains/Earhead	1000 Gr. Wt, g	Yield, q/ha	Protein
T1	354	34.96	51.45	46.89	10.83
T2	356	36.07	51.94	48.33	11.20
T3	358	35.07	51.45	49.73	11.20
T4	371	35.66	52.94	50.62	11.27
T5	373	35.69	53.42	52.19	11.23
T6	346	36.22	52.26	48.41	11.10
T7	364	35.34	53.36	51.30	10.93
T8	346	35.17	51.77	48.38	11.17
T9	349	35.59	52.05	49.99	11.30
Mean	357	35.53	52.29	49.54	11.14
S.E.(M)	4.23	1.10	0.97	0.68	0.12
C.D.	9.9	2.6	2.3	1.6	0.36

1. 1/2 at basal+1/2 at tillering (35-40 DAS)
2. 1/2 at basal+1/4 at tillering (35-40 DAS) +1/4 at anthesis stage (80-90DAS)
3. 1/3 at basal+1/3 at tillering (35-40 DAS) +1/3 at flag leaf stage (65-70DAS)
4. 1/2 at basal+1/2 at tillering (35-40 DAS) +5.0% urea spray at anthesis stage (80-90DAS)
5. 1/2 at basal+1/2 at tillering (35-40 DAS) +5.0% urea + 0.5% ZnSO4.7H2O spray at anthesis stage (80-90DAS)
6. 1/2 at basal+1/4 at tillering (35-40 DAS) +5.0% urea spray at anthesis stage (65-70DAS)
7. 1/2 at basal+1/4 at tillering (35-40 DAS) +5.0% urea + 0.5% ZnSO4.7H2O spray at flag leaf (65-70DAS) and 0.5% urea spray at anthesis stage (80-90DAS)
8. 1/3 at basal+1/3 at tillering (35-40 DAS) +5.0% spray at flag leaf stage (80-90DAS)
9. 1/3 at basal+1/3 at tillering (35-40 DAS) +5.0% Urea + 0.5% ZnSO4.7H2O spray at anthesis (80-90DAS)

Table 3.1 NORTH WESTERN PLAIN ZONE 2021-22
N and Zn Scheduling Yield, q/ha

	Ludhiana	**Karnal**	**Agra**	**Hisar**	**Durgapura**
T1	32.65	52.69	42.41	45.55	61.17
T2	35.41	55.80	44.71	48.11	57.60
T3	38.98	55.13	46.44	47.94	60.13
T4	33.37	56.57	50.96	46.89	65.33
T5	36.35	54.47	53.51	48.94	67.67
T6	31.44	57.03	48.81	44.11	60.67
T7	33.30	56.77	55.43	45.00	66.00
T8	36.01	58.09	47.75	43.06	57.00
T9	35.36	56.92	52.99	44.34	60.33
Mean	34.76	55.94	49.22	45.99	61.77
S.E.(M)	2.19	1.01	0.85	1.08	1.99
C.D.	6.58	3.03	2.54	3.23	5.98
C.V.	10.93	3.13	2.98	4.06	5.60

SPL 3: Yield maximisation of barley through integrated nutrient supply and PGRs application

Objective: To increase barley productivity and nutrient use efficiency.

The trial was conducted with twelve different combinations of FYM, Recommended fertiliser and PGRs at 10 locations in different zone.

In NWPZ, the highest yield was obtained with RDF 125%+10t FYM+PGR followed by RDF+10t FYM+PGR which were statistically at par and other combinations were inferior to these treatments (Table 4). In NEPZ, The highest yield was obtained by RDF 150%+PGR and other combinations were inferior to this treatment (Table 4a). In NHZ, The highest yield was obtained by RDF 125%+10t FYM+PGR followed by RDF 150%+PGR which were at par and other combinations were inferior to these treatments (Table 4b). In all the zones, the yield increased with the increase in level of fertiliser and also with the addition of FYM and PGRs.

Table 4 NORTH WESTERN PLAIN ZONE Pooled 2021-22

Yield maximisation Var: BH946

	Tillers/m2	Grains/ Earhead	1000 GW (g)	Yield, q/ha
1. Control (No fertiliser)	278	39.50	37.00	26.79
2. RDF 50%+10t FYM	326	46.05	38.81	41.52
3. RDF 50%+10t FYM+PGR	329	47.29	38.39	42.87
4. RDF 75%+10t FYM	342	47.55	38.36	44.21
5. RDF 75%+10t FYM+PGR	350	46.91	38.87	46.37
6. RDF	352	47.08	39.12	46.65
7. RDF+PGR	361	47.58	39.50	49.33
8. RDF + 10t FYM	361	47.02	38.53	47.24
9. RDF + 10t FYM+PGR	378	46.54	40.20	52.39
10. RDF 125%+PGR	376	46.86	39.35	50.42
11. RDF 125%+10t FYM+PGR	383	46.71	40.00	53.11
12. RDF 150%+PGR	379	46.41	39.72	51.45
Mean	351	46.29	38.99	46.03
S.E.(M)	4.62	0.95	0.42	0.62
C.D.	10.8	2.23	0.99	1.46

Table 4.1 NORTH WESTERN PLAINZONE (Location wise) **2021-22**

Yield maximisation Yield, q/ha

	Ludhiana	Hisar	Karnal	Agra	Durgapura
1. Control (No fertiliser)	13.66	24.70	34.67	29.45	31.47
2. RDF 50%+10t FYM	35.56	39.85	45.28	37.59	49.33
3. RDF 50%+10t FYM+PGR	35.63	41.32	46.51	40.90	50.00
4. RDF 75%+10t FYM	38.14	43.11	44.77	41.01	54.00
5. RDF 75%+10t FYM+PGR	38.29	43.30	49.97	43.69	56.60
6. RDF	39.23	44.08	47.48	43.79	58.67
7. RDF+PGR	43.16	47.07	50.32	47.95	58.17
8. RDF + 10t FYM	38.33	44.03	49.83	52.03	51.97
9. RDF + 10t FYM+PGR	43.25	47.20	50.13	57.88	63.50
10. RDF 125%+PGR	38.40	45.04	49.83	52.72	66.10
11. RDF 125%+10t FYM+PGR	41.48	47.76	50.20	59.64	66.47
12. RDF 150%+PGR	42.67	47.11	50.11	55.01	62.33
Mean	37.32	42.88	47.42	46.80	55.72
S.E.(M)	1.44	1.24	1.50	1.06	1.63
C.D.	3.50	3.01	3.65	2.58	3.95
C.V.	6.69	5.01	5.49	3.94	5.06

Table 4a **NORTH EASTERN PLAIN ZONE** **2021-22**

Yield maximisation

	Earhead/ m^2	Grains/Earhead	1000 Gr. Wt, g	Yield, q/ha
1. Control (No fertiliser)	230	33.96	33.94	25.59
2. RDF 50%+10t FYM	292	31.13	36.47	30.27
3. RDF 50%+10t FYM+PGR	292	31.88	35.93	31.01
4. RDF 75%+10t FYM	306	32.50	36.25	33.83
5. RDF 75%+10t FYM+PGR	297	36.73	36.09	38.13
6. RDF	308	36.41	37.39	38.72
7. RDF+PGR	314	36.30	36.65	39.17
8. RDF + 10t FYM	321	36.35	37.61	40.29
9. RDF + 10t FYM+PGR	330	35.05	37.82	40.12
10. RDF 125%+PGR	330	36.20	37.33	41.18
11. RDF 125%+10t FYM+PGR	327	34.99	37.66	40.17
12. RDF 150%+PGR	330	35.67	37.58	41.89
Mean	306	34.76	36.73	36.70
S.E.(M)	5.09	0.70	0.32	0.46
C.D.	12.01	1.66	0.76	1.09

Table 4a.1 NORTH EASTERN PLAIN ZONE(Location wise) 2021-22

Yield maximisation Yield, q/ha

	Ayodhya	**Varanasi**	**Kanpur**
1. Control (No fertiliser)	21.05	20.30	35.43
2. RDF 50%+10t FYM	29.20	21.51	40.10
3. RDF 50%+10t FYM+PGR	29.36	21.23	42.43
4. RDF 75%+10t FYM	32.63	26.83	42.03
5. RDF 75%+10t FYM+PGR	32.69	38.70	43.00
6. RDF	35.05	37.57	43.53
7. RDF+PGR	35.38	36.73	45.40
8. RDF + 10t FYM	36.68	38.53	45.67
9. RDF + 10t FYM+PGR	37.00	36.87	46.50
10. RDF 125%+PGR	37.13	40.60	45.80
11. RDF 125%+10t FYM+PGR	38.02	38.70	43.80
12. RDF 150%+PGR	38.50	43.47	43.70
Mean	33.56	33.42	43.12
S.E.(M)	0.48	0.43	1.22
C.D.	1.17	1.05	2.96
C.V.	2.48	2.24	4.89

Table 4b NORTHERN HILLS ZONE 2021-22

Yield maximisation

	Earhead/ m^2	Grains/Earhead	1000 Gr. Wt, g	Yield, q/ha
1. Control (No fertiliser)	233	17.30	37.89	16.17
2. RDF 50%+10t FYM	296	24.71	40.89	31.78
3. RDF 50%+10t FYM+PGR	300	25.24	41.59	32.27
4. RDF 75%+10t FYM	321	25.09	41.70	35.61
5. RDF 75%+10t FYM+PGR	321	26.26	41.84	36.00
6. RDF	322	25.88	43.27	37.63
7. RDF+PGR	327	25.26	43.02	37.64
8. RDF + 10t FYM	327	27.47	42.72	40.28
9. RDF + 10t FYM+PGR	331	27.31	42.40	41.29
10. RDF 125%+PGR	336	27.41	42.53	42.70
11. RDF 125%+10t FYM+PGR	347	29.11	43.24	45.99
12. RDF 150%+PGR	353	28.87	42.83	45.46
Mean	318	25.83	41.99	36.90
S.E.(M)	9.47	1.27	0.40	1.28
C.D.	22.5	3.02	0.96	3.03

Table 4b.1 NORTHERN Hill ZONE (Location wise) 2021-22

Yield maximisation Yield, q/ha

	Malan	**Bajaura**
1. Control (No fertiliser)	13.67	18.67
2. RDF 50%+10t FYM	22.23	41.33
3. RDF 50%+10t FYM+PGR	23.90	40.63
4. RDF 75%+10t FYM	25.88	45.33
5. RDF 75%+10t FYM+PGR	27.84	44.17
6. RDF	29.27	46.00
7. RDF+PGR	30.27	45.00
8. RDF + 10t FYM	29.89	50.67
9. RDF + 10t FYM+PGR	33.24	49.33
10. RDF 125%+PGR	34.91	50.50
11. RDF 125%+10t FYM+PGR	38.47	53.50
12. RDF 150%+PGR	39.22	51.70
Mean	29.07	44.74
S.E.(M)	2.03	1.54
C.D.	4.93	3.75
C.V.	12.11	5.98

Table 4.2 Yield maximisation All Zone 2021-22

Three Year Yield, q/ha

	NWPZ	**NEPZ**	**NHZ**
1. Control (No fertiliser)	25.97	27.30	15.39
2. RDF 50%+10t FYM	38.12	32.39	30.59
3. RDF 50%+10t FYM+PGR	38.93	34.36	30.69
4. RDF 75%+10t FYM	40.75	37.07	34.26
5. RDF 75%+10t FYM+PGR	41.37	39.52	34.50
6. RDF	42.43	39.56	35.57
7. RDF+PGR	43.07	40.89	35.32
8. RDF + 10t FYM	43.33	41.10	38.19
9. RDF + 10t FYM+PGR	45.73	40.46	38.95
10. RDF 125%+PGR	45.48	42.29	39.40
11. RDF 125%+10t FYM+PGR	47.94	41.59	43.00
12. RDF 150%+PGR	46.92	42.40	42.73
Mean	41.67	38.24	34.88
C.D.	2.58	1.36	1.07

SPL4: Enhancing nutrient use efficiency through nano fertiliser in barley

Objective: To optimise dose of nano fertiliser in barley and to enhance the nutrient use efficiency.

The experiment was conducted at five locations in NWPZ and different combinations of nano fertilizer were used to optimise nano nitrogen dose for barley. The productivity of barley increased with increase in the level of nitrogen up to recommended level and the addition of nano nitrogen did not affect significantly. The productivity of recommended dose and recommended + Nano N were at par and significantly more than the other treatments.

Table 5 NORTH WESTERN PLAINS ZONE 2021-22

	Nano Fertiliser		**Pooled**	
Treatments	Earhead/ m^2	Grains/Earhead	1000 Gr. Wt, g	Yield, q/ha
T1	288	46.55	35.48	29.85
T2	302	48.37	36.34	35.05
T3	325	46.83	37.58	40.66
T4	341	47.83	37.89	43.26
T5	348	48.62	38.51	46.93
T6	360	48.01	38.84	48.19
T7	368	48.14	39.27	50.20
T8	376	48.06	39.17	50.45
T9	365	47.76	38.61	49.53
Mean	342	47.80	37.96	43.79
S.E.(M)	4.47	0.96	0.40	0.56
C.D.	10.5	2.25	0.94	1.32

T1 Control (P+K only)
T2 Control (P+K only) +1000 ml NN/ha at 30-35 DAS+1000ml/ha at 60-65 DAS
T3 50% RDN + 500ml NN/ha at 30-35 DAS+500ml/ha at 60-65 DAS
T4 50% RDN + 1000 NN/ha at 30-35 DAS+1000ml/ha at 60-65 DAS
T5 75% RDN +500ml NN at 30-35 DAS+500ml NN at 60-65 DAS
T6 75% RDN + 1000ml NN at 30-35 DAS+1000ml NN at 60-65 DAS
T7 RDN + 500ml NN/ha at 30-35 DAS+500ml/ha at 60-65 DAS
T8 RDN + 1000ml NN/ha at 30-35 DAS+1000ml/ha at 60-65
T9 Recommended doses of Nitrogen (RDN)

Table 5.1 NORTH WESTERN PLAINS ZONE 2021-22

	Nano Fertiliser				Yield, q/ha
Treatments	**Ludhiana**	**Hisar**	**Agra**	**Karnal**	**Durgapura**
T1	19.91	23.55	29.68	41.27	34.83
T2	20.05	32.76	33.04	45.17	44.23
T3	28.09	37.04	37.06	49.37	51.74
T4	27.90	38.46	41.20	50.43	58.33
T5	34.05	42.19	45.40	51.35	61.67
T6	33.52	43.06	49.64	51.73	63.00
T7	40.38	45.96	52.15	54.15	58.33
T8	40.47	46.14	55.99	54.67	55.00
T9	40.53	45.27	48.75	54.01	59.10
Mean	31.66	39.38	43.66	50.24	54.02
S.E.(M)	1.51	1.16	0.85	0.92	1.66
C.D.	4.52	3.49	2.55	2.77	4.99
C.V.	8.26	5.12	3.37	3.19	5.34

SPL 5: Effect of Zn application on quality and productivity of barley

Objective: To enhance the quality and productivity of barley

The trial was conducted in all the zones in split plot design having Zn application (6 treatments) in main plot and variety (two) in sub plot. Zinc treatment includes control, soil application, foliar application (0.5% zinc sulphate) and soil and foliar application.

In NWPZ, the trial was conducted at Agra, Durgapura, Ludhiana, Hisar, Karnal. Soil application with zinc sulphate @ 25 kg/ha and soil application followed by foliar spray (0.5% zinc sulphate) were at par and superior to other treatments (Table 6). The results were similar in NHZ. In NEPZ and CZ, the trial was conducted at Faizabad, Kanpur, Varanasi and Udaipur. Soil application with zinc sulphate @ 25 kg/ha followed by foliar application (0.5% zinc sulphate) at heading and early milk stage was found superior compared to all other treatments (Table 6a & 6b). In NHZ, the trial was conducted at Bajaura and Malan. Soil application with zinc sulphate @ 25 kg/ha and zinc sulphate @ 12.5 or 25 kg/ha followed by foliar application at heading and early milk stage were at par and superior to other treatments (Table 6c).

Table 6 NORTH WESTERN PLAIN ZONE POOLED 2020-21

Zn X Varieties

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
			Yield, q/ha				
BH 946	44.56	50.50	52.49	47.37	52.70	53.04	50.11
DWRB 123	42.36	45.82	47.44	44.23	48.20	48.37	46.07
MEAN	43.46	48.16	49.96	45.80	50.45	50.71	48.09
CD (0.05)	Zn(A) 1.38		Variety(B) 0.57		B within A NS		A within B NS
			Earhead/ m^2				
BH 946	345	368	379	353	386	382	369
DWRB 123	372	384	395	380	396	400	388
MEAN	358	376	387	366	391	391	378
CD (0.05)	Zn(A) 9.22		Variety(B) 5.52		B within A NS		A within B NS
			Grains/Earhead				
BH 946	46.58	46.02	45.32	44.92	45.11	44.79	45.46
DWRB 123	28.89	28.48	28.95	32.22	28.25	28.10	29.15
MEAN	37.74	37.25	37.13	38.57	36.68	36.44	37.30
CD (0.05)	Zn(A) NS		Variety(B) 1.65		B within A NS		A within B NS
			1000 Gr. Wt, g				
BH 946	38.53	40.20	40.90	39.32	41.58	41.62	40.36
DWRB 123	46.80	48.96	49.19	47.66	48.95	49.50	48.51
MEAN	42.66	44.58	45.05	43.49	45.26	45.56	44.43
CD (0.05)	Zn(A) 1.05		Variety(B) 0.56		B within A NS		A within B NS
			Three year Yield, q/ha				
BH 946	44.96	49.22	51.66	45.42	50.83	51.00	48.85
DWRB 123	44.26	46.57	49.08	45.04	48.85	49.36	47.19
MEAN	44.61	47.90	50.37	45.23	49.84	50.18	
CD (0.05)	Zn(A) 1.50		Variety(B) 1.13		B within A NS		A within B NS

Table 6.1 **NORTH WESTERN PLAIN ZONE** **2021-22**

Zn X Varieties Yield, q/ha

Ludhiana

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BH 946	34.54	38.13	37.97	34.33	39.93	39.22	37.35
DWRB 123	34.38	38.58	38.84	34.86	39.30	39.57	37.59
MEAN	34.46	38.35	38.40	34.59	39.61	39.39	37.47

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	N.S.	2.37	7.46	15.48
Varieties	(B)	N.S.	0.82	2.51	9.24
B within A		N.S.	2.00	6.16	
A within B			2.76	8.50	

Karnal

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BH 946	52.87	62.72	63.43	57.31	59.09	58.09	58.92
DWRB 123	52.67	52.92	53.86	53.15	53.35	51.97	52.99
MEAN	52.77	57.82	58.64	55.23	56.22	55.03	55.95

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.81	2.56	3.56
Varieties	(B)	**	0.33	1.03	2.53
B within A		**	0.82	2.52	
A within B			1.00	3.08	

Hisar

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BH 946	44.97	47.66	48.28	47.25	48.12	48.65	47.49
DWRB 123	44.00	45.05	45.88	44.06	46.58	45.47	45.17
MEAN	44.48	46.36	47.08	45.65	47.35	47.06	46.33

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	N.S.	0.60	1.90	3.18
Varieties	(B)	**	0.45	1.39	4.12
B within A		N.S.	1.10	3.39	
A within B			0.98	3.03	

Durgapura

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BH 946	49.33	55.40	60.53	53.73	61.80	63.77	57.43
DWRB 123	41.53	47.30	50.47	47.27	51.00	53.63	48.53
MEAN	45.43	51.35	55.50	50.50	56.40	58.70	52.98

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	1.32	4.16	6.11
Varieties	(B)	**	0.62	1.91	4.98
B within A		N.S.	1.52	4.69	
A within B			1.70	5.25	

Agra

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BH 946	41.10	48.61	52.24	44.21	54.58	55.49	49.37
DWRB 123	39.21	45.26	48.14	41.83	50.78	51.23	46.07
MEAN	40.15	46.93	50.19	43.02	52.68	53.36	47.72

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.39	1.24	2.01
Varieties	(B)	**	0.27	0.83	2.39
B within A		N.S.	0.66	2.03	
A within B			0.61	1.88	

Table 6a NORTH EASTERN PLAIN ZONE POOLED 2020-21

Zn X Varieties

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
			Yield, q/ha				
DWRB137	36.93	37.52	39.59	39.96	40.86	41.45	39.38
HUB 113	36.69	39.12	40.38	40.63	41.28	41.93	40.00
MEAN	36.81	38.32	39.98	40.29	41.07	41.69	39.69
CD (0.05)	Zn(A) 0.76	Variety(B) 0.51	B within A 1.46		A within B 1.12		
			Earhead/ m^2				
DWRB137	315	325	318	327	335	351	329
HUB 113	375	362	361	369	375	380	371
MEAN	345	343	340	348	355	366	350
CD (0.05)	Zn(A) 8.09	Variety(B) 6.71	B within A NS		A within B NS		
			Grains/Earhead				
DWRB137	30.77	31.76	33.11	32.60	33.15	32.22	32.27
HUB 113	37.33	39.96	40.94	40.51	41.89	41.27	40.32
MEAN	34.05	35.86	37.02	36.56	37.52	36.75	36.29
CD (0.05)	Zn(A) 0.85	Variety(B) 0.54	B within A NS		A within B NS		
			1000 Gr. Wt, g				
DWRB137	35.80	37.50	37.50	37.01	38.94	38.72	37.58
HUB 113	33.44	33.76	34.40	34.20	35.07	34.82	34.28
MEAN	34.62	35.63	35.95	35.61	37.01	36.77	35.93
CD (0.05)	Zn(A) 0.46	Variety(B) 0.29	B within A NS		A within B NS		
			Three year Yield, q/ha				
DWRB137	38.29	39.43	40.29	41.07	41.22	42.62	40.49
HUB 113	37.75	39.64	40.91	40.72	41.77	42.76	40.59
MEAN	38.02	39.54	40.60	40.90	41.50	42.69	
CD (0.05)	Zn(A) 0.62	Variety(B) NS	B within A NS		A within B NS		

Table 6a.1 **NORTH EASTERN PLAIN ZONE** **2021-22**

Zn X Varieties Yield, q/ha

Varanasi

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
DWRB137	34.40	35.31	37.90	36.99	36.77	37.53	36.48
HUB113	32.45	35.83	37.77	37.00	37.00	38.13	36.36
MEAN	33.43	35.57	37.83	37.00	36.88	37.83	36.42

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.43	1.36	2.90
Varieties	(B)	N.S.	0.13	0.40	1.49
B within A		*	0.31	0.97	
A within B			0.49	1.50	

Kanpur

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
DWRB137	46.60	46.17	48.93	50.17	52.40	51.87	49.36
HUB113	44.87	47.53	48.50	49.30	50.53	49.77	48.42
MEAN	45.73	46.85	48.72	49.73	51.47	50.82	48.89

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.82	2.58	4.11
Varieties	(B)	N.S.	0.58	1.79	5.03
B within A		N.S.	1.42	4.37	
A within B			1.30	3.99	

Ayodhya

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
DWRB137	29.79	31.10	31.93	32.71	33.42	34.95	32.32
HUB113	32.74	34.00	34.86	35.60	36.30	37.88	35.23
MEAN	31.27	32.55	33.395	34.15	34.86	36.42	33.77

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.21	0.65	1.51
Varieties	(B)	**	0.23	0.72	2.94
B within A		N.S.	0.57	1.77	
A within B			0.46	1.40	

Table 6b **Central Zone** **Udaipur** **2021-22**

Zn X Varieties

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
			Yield, q/ha				
DWRB137	43.35	44.63	48.20	49.53	51.37	53.90	48.50
RD2899	45.40	47.87	49.48	51.20	53.67	54.27	50.31
MEAN	44.38	46.25	48.84	50.37	52.52	54.08	49.41
CD (0.05)	Zn(A) 4.78	Variety(B) 2.07		B within A 5.07		A within B 5.89	
			Earhead/ m^2				
DWRB137	293	322	325	330	335	347	325
RD2899	298	327	330	332	342	363	332
MEAN	296	324	328	331	338	355	329
CD (0.05)	Zn(A) 22.7	Variety(B) NS		B within A NS		A within B NS	
			Grains/Earhead				
DWRB137	42.97	45.63	47.42	38.95	39.83	48.10	43.82
RD2899	44.00	47.77	44.70	50.72	41.33	52.67	46.86
MEAN	43.48	46.70	46.06	44.83	40.58	50.38	45.34
CD (0.05)	Zn(A) 3.44	Variety(B1.71		B within A 4.20		A within B 4.49	
			1000 Gr. Wt, g				
DWRB137	42.13	45.79	47.69	47.87	48.32	48.57	46.73
RD2899	43.64	47.32	48.21	48.29	48.25	49.58	47.55
MEAN	42.89	46.56	47.95	48.08	48.28	49.07	47.14
CD (0.05)	Zn(A) 2.49	Variety(B) 1.35		B within A 3.30		A within B 3.37	
			Three year Yield, q/ha				
DWRB137	34.84	35.78	37.81	39.24	41.63	40.96	38.38
RD2899	33.89	37.08	38.26	40.70	39.98	42.21	38.69
MEAN	34.36	36.43	38.03	39.97	40.80	41.59	
CD (0.05)	Zn(A) 2.97	Variety(B) NS		B within A NS		A within B NS	

Table 6c **NORTHERN HILL ZONE** **POOLED** **2021-22**

Zn X Varieties

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
			Yield, q/ha				
BHS 400	40.02	41.97	44.25	42.28	43.76	45.58	42.98
VLB 118	36.55	38.24	40.16	38.66	40.79	41.80	39.37
MEAN	38.29	40.10	42.20	40.47	42.28	43.69	41.17
CD (0.05)	Zn(A) 2.15	Variety(B) 1.49		B within A NS		A within B NS	
			Earhead/ m^2				
BHS 400	362	401	403	399	406	415	397
VLB 118	326	348	341	344	349	360	345
MEAN	344	374	372	372	377	387	371
CD (0.05)	Zn(A) 19.8	Variety(B) 9.28		B within A 22.7		A within B 25.5	

			Grains/Earhead				
BHS 400	26.25	27.53	29.47	29.18	27.81	28.62	28.14
VLB 118	24.67	25.27	27.50	26.32	25.94	25.98	25.94
MEAN	25.46	26.40	28.48	27.75	26.87	27.30	27.04
CD (0.05)	Zn(A) 1.38	Variety(B) 0.86	B within A 2.10	A within B 2.02			
			1000 Gr. Wt, g				
BHS 400	41.98	42.60	42.95	43.13	44.02	43.88	43.09
VLB 118	43.04	43.24	43.37	42.80	44.39	44.55	43.56
MEAN	42.51	42.92	43.16	42.96	44.21	44.21	43.33
CD (0.05)	Zn(A) 0.85	Variety(B)	B within A NS	A within B NS			
			Three year Yield, q/ha				
BHS 400	37.61	39.42	41.63	39.65	41.15	43.11	40.43
VLB 118	34.36	36.68	38.56	36.63	38.90	40.01	37.53
MEAN	35.99	38.05	40.10	38.14	40.03	41.56	
CD (0.05)	Zn(A) 0.34	Variety(B) 0.31	B within A NS	A within B NS			

Table 6c.1 **NORTHERN HILL ZONE** **2021-22**

Zn X Varieties Yield, q/ha

Malan

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BHS 400	32.05	33.93	38.16	35.89	36.19	39.49	35.95
VLB 118	28.76	30.82	33.81	33.15	34.42	36.27	32.87
MEAN	30.40	32.37	35.98	34.52	35.30	37.88	34.41

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	*	1.46	3.74	10.38
Varieties	(B)	*	0.91	2.29	11.20
B within A		N.S.	2.23	5.61	
A within B			2.15	5.41	

Bajaura

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BHS 400	48.00	50.00	50.33	48.67	51.33	51.67	50.00
VLB 118	44.33	45.67	46.50	44.17	47.17	47.33	45.86
MEAN	46.17	47.83	48.42	46.42	49.25	49.50	47.93

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	N.S.	0.99	2.55	5.08
Varieties	(B)	**	0.83	2.10	7.38
B within A		N.S.	2.04	5.15	
A within B			1.75	4.42	

SPL 6: Enhancing productivity of barley using Silicon in low moisture areas.

Objectives: To evaluate the performance of barley cultivars under different irrigation and silicon application levels

The trial was conducted in dry areas of NWPZ (Agra, Durgapura and Hisar) and Udaipur in split plot design having Irrigation levels (4 treatments) in main plot and Silicon doses (4 levels) in sub plot. Pooled results of NWPZ revealed Irrigation levels and silicon doses significantly affected the productivity of barley. The highest yield was obtained with three irrigation and 200 kg silicon per ha. Silicon application 100 kg/ha to 200 kg /ha were at par at different irrigation levels but superior to without silicon application (Table 7). On an average, the response of silicon was up to 150 kg/ha. At Udaipur, three irrigations with 200 kg silicon was superior to other treatment combinations (Table 7.1).

Table 7 NORTH WESTERN PLAIN ZONE POOLED 2021-22
Irrigation X Silicon Levels

Silicon	Irrigation levels				
	Zero	one	Two	Three	Mean
			Yield, q/ha		
Control	26.61	37.76	46.43	52.35	40.79
Silicon 100Kg/ha	30.25	40.45	48.98	53.15	43.21
Silicon 150Kg/ha	32.77	41.92	50.44	53.52	44.66
Silicon 200Kg/ha	29.38	43.59	51.13	53.95	44.51
MEAN	29.75	40.93	49.24	53.24	43.29
CD (0.05)	Irrigation(A) 1.85	Silicon(B) 1.77	B within A 3.54	A within B 3.58	
			Earhead/ m^2		
Control	259	301	318	340	305
Silicon 100Kg/ha	275	314	330	346	316
Silicon 150Kg/ha	286	322	336	346	323
Silicon 200Kg/ha	290	325	338	347	325
MEAN	278	315	331	345	317
CD (0.05)	Irrigation((A) 4.64	Silicon (B) 1.88	B within A 3.76	A within B 5.65	
			Grains/Earhead		
Control	31.18	35.19	40.23	42.76	37.34
Silicon 100Kg/ha	32.75	36.60	40.09	41.57	37.75
Silicon 150Kg/ha	34.41	36.99	40.29	40.88	38.14
Silicon 200Kg/ha	35.40	38.02	41.06	41.54	39.01
MEAN	33.44	36.70	40.42	41.69	38.06
CD (0.05)	Irrigation((A) 1.03	Silicon (B) 0.94	B within A 1.87	A within B 1.92	
			1000 Gr. Wt, g		
Control	36.72	39.39	39.97	41.59	39.42
Silicon 100Kg/ha	37.40	40.18	41.50	41.89	40.24
Silicon 150Kg/ha	37.45	40.76	41.86	42.27	40.59
Silicon 200Kg/ha	38.20	40.61	42.13	41.88	40.70
MEAN	37.44	40.23	41.36	41.91	40.24
CD (0.05)	Irrigation((A) 0.72	Silicon (B) 0.72	B within A 1.45	A within B 1.44	

Three year Yield, q/ha					
Control	25.27	35.93	44.54	51.70	39.36
Silicon 100Kg/ha	29.43	39.80	48.48	54.23	42.99
Silicon 150Kg/ha	31.91	41.51	51.12	56.65	45.29
Silicon 200Kg/ha	33.69	43.24	52.57	57.92	46.85
MEAN	30.07	40.12	49.18	55.12	
CD (0.05)	Irrigation(A) 2.27	Silicon(B) 1.58	B within A NS	A within B NS	

Table 7.1 **NORTH WESTERN PLAIN ZONE** **Agra** **2021-22**

Irrigation X Silicon Levels Yield, q/ha

Silicon	Irrigation levels				
	Zero	one	Two	Three	Mean
Control	37.30	47.60	53.17	57.07	48.79
Silicon 100Kg/ha	41.66	48.19	54.09	58.07	50.50
Silicon 150Kg/ha	43.85	49.14	55.81	58.86	51.91
Silicon 200Kg/ha	41.80	51.45	56.21	58.99	49.62
MEAN	38.70	49.10	54.82	58.25	50.21

		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	**	1.66	5.75	11.46
Silicon	(B)	N.S.	1.73	5.05	11.93
B within A		N.S.	3.46	10.10	
A within B			3.43	10.43	

Hisar

Control	24.93	39.01	45.18	46.42	38.88
Silicon 100Kg/ha	27.25	41.33	46.54	46.21	40.33
Silicon 150Kg/ha	29.19	42.11	47.04	46.33	41.17
Silicon 200Kg/ha	30.68	42.86	47.04	46.13	41.68
MEAN	28.01	41.33	46.45	46.27	40.52

		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	**	0.63	2.17	5.37
Silicon	(B)	N.S.	0.74	2.15	6.29
B within A		N.S.	1.47	4.29	
A within B			1.42	4.30	

Durgapura

Control	17.60	26.67	40.93	53.57	34.69
Silicon 100Kg/ha	21.83	31.83	46.30	55.17	38.78
Silicon 150Kg/ha	25.27	34.50	48.47	55.37	40.90
Silicon 200Kg/ha	25.63	36.47	50.13	56.73	42.24
MEAN	22.58	32.37	46.46	55.21	39.15

		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	**	1.00	3.46	8.85
Silicon	(B)	**	0.92	2.68	8.12
B within A		N.S.	1.84	5.36	
A within B			1.88	5.77	

		Udaipur			
Control	26.85	30.27	38.70	35.63	32.86
Silicon 100Kg/ha	32.57	36.18	40.18	48.58	39.38
Silicon 150Kg/ha	33.87	37.35	41.60	52.30	41.28
Silicon 200Kg/ha	36.12	43.78	43.33	54.80	44.51
MEAN	32.35	36.89	40.95	47.83	39.51

		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	**	1.22	4.21	10.66
Silicon	(B)	**	0.94	2.76	8.28
B within A		*	1.89	5.51	
A within B			2.04	6.34	

		Three year Yield, q/ha			
Control	23.44	22.60	27.95	27.48	25.37
Silicon 100Kg/ha	25.11	26.81	28.81	33.48	28.55
Silicon 150Kg/ha	26.36	26.92	29.66	36.11	29.76
Silicon 200Kg/ha	26.86	29.45	32.08	37.30	31.42
MEAN	25.44	26.44	29.62	33.59	

CD (0.05)	Irrigation(A)	6.03	Silicon(B)	2.37	B within A	NS	A within B NS

SPL 7: Effect of Sowing method and Seed rate on Barley productivity

Objectives: To evaluate the effect of sowing method and Seed rate on Barley productivity.

The trial was conducted at five locations in NWPZ (Agra, Hisar, Ludhiana, Karnal and Durgapura) in split plot design having sowing method (2 treatments) in main plot and seed rate (3 levels) in sub plot. Pooled results revealed that normal sowing and paired row were similar in productivity and seed rate 100 kg/ha was superior to 75 and 87.5 kg/ha. The highest yield (42.54 q/ha) was obtained in paired row with 100 kg seed /ha (Table 8).

Table 8 Effect of Sowing Method and seed rate on barley productivity 2021-22

Pooled

Seed rate, kg/ha	Method of Sowing: Normal	Rank	Paired row	Rank	Mean	Rank
			Yield, q/ha			
75	38.93	3	38.30	3	38.62	3
87.5	40.14	2	40.81	2	40.47	2
100	40.48	1	42.54	1	41.51	1
MEAN	39.85		40.55		40.20	
CD (0.05)	SM(A) 1.29		SR(B) 0.83	B within A 1.17		A within B 1.58
			Earhead/ m^2			
75	261.7	3	284.2	3	273.0	3
87.5	282.9	2	299.4	2	291.2	2
100	291.2	1	312.8	1	302.0	1
MEAN	278.6		298.8		288.7	
CD (0.05)	SM(A) 6.95		SR(B) 5.62	B within A NS		A within B NS
			Grains/Earhead			
75	44.48	1	44.64	1	44.56	3
87.5	43.86	2	43.03	2	43.44	2
100	42.20	3	42.83	3	42.52	1
MEAN	43.52		43.50		43.51	
CD (0.05)	SM(A) 1.36		SR(B) 1.18	B within A NS		A within B NS
			1000 GW (g)			
75	34.99	1	35.83	1	35.41	1
87.5	34.64	2	34.89	2	34.77	2
100	34.05	3	34.13	3	34.09	3
MEAN	34.56		34.95		34.76	
CD (0.05)	SM(A) 0.96		SR(B) 0.66	B within A NS		A within B NS

Centers: Agra, Hisar, Ludhiana, Karnal, Durgapura

Table 8.1 Effect of Sowing Method and seed rate on barley productivity

Ludhiana

Seed rate, kg/ha	Method of Sowing: Normal	Rank	Paired row	Rank	Mean	Rank
75	43.33	3	44.91	2	44.12	3
87.5	44.49	1	44.31	3	44.4	2
100	44.32	2	46.09	1	45.21	1
MEAN	44.05		45.10		44.58	
		F. Test	S.E.m	C.D.	C.V.(%)	
Sowing Method	(A)	N.S.	1.80	10.97	12.13	
Seed rate	(B)	N.S.	1.08	3.53	5.95	
B within A		N.S.	1.53	5.00		
A within B			2.19	7.15		

Hisar

	Method of Sowing					
ed rate, kg/ha	Normal	Rank	Paired row	Rank	Mean	Rank
75	45.80	3	43.21	3	44.50	3
87.5	47.66	2	46.25	2	46.96	2
100	48.66	1	46.98	1	47.82	1
MEAN	47.37		45.48		46.43	
		F. Test	S.E. m	C.D.	C.V.(%)	
Sowing Method	(A)	*	0.29	1.74	1.84	
Seed rate	(B)	*	0.73	2.38	3.85	
B within A		N.S.	1.03	3.36		
A within B			0.89	2.90		

Karnal

	Method of Sowing					
Seed rate, kg/ha	Normal	Rank	Paired row	Rank	Mean	Rank
75	41.20	1	44.71	3	42.95	2
87.5	40.12	3	45.36	2	42.74	3
100	41.07	2	45.56	1	43.31	1
MEAN	40.80		45.21		43.00	
		F. Test	S.E.m	C.D.	C.V.(%)	
Sowing Method	(A)	*	0.59	3.60	4.13	
Seed rate	(B)	N.S.	0.42	1.37	2.40	
B within A		N.S.	0.59	1.94		
A within B			0.77	2.50		

Durgapura

	Method of Sowing					
Seed rate, kg/ha	Normal	Rank	Paired row	Rank	Mean	Rank
75	51.81	3	55.35	3	53.58	3
87.5	55.39	1	63.21	2	59.30	2
100	53.00	2	68.00	1	60.50	1
MEAN	53.40		62.19		57.79	
		F. Test	S.E.m	C.D.	C.V.(%)	
Sowing Method	(A)	N.S.	1.61	9.78	8.35	
Seed rate	(B)	**	1.03	3.34	4.34	
B within A		*	1.45	4.73		
A within B			2.00	6.51		

Agra

	Method of Sowing					
Seed rate, kg/ha	Normal	Rank	Paired row	Rank	Mean	Rank
75	51.46	3	41.62	3	46.54	3
87.5	53.15	2	45.72	2	49.43	2
100	55.85	1	48.59	1	52.22	1
MEAN	53.49		45.31		49.40	
		F. Test	S.E.m	C.D.	C.V.(%)	
Sowing Method	(A)	**	0.20	1.22	1.21	
Seed rate	(B)	**	0.33	1.08	1.64	
B within A		*	0.47	1.52		
A within B			0.43	1.40		

SOIL PHYSICO-CHEMICAL PROPERTIES

SOIL PROPERTY	Locations										
	1	2	3	4	5	6	7	8	9	10	11
	Malan	Bajaura	Agra	Durgapura	Hisar	Ludhiana	Karnal	Kanpur	Varanasi	Kumarganj	Udaipur
SOIL GROUP	Silty clay loam	Silty loam	Sandy loam	Loamy sand	Sandy loam	Loamy sand	Clay loam	Sandy Loam	Sandy clay loam	Sandy loam	Clay - loam
SAND, (%)	1.52	28.2	57.85	81.00	72	83.5	-	52	50.8	-	38.75
SILT, (%)	5.3	53.4	21.48	9.40	18.5	7.9	-	34	23.4	-	26.78
CLAY , (%)	155	18.4	20.67	7.60	9.5	8.5	-	14	25.7	-	34.47
BULK DENSITY, Mg m^{-3}	33	1.54		1.53	1.4	1.48	-	-	1.37	-	1.46
FIELD CAPACITY,(%)	13.5	-	18.64	11.23	-	-	-	-	19.5	-	-
PERMANENT WILTING POINT,(%)	0.80	-	9.61	3.15	-	-	-	-	5.6	-	-
ORGANIC CARBON, (%)	434	0.62	0.36	0.24	0.38	0.44	0.54	0.37	0.38	-	0.55
AVAILABLE N, Kg ha^{-1}	45.5	378	181.49	187	142	-	166	-	180.9	-	287.52
AVAILABLE P_2O_5,kg ha^{-1}	248	28.5	27.86	27.66	17.3	20.5	8.8	16	24.6	-	23.67
AVAILABLE K_2O,kg ha^{-1}	4.51	178	279.37	232	292	50	244	171	198.8	-	365.15
PH (1:2)	1.62	6.4	8.45	8.1	7.8	7.5	8.1	7.6	7.3	-	8.02
EC(1:2)	12.38	55	1.77	0.26	0.21	0.3	0.24	0.19	0.36	-	0.9

Meteorological Information

Bajaura Lattitude 31º 48' N Longitude 77º 00' E Height above MSL 1090 m								**Malan Latitude 32º 1' N Longitude 76º 2' E Height above MSL 950 m**							
Julian weeks	Temperature,C		RH %		Rainfall	Pan Evap.	Sun Shine	Julian weeks	Temperature,C		RH %		Rainfall	Pan Evap.	Sun Shine
	Min.	Max.	Min.	Max.	mm	mm			Max.	Min.	Max.	Min.	mm	mm	hrs/day
40 (01-07 Oct.)								40 (01-07 Oct.)	31.9	16.2	80.9	75.9	58.8		
41 (08-14 Oct.)								41 (08-14 Oct.)	32	14.7	80.7	75.4	0		
42 (15-21 Oct.)	14.3	30.0	46	81	0			42 (15-21 Oct.)	31.8	13.5	80.7	69	2.4		
43 (22-28 Oct)	10.6	31.1	36	82	0			43 (22-28 Oct)	31	12.9	77.4	69.6	18.4		
44 (29-04 Nov.)	8.4	26.6	53	86	43.8			44 (29-04 Nov.)	28.4	12.6	79.6	72.1	0		
45 (05-11 Nov.)	7	24.1	46	89	7			45 (05-11 Nov.)	27.2	12	76	70.3	0		
46 (12-18 Nov.)	3.4	24.4	46	90	0			46 (12-18 Nov.)	26.5	7.1	76.4	69.1	0		
47 (19-25 Nov.)	1.6	25.1	34	93	0			47 (19-25 Nov.)	26.9	8.9	70	63.3	0		
48 (26-02 Dec.)	-0.2	24.0	31	91	0			48 (26-02 Dec.)	25.8	8.3	74.7	63	0		
49 (03-09 Dec.)	-0.7	24.4	25	92	0			49 (03-09 Dec.)	24.1	8.1	70.7	66.7	0		
50 (10-16 Dec.)	-0.3	21.1	37	88	0			50 (10-16 Dec.)	24.6	7.8	71.7	66.6	0		
51 (17-23 Dec)	3.5	17.2	51	90	22.5			51 (17-23 Dec)	24.8	7.58	71.1	65	0		
52 (24-31 Dec)	-2.3	18.8	45	92	0			52 (24-31 Dec)	24.5	6.1	67.6	64.1	10.3		
1 (01-07 Jan)	-1.5	16.8	39	89	0.7			1 (01-07 Jan)	22.9	5.6	71.1	67.9	54.1		
2 (8-14 Jan)	-1.3	16.1	47	91	1.2			2 (8-14 Jan)	22.2	5.6	66.9	62.6	32.8		
3 (15-21 Jan)	1.6	15.9	53	86	50.2			3 (15-21 Jan)	22.8	5.8	71	65.4	6.21		
4 (22-28 Jan)	0.1	13.3	54	90	32.8			4 (22-28 Jan)	22.2	5.5	71.4	66.3	56.8		
5 (29-04 Feb.)	0.5	16.6	40	91	3.3			5 (29-04 Feb.)	23.3	6	72.1	68.3	43		
6 (05-11 Feb.)	1.5	13.8	56	93	28.8			6 (05-11 Feb.)	26.2	7.8	74.9	70.9	0		
7 (12-18 Feb.)	-0.1	16	63	92	20.2			7 (12-18 Feb.)	27.5	7.6	77.9	74.7	0		
8 (19-25 Feb.)	0.4	15.4	54	91	16.2			8 (19-25 Feb.)	26	7.4	76.4	72.6	16.4		
9 (26-04 Mar.)	-1.5	20.5	46	90	0			9 (26-04 Mar.)	26.9	8.9	77.7	74	20.6		
10 (05-11 Mar.)	1.9	18	54	89	29.1			10 (05-11 Mar.)	27.5	9.1	79.3	74.7	0		
11 (12-18 Mar.)	2.1	17.1	52	88	30.8			11 (12-18 Mar.)	28.8	9.9	81.3	75.3	0		
12 (19-25 Mar.)	3.5	23.8	41	88	0			12 (19-25 Mar.)	29.5	9.7	81.7	75.3	0		
13 (26-01 Apr.)	5.4	30	36	84	0			13 (26-01 Apr.)	31.1	10.3	81.7	76.6	0		
14 (02-08 Apr.)	6	29.6	22	81	1.1			14 (02-08 Apr.)	33.3	11.7	82.3	75.7	0		
15 (09-15 Apr.)	5	30.2	16	80	0			15 (09-15 Apr.)	33.8	13.4	82.1	77	1.3		
16 (16-22 Apr.)	5.9	30.8	17	78	0			16 (16-22 Apr.)	33.5	13.9	81.9	74.9	0		
17 (23-29 April)	8.3	31.7	23	77	4.2			17 (23-29 April)	33.9	14.6	82.4	76.7	0		
18(30-06 May)	7.1	30.2	25	80	1.1			18(30-06 May)	32.7	14	81.3	76.1	5.6		
19 (8-14 May, 19)	7.7	31.8	23	71	0			19 (8-14 May, 19)	29.6	13.7	76.4	67.7	9.1		
20 (15-21 May, 19)	10.8	30.9	37	74	12.7			20 (15-21 May, 19)	33.5	15	82.3	78	6.4		

Agra Latitude 27º02' N Longitude 77º 09' E Height above MSL 163.4 m								Udaipur Latitude 24º35' N Longitude 73º 42' E Height above MSL 582.17 m							
Julian weeks	Temperature,C		RH %		Rainfall	Pan Evap.	Sun Shine	Julian weeks	Temperature,C		RH %		Rainfall	Pan Evap.	Sun Shine
	Max.	Min.	Max.	Min.	mm	mm			Max.	Min.	Max.	Min.	mm	mm	hrs/day
40 (01-07 Oct.)	36	24	92	68	9.7	3.71		40 (01-07 Oct.)	31.2	20.4	95.3	75.1	3.3	3.5	5.9
41 (08-14 Oct.)	37	19	92	43	-	4		41 (08-14 Oct.)	32.9	19.6	91.9	65.1	1.8	4.3	6.5
42 (15-21 Oct.)	36	16	100	52	3.4	3.57		42 (15-21 Oct.)	30.9	15.0	86.7	69.3	6.6	3.9	7.1
43 (22-28 Oct)	33	15	92	46	-	2.2		43 (22-28 Oct)	29.9	13.8	90.9	72.2	0.0	4.2	8.0
44 (29-04 Nov.)	31	14	90	71	-	2.42		44 (29-04 Nov.)	30.4	9.4	85.1	45.4	0.0	4.1	8.7
45 (05-11 Nov.)	30	13	90	70	-	1.42		45 (05-11 Nov.)	29.6	8.5	87.9	52.9	0.0	3.8	8.0
46 (12-18 Nov.)	28	10	90	69	-	1		46 (12-18 Nov.)	27.5	7.4	93.3	62.7	12.0	3.1	6.4
47 (19-25 Nov.)	28	9	90	55	-	1.57		47 (19-25 Nov.)	24.9	12.5	94.9	58.7	170.8	1.9	5.0
48 (26-02 Dec.)	28	10	100	56	-	1.13		48 (26-02 Dec.)	27.0	10.3	95.1	57.6	0.0	2.8	6.5
49 (03-09 Dec.)	27	9	90	67	-	1.26		49 (03-09 Dec.)	23.6	9.4	95.0	59.6	0.0	1.4	4.6
50 (10-16 Dec.)	24	8	89	58	-	1		50 (10-16 Dec.)	25.0	6.5	95.9	55.3	0.0	1.5	6.1
51 (17-23 Dec)	23	8	87	66	-	1		51 (17-23 Dec)	23.6	3.3	92.3	51.1	0.0	1.1	7.7
52 (24-31 Dec)	22	8	100	66	-	1		52 (24-31 Dec)	23.6	7.9	94.4	59.4	18.0	1.5	6.9
1 (01-07 Jan)	23	5	100	66	7.2	1		1 (01-07 Jan)	23.3	8.9	94.4	69.0	4.8	1.1	6.0
2 (8-14 Jan)	20	6	100	72	5.72	1		2 (8-14 Jan)	20.9	3.9	95.7	53.1	0.0	0.8	8.8
3 (15-21 Jan)	19	6	87	80	-	1		3 (15-21 Jan)	23.6	3.9	96.0	61.9	0.0	0.6	8.2
4 (22-28 Jan)	20	6	89	80	4.6	1		4 (22-28 Jan)	21.6	3.3	92.6	64.0	0.0	0.9	8.8
5 (29-04 Feb.)	23	5	100	74	-	1		5 (29-04 Feb.)	27.0	4.2	89.3	59.7	0.0	1.1	8.5
6 (05-11 Feb.)	26	5	90	74	4.37	1.28		6 (05-11 Feb.)	25.9	5.1	92.0	69.1	0.0	1.0	8.8
7 (12-18 Feb.)	27	7	89	54	-	2		7 (12-18 Feb.)	26.7	5.1	95.3	66.7	0.0	1.1	8.7
8 (19-25 Feb.)	28	10	90	50	-	2.28		8 (19-25 Feb.)	30.0	7.6	86.1	57.9	0.0	3.4	9.4
9 (26-04 Mar.)	29	10	90	70	-	1.85		9 (26-04 Mar.)	30.1	8.9	90.4	70.6	0.0	3.9	8.2
10 (05-11 Mar.)	31	14	90	58	-	3.14		10 (05-11 Mar.)	31.4	12.4	82.7	48.0	3.5	4.3	7.5
11 (12-18 Mar.)	36	15	91	46	-	3.71		11 (12-18 Mar.)	36.3	12.3	59.3	17.1	0.0	5.9	8.3
12 (19-25 Mar.)	38	19	92	36	-	4.1		12 (19-25 Mar.)	37.7	13.1	48.8	19.9	0.0	6.2	7.3
13 (26-01 Apr.)	40	19	92	41	-	7.1		13 (26-01 Apr.)	38.0	12.0	45.6	14.9	0.0	6.3	8.4
14 (02-08 Apr.)	37	19	92	26	-	8		14 (02-08 Apr.)	39.7	13.4	46.0	10.4	0.0	6.5	8.4
15 (09-15 Apr.)	37	20	78	23	-	7.1		15 (09-15 Apr.)	40.0	17.0	48.7	12.1	0.0	8.8	8.8
16 (16-22 Apr.)	38	21	86	26	-	7.71		16 (16-22 Apr.)	40.3	20.5	33.4	14.0	0.0	10.7	8.8
17 (23-29 April)	40	23	85	32	-	4.42		17 (23-29 April)	40.2	19.4	32.7	13.4	0.0	11.0	10.2
18(30-06 May)	40	25	85	28	-	6.85		18(30-06 May)	40.1	23.0	17.5	36.0	0.0	12.1	9.4
19(07-13 May)	41	23	92	34	-	4			42.6	24.2	14.9	33.6	0.0	12.8	8.1
20(14-20 May)	42	24	86	25	-	7.28									

Kanpur Latitude 25^0 28' N Longitude 80^o 34' E Height above MSL 125.9 m								**Faizabad Latitude 26^o 47' N Longitude 82^o 12' E Height above MSL 113 m**							
Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine	Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine
	Max.	Min.	Max.	Min.	mm	mm			Max.	Min.	Av.		mm	mm	hrs/day
40 (01-07 Oct.)	34.4	25.1	86	61	8.2	21.4	7	40 (01-07 Oct.)	24.5	32.7	82.8		18.0	6.2	8.1
41 (08-14 Oct.)	34.4	22.7	82	45	0	23.8	7.7	41 (08-14 Oct.)	24.0	34.0	79.5		0	6.3	9.0
42 (15-21 Oct.)	32.4	22.5	87	56	136.6	22.4	4.6	42 (15-21 Oct.)	23.6	31.8	81.3		24.0	5.6	6.9
43 (22-28 Oct)	30.6	18	87	48	0	22.4	6.4	43 (22-28 Oct)	18.2	31.1	68.0		0	4.1	6.5
44 (29-04 Nov.)	29.7	14.2	93	43	0	21.6	7.2	44 (29-04 Nov.)	15.0	29.7	68.3		0	3.3	7.5
45 (05-11 Nov.)	28.8	12.8	95	42	0	20.4	4.4	45 (05-11 Nov.)	13.7	29.7	69.4		00	3.2	6.5
46 (12-18 Nov.)	27.5	11.9	95	44	0	19.6	5.4	46 (12-18 Nov.)	12.3	27.7	77.3		00	3.2	7.2
47 (19-25 Nov.)	26.9	13.3	83	42	1.2	19.6	4.6	47 (19-25 Nov.)	13.5	27.4	76.0		00	2.8	3.6
48 (26-02 Dec.)	26.3	11.9	95	47	0	18.8	2.5	48 (26-02 Dec.)	13.0	28.2	74.9		00	2.6	5.9
49 (03-09 Dec.)	26	13.5	92	47	0	16.8	4.8	49 (03-09 Dec.)	12.6	27.5	74.7		00	3.0	4.7
50 (10-16 Dec.)	23.7	8.6	95	44	0	16.2	4.3	50 (10-16 Dec.)	7.9	22.8	79.4		00	2.7	6.2
51 (17-23 Dec)	22.1	7.1	85	43	0	15.4	4.4	51 (17-23 Dec)	5.8	21.7	77.3		00	2.0	5.0
52 (24-31 Dec)	20	9	97	75	8.6	16.4	1.2	52 (24-31 Dec)	9.3	24.6	78.4		00	2.1	4.6
1 (01-07 Jan)	20.4	8.5	96	70	23.5	11.2	2.6	1 (01-07 Jan)	9.3	19.4	82.5		14.2	2.2	2.5
2 (8-14 Jan)	19.6	10.3	94	74	14.6	10	2.3	2 (8-14 Jan)	10.6	20.2	87.2		11.6	2.3	2.1
3 (15-21 Jan)	15.7	4.9	93	72	0	9.8	2.1	3 (15-21 Jan)	5.7	15.9	86.6		00	2.3	1.9
4 (22-28 Jan)	17.9	7.7	95	66	3	8.6	2.3	4 (22-28 Jan)	8.3	17.3	87.4		00	2.2	2.9
5 (29-04 Feb.)	21.2	7,5	91	58	13	8.4	6.3	5 (29-04 Feb.)	8.8	19.6	86.7		00	2.6	4.9
6 (05-11 Feb.)	22.7	8.1	93	52	0	9.4	6.1	6 (05-11 Feb.)	9.0	20.8	84.9		00	2.7	6.0
7 (12-18 Feb.)	25	8.1	93	50	0	11	8.4	7 (12-18 Feb.)	9.9	24.0	80.4		00	3.6	8.3
8 (19-25 Feb.)	27.4	12.3	87	42	0	13.4	8.3	8 (19-25 Feb.)	13.5	25.6	77.7		00	4.9	8.1
9 (26-04 Mar.)	27.8	11.7	90	46	00	14.6	8	9 (26-04 Mar.)	11.4	27.1	79.6		00	5.2	9.0
10 (05-11 Mar.)	29.2	13.9	87	44	00	15.4	6.6	10 (05-11 Mar.)	12.5	29.1	77.3		0	5.7	7.8
11 (12-18 Mar.)	33.4	17.4	83	44	00	38.4	7	11 (12-18 Mar.)	16.2	32.0	77.1		0	6.4	8.3
12 (19-25 Mar.)	36.4	18.6	79	30	00	18.2	6	12 (19-25 Mar.)	18.5	35.3	72.9		0	6.9	8.6
13 (26-01 Apr.)	38.2	18.4	72	28	00	19	7.2	13 (26-01 Apr.)	16.7	36.8	58.9		0	6.9	8.3
14 (02-08 Apr.)	40	17.6	68	22	00	23.8	7.2	14 (02-08 Apr.)	17.2	36.3	56.9		0	6.3	9.4
15 (09-15 Apr.)	40.8	21.1	64	25	00	26	6	15 (09-15 Apr.)	19.6	39.2	54.1		0	4.9	8.3
16 (16-22 Apr.)	41.1	22	55	26	00	3.8	6.3	16 (16-22 Apr.)	22.4	40.7	53.1		0	5.9	9.4
17 (23-29 April)	42.2	22.2	46	19	00	3.8	6.2	17 (23-29 April)							
18(30-06 May)	39.8	25	65	29	00	3.8	4.3	18(30-06 May)							

Varanasi Latitude 25º28' N Longitude 83 º 03' E Height above MSL 75.7 m							
Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine
	Max.	Min.	Max.	Min.	mm	mm	
40 (01-07 Oct.)							
41 (08-14 Oct.)							
42 (15-21 Oct.)							
43 (22-28 Oct)							
44 (29-04 Nov.)							
45 (05-11 Nov.)	29.7	14	95	54	0	1.8	6.7
46 (12-18 Nov.)	28.5	13.5	96	48	0	1.9	6.5
47 (19-25 Nov.)	28.7	12.2	90	40	0	1.8	7.2
48 (26-02 Dec.)	26.7	10.6	97	51	0	1.2	5.4
49 (03-09 Dec.)	26.8	12.8	97	54	0	1.2	4.2
50 (10-16 Dec.)	24.6	8.6	94	44	0	1.2	5.4
51 (17-23 Dec)	22.3	7.2	91	53	0	1.3	6
52 (24-31 Dec)	21.9	10	97	72	0	0.8	3.1
1 (01-07 Jan)	19.2	8.8	98	75	1.2	0.6	3.3
2 (8-14 Jan)	22.1	11.8	96	74	5.4	0.9	1.6
3 (15-21 Jan)	18.5	6.7	93	70	0	1.2	2.2
4 (22-28 Jan)	20	9.8	94	68	49	1.7	3.4
5 (29-04 Feb.)	22.7	8.6	94	61	0	1.9	7.2
6 (05-11 Feb.)	22.6	9.6	94	57	0	2	5.7
7 (12-18 Feb.)	25	7.9	92	47	0	2.7	9.6
8 (19-25 Feb.)	26.7	12.3	90	59	0.3	3.2	8.7
9 (26-04 Mar.)	28.6	12.5	95	53	0.4	2.9	8.4
10 (05-11 Mar.)	29.7	13.5	89	54	0	3.5	9.4
11 (12-18 Mar.)	32.9	16.6	89	53	0	4.1	8.9
12 (19-25 Mar.)	36.5	19.3	85	49	0	4.6	8.7
13 (26-01 Apr.)	38	18.6	79	39	0	5.9	9.4
14 (02-08 Apr.)	40.2	18.1	76	31	0	6.5	9.7
15 (09-15 Apr.)	40.5	21.6	78	33	0	6.2	9.4
16 (16-22 Apr.)	40.9	21.9	73	32	0	7.5	9.8
17 (23-29 April)							
18(30-06 May)							
19(07-13 May)							
20(14-20 May)							

Hisar Latitude 29º10' N Longitude 75º 46' E Height above MSL 215.2 m								**Durgapura** Latitude 26º **51' N Longitude 75º 47' E Height above MSL 390 m**							
Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine	Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine
	Max.	Min.	Max.	Min.	mm	mm			Max.	Min.	Max.	Min.	mm	mm	hrs/day
40 (01-07 Oct.)	33.3	25.3	93	66	5.5	3.8	6.7	40 (01-07 Oct.)	33.3	23.5	83	53	24.6		
41 (08-14 Oct.)	34.8	21.6	86	37	0	3.5	8.2	41 (08-14 Oct.)	35.6	21	66	32	0		
42 (15-21 Oct.)	31.3	18.4	86	50	0	2.2	6.3	42 (15-21 Oct.)	32.1	19	67	41	5		
43 (22-28 Oct)	29.8	15.9	86	44	0	3.6	7.8	43 (22-28 Oct)	30.8	17.5	60	30	0		
44 (29-04 Nov.)	30.4	13.5	83	34	0	2.5	7	44 (29-04 Nov.)	30.6	13.8	55	19	0		
45 (05-11 Nov.)	28.9	11.8	90	37	0	1.6	4.3	45 (05-11 Nov.)	30.4	13	68	19	0		
46 (12-18 Nov.)	27.4	9.1	92	33	0	1.7	4.2	46 (12-18 Nov.)	27.6	11.1	72	21	0		
47 (19-25 Nov.)	26.6	7.9	89	30	0	1.6	7.1	47 (19-25 Nov.)	26.9	12.2	67	30	0.8		
48 (26-02 Dec.)	25.3	9.2	95	48	0	1.5	5.1	48 (26-02 Dec.)	27.9	12.6	72	33	0		
49 (03-09 Dec.)	23.3	8.5	99	49	0	1.2	5	49 (03-09 Dec.)	24.5	9.9	80	36	0.4		
50 (10-16 Dec.)	22.2	5.7	95	42	0	1.4	6.5	50 (10-16 Dec.)	23.1	9.7	68	39	0		
51 (17-23 Dec)	18.9	3.3	94	45	0	1.2	5.2	51 (17-23 Dec)	22.4	6	65	17	0		
52 (24-31 Dec)	20.3	6.4	93	56	1.2	1.3	4	52 (24-31 Dec)	22.1	10.7	73.3	38	3.2		
1 (01-07 Jan)	18.5	8.6	99	63	16.5	0.9	3.7	1 (01-07 Jan)	20.6	9.0	87	83	8.2		
2 (8-14 Jan)	15.9	8.2	96	79	23.5	1.3	1.9	2 (8-14 Jan)	17.9	7.6	92	54	16.6		
3 (15-21 Jan)	14	6.6	96	79	1.4	0.7	0.7	3 (15-21 Jan)	19.2	6.8	92	50	0.0		
4 (22-28 Jan)	15.5	6.6	99	69	22.6	1.7	2.6	4 (22-28 Jan)	18.4	6.8	88	41	9.2		
5 (29-04 Feb.)	20	6.5	97	63	0	1.1	5.6	5 (29-04 Feb.)	23.7	8.6	82	34	0.0		
6 (05-11 Feb.)	21.5	7.7	96	48	5.8	1.4	6.8	6 (05-11 Feb.)	23.7	10.0	78	32	0.0		
7 (12-18 Feb.)	24.8	6.4	97	48	0	2	8.6	7 (12-18 Feb.)	25.9	11.0	61	24	0.0		
8 (19-25 Feb.)	24.8	9.5	87	46	0	2.8	7.7	8 (19-25 Feb.)	28.4	13.7	48	23	0.0		
9 (26-04 Mar.)	24.6	9.4	95	49	0	2.5	7.9	9 (26-04 Mar.)	27.6	13.1	70	26	0.0		
10 (05-11 Mar.)	27.1	10.5	93	43	0	3	7.3	10 (05-11 Mar.)	29.4	13.9	60	23	0.0		
11 (12-18 Mar.)	32.7	14.7	91	40	0	3.3	8.1	11 (12-18 Mar.)	35.2	17.2	55	17	0.0		
12 (19-25 Mar.)	35	17.2	85	30	0	3.7	7.4	12 (19-25 Mar.)	37.1	22.1	47	16	0.0		
13 (26-01 Apr.)	37.5	15.6	73	17	0	5.1	8.3	13 (26-01 Apr.)	37	19.4	35	9	0.0		
14 (02-08 Apr.)	39.3	15.2	76	28	0	6	8.8	14 (02-08 Apr.)	37.7	19.3	40	9	0.0		
15 (09-15 Apr.)	41.1	19.8	68	40	0	6.6	7.8	15 (09-15 Apr.)	40.5	23.1	28	9	0.0		
16 (16-22 Apr.)	40.2	21.2	71	42	1.5	8.1	8.2	16 (16-22 Apr.)	40.3	25.7	28	11	0.0		
17 (23-29 April)	40.1	20	63	28	0	7.1	9.2	17 (23-29 April)							
18(30-06 May)	41.5	24.3	59	25	0	7.5	8.3	18(30-06 May)							

Karnal Latitude 29º 43' N Longitude 76 º 58' E Height above MSL 245								**Ludhiana Latitude 30º56' N Longitude 75º 52' E Height above MSL 247 m**							
Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine	Julian weeks	Temperature, C		RH %		Rainfall	Pan Evap.	Sun Shine
	Max.	Min.	Max.	Min.	mm	mm	hrs/day		Max.	Min.	Max.	Min.	mm	mm	hrs/day
40 (01-07 Oct.)								40 (01-07 Oct.)	32.80	24.40	87.14	56.00	6.60	21.40	8.70
41 (08-14 Oct.)								41 (08-14 Oct.)	33.71	21.60	85.14	40.14	0.00	23.20	9.47
42 (15-21 Oct.)								42 (15-21 Oct.)	31.81	19.17	86.71	39.71	0.00	18.40	7.06
43 (22-28 Oct)								43 (22-28 Oct)	27.69	15.60	86.43	42.29	31.00	21.00	8.79
44 (29-04 Nov.)	28.8	14.3	78.4	38.9	00.0	02.5	07.7	44 (29-04 Nov.)	28.71	14.97	80.86	31.29	0.00	22.40	7.13
45 (05-11 Nov.)	28.8	11.9	93.9	30.3	00.0	02.3	07.3	45 (05-11 Nov.)	28.37	11.99	91.57	29.71	0.00	13.60	6.26
46 (12-18 Nov.)	27.6	09.9	92.1	32.3	00.0	02.0	07.4	46 (12-18 Nov.)	26.57	9.60	93.00	29.00	0.00	10.80	6.97
47 (19-25 Nov.)	26.7	09.5	91.6	35.3	00.0	01.8	07.4	47 (19-25 Nov.)	26.03	8.51	92.43	31.14	0.00	11.20	8.21
48 (26-02 Dec.)	24.6	10.5	96.0	50.9	00.0	01.2	05.4	48 (26-02 Dec.)	23.77	9.63	94.00	43.29	0.00	8.00	4.97
49 (03-09 Dec.)	23.8	10.7	95.3	46.9	00.0	01.3	05.3	49 (03-09 Dec.)	24.49	9.80	92.57	45.43	0.00	9.50	6.03
50 (10-16 Dec.)	22.0	07.2	97.9	58.4	00.0	01.1	05.5	50 (10-16 Dec.)	20.80	6.14	96.14	49.71	0.00	8.20	4.54
51 (17-23 Dec)	18.1	04.9	97.9	69.6	00.0	00.9	04.5	51 (17-23 Dec)	18.40	5.09	95.29	48.29	0.00	7.40	6.11
52 (24-31 Dec)	20.4	06.5	98.4	70.3	01.2	01.2	03.4	52 (24-31 Dec)	19.09	4.94	96.71	52.43	0.00	6.20	5.23
1 (01-07 Jan)	18.4	08.6	98.1	77.3	13.6	01.0	03.7	1 (01-07 Jan)	17.60	8.76	93.00	68.00	51.60	10.20	2.66
2 (8-14 Jan)	15.1	09.5	100.0	91.9	43.3	00.6	00.5	2 (8-14 Jan)	15.46	9.69	95.43	83.14	47.80	7.20	2.16
3 (15-21 Jan)	12.6	07.6	98.0	87.1	01.2	00.6	00.2	3 (15-21 Jan)	13.57	8.31	92.71	76.57	0.80	4.60	0.11
4 (22-28 Jan)	13.5	07.9	97.3	85.1	35.0	00.5	00.7	4 (22-28 Jan)	14.57	8.06	95.86	76.43	13.20	5.00	2.54
5 (29-04 Feb.)	17.3	07.5	99.6	70.9	20.4	01.2	04.5	5 (29-04 Feb.)	17.57	7.49	94.29	62.00	31.00	8.20	4.41
6 (05-11 Feb.)	19.3	07.3	96.6	58.6	00.0	01.1	05.2	6 (05-11 Feb.)	19.90	7.83	93.14	49.00	0.00	9.60	8.49
7 (12-18 Feb.)	22.7	06.1	98.7	46.9	00.0	02.1	08.8	7 (12-18 Feb.)	23.40	7.21	94.14	42.43	0.00	13.00	9.04
8 (19-25 Feb.)	23.7	09.8	92.6	50.6	00.0	02.5	06.7	8 (19-25 Feb.)	23.49	10.29	85.86	41.00	3.40	18.60	7.46
9 (26-04 Mar.)	23.7	10.1	96.1	49.1	09.5	02.3	07.8	9 (26-04 Mar.)	21.88	10.43	89.83	54.20	9.10	12.00	7.92
10 (05-11 Mar.)	27.0	12.3	94.9	47.0	00.0	02.9	07.7	10 (05-11 Mar.)	27.20	13.09	91.43	40.14	0.00	19.00	8.44
11 (12-18 Mar.)	30.5	16.5	96.0	53.0	00.0	03.3	07.9	11 (12-18 Mar.)	31.83	17.39	90.00	45.71	0.00	27.00	9.47
12 (19-25 Mar.)	33.6	17.3	91.0	38.7	00.0	04.2	07.8	12 (19-25 Mar.)	33.57	18.96	82.71	32.57	0.00	27.80	9.43
13 (26-01 Apr.)	36.3	15.8	77.6	20.9	00.0	05.4	08.2	13 (26-01 Apr.)	35.63	17.14	79.43	22.71	0.00	31.40	10.53
14 (02-08 Apr.)	38.6	16.5	62.3	13.1	00.0	06.6	08.6	14 (02-08 Apr.)	38.29	17.69	72.71	13.71	0.00	42.00	10.79
15 (09-15 Apr.)	40.6	19.4	58.1	14.9	00.0	06.7	06.8	15 (09-15 Apr.)	39.94	21.54	61.43	16.00	0.00	47.80	7.89
16 (16-22 Apr.)	39.1	20.8	49.3	16.3	00.0	08.1	07.5	16 (16-22 Apr.)	38.29	21.60	49.86	18.71	0.00	47.20	8.89
17 (23-29 April)	39.9	21.3	46.7	14.0	00.0	08.9	08.7	17 (23-29 April)							
18(30-06 May)	38.5	24.7	65.6	33.4	30.8	08.0	04.3	18(30-06 May)							
19(07-13 May)	37.5	25.3	62.9	38.1	00.0	07.2	08.6	19(07-13 May)							
20(14-20 May)	40.4	25.8	60.4	29.0	00.0	07.9	07.5								

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MALTING QUALITY EVALUATION

The Barley Improvement Unit took up the malting quality evaluation of grain samples of Initial Varietal Trial (IVT) and Advanced Varietal Trial (AVT) on malt barley received from various test sites at its central facility. The grain samples (500gm each) were received from seven locations (Navgaon, Hisar, Bathinda, Durgapura, Karnal, Ludhiana and Pantnagar). This year a total of 217 coded samples were received.

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

State	Location	Trial	No. of Samples
Haryana	Hisar	IVT	25
		AVT	6
	Karnal	IVT	25
		AVT	6
Punjab	Ludhiana	IVT	25
		AVT	6
	Bathinda	IVT	25
		AVT	6
Rajasthan	Navgaon	IVT	25
		AVT	6
	Durgapura	IVT	25
		AVT	6
Uttarakhand	Pantnagar	IVT	25
		AVT	6
Total			**217**

**Data is not being reported because of very late arrival of samples.*

Table 5.2: Malting quality traits analyzed

Grain Quality	Malt Quality
- 1000 Grain Weight (g)	- Malt Friability (%)
- Test Weight (kg/hl)	- Malt Homogeneity (%)
- Germination (at 72 hrs) (%)	- Hot Water extract % (F.g.d.b.)
- Husk Content (%)	- Diastatic Power (^{0}L)
- Protein Content (%)	- Wort Filtration rate (ml/hr)
- β- glucan (%)	- Kolbach Index
- 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 samples were first analyzed for physical and biochemical grain parameters important for malting based on the approved guidelines. The different traits (test weight, bold / thin proportion, germinative energy, 1000 grain weight and husk content) were analyzed as per EBC approved procedures. Crude protein content, starch content and moisture content of grains was predicted using FOSS NIR system. The processed grain samples (thin grains removed) were subjected to micro-malting on the "Joe White Micro-Malting System" taking 100 gm sample from each genotype. Micro-malting was done in three phases, which included steeping, germination and kilning. Steeping was done in three stages (wet stage for 8 hours at 18^{o}C; air rest for 12 hours at 18^{o}C and wet stage for 8 hours at 18^{o}C) in a total duration of 32 hours. Germination was done in two stages (24 hours at 18^{o}C and 24 hours at 16^{o}C) in total of 48 hours. Kilning was done for a total of 30 hours starting from 30^{o}C with final temperature of 80^{o}C.

The Analytical Guidelines for Barley Breeders in India (Annexure-1) approved by the "National Core Group on Malt Barley Development" (NCGMBD) were followed for the minimum standards of physical and biochemical properties of barley grain and malt, for evaluation of new genotypes. The analytical methods of EBC (Analytica EBC, 2003) were followed for determination of various quality parameters. 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 (2017) 663–668.

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

- *Protein content, Kolbach index, Starch content has been estimated using NIR system on dry weight basis. Moisture content in grains was also predicted through NIR.*
- *Grain & Wort β- glucan content and 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 diastatic power was done by the method as described above, thus 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 unusual higher temperatures during this year; IVT & AVT entries have different plot size & replications, therefore results of AVT & IVT may be interpreted in that perspective*
- *The quality data of Ludhiana and Bhatinda centre in AVT is not included in Zonal mean, because of relatively inferior grain physical parameters*
- *The quality data of Karnal, Ludhiana and Bathinda centres of IVT is not included in zonal mean, because of relatively inferior grain physical parameters*

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

S. No.	Cycle start date	Locations
1	23. 05.2022	Navgaon and Hisar
2	30.05.2022	Ludhiana, Durgapura and Karnal
3	10.06.2022	Ludhiana and Bathinda
4	17.06.2022	Pantnagar

Several genotypes were observed as good source for individual grain and malt quality traits (Table 5.3), though they may not have good values for remaining traits. The average zonal performance of the AVT and IVT entries for grain and malt quality traits is given in Tables 4a & 4b and 5a & 5b. The location wise data for each physical and biochemical grain/malt quality parameter are given in Annexure 2 and 3. The mean values were taken for identifying promising lines based on minimum standards determined by the 'NCGMBD' for malt barley in the country revised time to time with the latest revision on 22.06.2020.

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 6 & 7). Thus, based on the twelve in important traits (a maximum possible score of 36), entries were identified as promising.

Table 5.3: Promising entries for individual malting quality trait*

Trait	Promising entries
Hectoliter weight	DWRB 219, DWRB 221
Bold Grains	UPB 1108, RD 3055, PL 933, RD 3056, DWRB 233
Husk Content	DWRB 221
Grain B- glucan	DWRB 221, BH 1040, DWRB 233, DWRB 229, UPB 1107
Malt Friability	RD 3056, DWRB 230, RD 3055, BH 1043
Hot water extract	RD 3056, RD 3057, DWRB 230
Filtration Rate	DWRB 219, PL 934, RD 3063, DWRB 233, UPB 1108
Diastatic Power	RD 3058, UPB 1108
FAN Content	DWRB 230, RD 3056, RD 3055
Wort β- glucan	DWRB 230, DWRB 229, BH 1040
Over all MQ	DWRB 221** RD 3056**

**Better or at par to the best check **As compared to two row checks only*

Table 5.4a: Grain quality of AVT malt barley entries in NWPZ#

S.N.	Code	Genotype	Test wt. (kg/hl) #	Bold (%)	Thin (%)	1000GW (g)	GER (%)	Protein (%)	Husk (%)	BG (%)
1	AVT-MB-3	DWRB 219	66	87	1.9	49	97	11.0	11.2	4.6
2	AVT-MB-6	DWRB 221	66	78	2.4	46	96	10.7	10.3	4.1
3	AVT-MB-4	DWRUB 52 ©	66	79	2.1	46	95	10.6	11.3	4.4
4	AVT-MB-5	RD 2849 ©	65	80	4.5	46	94	10.6	11.2	5.0
5	AVT-MB-1	DWRB 182 ©	61	74	4.7	41	95	10.6	11.2	4.2
6	AVT-MB-2	DWRB 137 ©	62	87	2.0	45	97	9.1	11.3	5.2

**Six row barley # = range in brackets*

Table 5.4b: Malt quality of AVT malt barley entries in NWPZ#

S.N.	Code	Genotype	Malt yield (%)	Friability (%)	Homogeneity (%)	FR (ml/hr.)	HWE (%fgdb)	DP (^{0}L) *	KI (%)	WBG	FAN
1	AVT-MB-3	DWRB 219	92	41	81	310	76.3	70	37	924	122
2	AVT-MB-6	DWRB 221	88	48	87	259	78.3	85	37	618	140
3	AVT-MB-4	DWRUB 52 ©	90	56	83	302	77.4	76	38	728	145
4	AVT-MB-5	RD 2849 ©	91	55	91	268	77.3	86	39	661	139
5	AVT-MB-1	DWRB 182 ©	90	59	83	292	79.4	101	36	788	127
6	AVT-MB-2	DWRB 137 ©	91	50	76	291	77.1	103	38	328	111

***Six row barley # = range in brackets*

Table 5.5a: Grain quality of IVT malt barley entries in NWPZ#

S.N.	Code	Genotype	Test wt (kg/hl) #	Bold (%)	Thin (%)	1000GW (g)	GER (%)	Protein (%)	Husk (%)	BG (%) *
1	IVT-MB-18	BH 1040	60	80	2.9	46	95	11.0	12.9	4.1
2	IVT-MB-1	BH 1041	64	76	2.6	44	97	10.6	11.0	5.0
3	IVT-MB-23	BH 1042	66	86	1.2	47	98	10.2	10.9	5.3
4	IVT-MB-12	BH 1043	61	74	3.8	42	98	9.1	13.5	5.0
5	IVT-MB-17	DWRB 229	65	58	3.6	43	97	10.3	12.9	4.2
6	IVT-MB-15	DWRB 230	63	97	0.3	51	97	9.5	11.1	5.6
7	IVT-MB-24	DWRB 231	65	90	0.8	47	98	9.9	10.7	5.0
8	IVT-MB-7	DWRB 232	61	91	1.1	54	97	9.9	11.9	5.2
9	IVT-MB-19	DWRB 233	64	93	1.2	56	96	10.9	10.8	4.2
10	IVT-MB-4	DWRB 234	63	80	2.6	48	97	9.3	10.8	5.0
11	IVT-MB-8	PL 933	64	94	0.7	52	98	11.6	10.9	4.6
12	IVT-MB-5	PL 934	64	82	1.2	48	96	10.0	11.3	4.7
13	IVT-MB-21	PL 935	57	74	3.5	53	98	9.9	12.1	4.5
14	IVT-MB-6	PL 938	63	75	2.3	47	97	11.5	11.9	4.5
15	IVT-MB-14	RD 3055	64	97	0.6	48	98	9.3	11.1	5.4
16	IVT-MB-22	RD 3056	62	93	0.7	45	97	10.5	11.1	6.1
17	IVT-MB-16	RD 3057	65	87	1.2	47	98	10.8	11.0	4.8
18	IVT-MB-10	RD 3058	64	69	1.5	49	96	10.3	12.3	6.0
19	IVT-MB-25	RD 3063	62	90	1.7	47	98	9.1	11.7	5.1
20	IVT-MB-9	UPB 1107	63	71	2.8	43	96	10.6	10.2	4.2
21	IVT-MB-13	UPB 1108	63	97	0.3	52	97	10.4	13.1	5.1
22	IVT-MB-2	DWRUB 52 ©	63	67	4.6	50	97	11.2	11.2	6.5
23	IVT-MB-11	RD 2849©	68	92	0.9	46	98	12.3	9.6	5.2
24	IVT-MB-20	DWRB 182 ©	66	84	1.2	47	97	9.8	11.9	4.3
25	IVT-MB-3	DWRB 137 ©**	66	83	1.5	48	97	10.5	10.2	4.6

**Two locations only **Six row barley # = range in brackets*

Table 5.5b: Malt quality of IVT malt barley entries in NWPZ#

S.N.	Code	Genotype	Malt yield (%)	Friability (%)	Homogeneity (%)	FR (ml/hr.)	HWE (%fgdb)	DP (^{0}L)	KI (%)	WBG*	FAN
1	IVT-MB-18	BH 1040	90	51	71	279	76.3	106	37	361	143
2	IVT-MB-1	BH 1041	91	49	80	284	75.8	103	39	818	141
3	IVT-MB-23	BH 1042	90	52	81	245	77.2	106	38	504	135
4	IVT-MB-12	BH 1043	91	61	87	286	74.0	103	38	543	127
5	IVT-MB-17	DWRB 229	91	47	74	263	75.3	98	37	336	135
6	IVT-MB-15	DWRB 230	91	62	84	231	77.9	98	39	256	164
7	IVT-MB-24	DWRB 231	90	55	79	260	75.8	95	39	811	131
8	IVT-MB-7	DWRB 232	92	42	66	253	72.3	95	37	1037	135
9	IVT-MB-19	DWRB 233	90	48	71	289	77.4	102	36	628	139
10	IVT-MB-4	DWRB 234	92	43	71	284	75.3	101	40	527	131
11	IVT-MB-8	PL 933	92	44	68	274	76.9	108	37	974	122
12	IVT-MB-5	PL 934	91	43	78	296	75.7	79	38	1346	115
13	IVT-MB-21	PL 935	90	56	79	275	77.4	93	41	522	133
14	IVT-MB-6	PL 938	92	45	74	281	74.9	110	37	802	134
15	IVT-MB-14	RD 3055	91	61	82	210	77.1	99	39	687	153
16	IVT-MB-22	RD 3056	90	62	78	255	78.0	108	40	432	161
17	IVT-MB-16	RD 3057	92	50	76	258	77.8	101	38	455	127
18	IVT-MB-10	RD 3058	91	50	82	229	76.0	113	39	654	148
19	IVT-MB-25	RD 3063	91	52	70	291	73.8	100	40	541	117
20	IVT-MB-9	UPB 1107	92	50	74	274	75.8	102	37	1019	132
21	IVT-MB-13	UPB 1108	90	55	84	289	75.9	112	38	843	126
22	IVT-MB-2	DWRUB 52 ©	92	40	66	238	74.3	95	38	1313	136
23	IVT-MB-11	RD 2849©	92	40	62	288	77.0	111	36	776	144
24	IVT-MB-20	DWRB 182 ©	91	56	83	240	77.8	73	38	736	136
25	IVT-MB-3	DWRB 137 ©**	92	47	83	259	77.5	78	38	1239	143

**One location only **Six row barley # = range in brackets*

Table 5.6: Weighted performances of AVT entries for malting quality

Code	Genotype	TW	Bold	Husk	Pro	BG	Fria	HWE	FR	DP	KI	FAN	WBG	Total (36)
AVT-MB-3	DWRB 219	3	1	1	2	1	0	1	3	1	1	1	0	**15**
AVT-MB-6	DWRB 221	3	0	3	2	2	0	1	2	2	1	2	0	**18**
AVT-MB-4	DWRUB 52 ©	3	0	2	2	2	0	1	3	1	2	2	0	**18**
AVT-MB-5	RD 2849 ©	2	0	2	2	1	0	1	3	2	2	2	0	**17**
AVT-MB-1	DWRB 182 ©	1	0	2	2	2	0	2	3	3	1	2	0	**18**
AVT-MB-2	DWRB 137 ©*	1	3	2	1	0	0	2	3	3	2	1	2	**20**

*Six row

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

Code	Genotype	TW	Bold	Husk	Pro	BG	Fria	HWE	FR	DP	KI	FAN	WBG	Total (36)
IVT-MB-18	BH 1040	0	0	0	2	2	0	1	3	3	1	2	1	**15**
IVT-MB-1	BH 1041	2	0	2	2	1	0	1	3	3	2	2	0	**18**
IVT-MB-23	BH 1042	3	1	2	2	0	0	1	3	2	2	2	0	**18**
IVT-MB-12	BH 1043	1	0	0	1	1	1	0	3	3	2	2	0	**14**
IVT-MB-17	DWRB 229	2	0	0	2	2	0	0	3	3	1	2	2	**17**
IVT-MB-15	DWRB 230	1	3	2	1	0	1	1	2	2	2	3	3	**21**
IVT-MB-24	DWRB 231	2	2	2	2	1	0	1	3	3	2	2	0	**20**
IVT-MB-7	DWRB 232	1	3	1	2	0	0	0	3	3	1	2	0	**16**
IVT-MB-19	DWRB 233	2	3	2	2	2	0	1	3	3	1	2	0	**21**
IVT-MB-4	DWRB 234	1	0	2	1	1	0	0	3	3	3	2	0	**16**
IVT-MB-8	PL 933	2	3	2	3	1	0	1	3	3	1	1	0	**20**
IVT-MB-5	PL 934	2	0	2	2	1	0	1	3	3	2	1	0	**17**
IVT-MB-21	PL 935	0	0	1	2	2	0	1	2	3	3	2	0	**16**
IVT-MB-6	PL 938	2	0	1	2	2	0	0	3	3	1	2	0	**16**
IVT-MB-14	RD 3055	2	3	2	1	0	1	1	2	2	2	3	0	**19**
IVT-MB-22	RD 3056	1	3	2	2	0	1	1	3	3	3	3	0	**22**
IVT-MB-16	RD 3057	2	1	2	2	1	0	1	3	3	2	2	0	**19**
IVT-MB-10	RD 3058	2	0	1	2	0	0	1	2	2	2	2	0	**14**
IVT-MB-25	RD 3063	1	2	2	1	0	0	0	3	3	3	1	0	**16**
IVT-MB-9	UPB 1107	1	0	3	2	2	0	1	3	3	1	2	0	**18**
IVT-MB-13	UPB 1108	1	3	0	2	0	0	1	3	3	2	2	0	**17**
IVT-MB-2	DWRUB 52 ©	1	0	2	2	0	0	0	2	2	2	2	0	**13**
IVT-MB-11	RD 2849©	3	3	3	3	0	0	1	3	3	1	2	0	**22**
IVT-MB-20	DWRB 182 ©	3	0	1	2	2	0	1	2	2	2	2	0	**17**
IVT-MB-3	DWRB 137 ©*	3	3	3	2	1	0	2	3	2	2	2	0	**23**

*= six- row barley

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

Annexure - 1

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

SN	*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 (d.b.)**	9.0-13%	9.0-13%
7	**Germination Capacity**	>96%	>96%
8	**Germinative Energy (72hrs)**	>96%	>96%
9	**β--glucan (db)**	<4.0%	<4.0%
	MALT PARAMETERS		
7.	**Malt Homogeneity**	>90%	>90%
8.	**Malt Friability**	>70.0	>65.0
9.	**Total Protein (d.b.)**	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}Linter)**	>90	>90
15.	**Wort β--glucan**	<300 ppm	<300 ppm
16.	**FAN**	>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(ºL)**	>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-MALT BARLEY

GRAIN PARAMETERS

Table 5.2.1: Thousand grain weight of AVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	48	47	50	37	51	40	48	**49**
2	AVT-MB-6	DWRB 221	43	47	46	38	49	42	46	**46**
3	AVT-MB-4	DWRUB 52 ©	45	44	46	39	50	40	47	**46**
4	AVT-MB-5	RD 2849 ©	48	43	46	36	50	40	42	**46**
5	AVT-MB-1	DWRB 182 ©	40	38	42	29	46	38	41	**41**
6	AVT-MB-2	DWRB 137 ©**	43	43	44	33	51	42	44	**45**
Average			**45**	**44**	**45**	**35**	**50**	**40**	**45**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	61	66	63	62	71	55	66	**66**
2	AVT-MB-6	DWRB 221	60	67	64	65	71	59	68	**66**
3	AVT-MB-4	DWRUB 52 ©	63	67	62	66	71	57	67	**66**
4	AVT-MB-5	RD 2849 ©	62	63	62	60	71	55	66	**65**
5	AVT-MB-1	DWRB 182 ©	56	59	60	57	68	59	64	**61**
6	AVT-MB-2	DWRB 137 ©**	59	61	62	55	68	58	60	**62**
Average			**60**	**64**	**62**	**61**	**70**	**57**	**65**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	88	81	83	57	95	72	90	**87**
2	AVT-MB-6	DWRB 221	76	71	71	56	88	65	87	**78**
3	AVT-MB-4	DWRUB 52 ©	83	72	70	54	84	59	85	**79**
4	AVT-MB-5	RD 2849 ©	87	70	65	45	89	70	86	**80**
5	AVT-MB-1	DWRB 182 ©	82	64	68	28	83	66	73	**74**
6	AVT-MB-2	DWRB 137 ©**	87	82	89	58	92	84	87	**87**
Average			**84**	**73**	**74**	**50**	**89**	**69**	**85**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	0.9	3.7	2.2	11.0	0.8	5.2	1.7	**1.9**
2	AVT-MB-6	DWRB 221	1.0	4.4	3.5	12.0	1.1	3.6	1.9	**2.4**
3	AVT-MB-4	DWRUB 52 ©	0.5	4.0	2.9	9.7	1.2	7.1	1.9	**2.1**
4	AVT-MB-5	RD 2849 ©	0.6	5.8	12.9	12.6	0.7	3.7	2.7	**4.5**
5	AVT-MB-1	DWRB 182 ©	2.5	10.5	3.7	26.7	2.8	5.3	3.9	**4.7**
6	AVT-MB-2	DWRB 137 ©**	1.2	3.7	1.8	13.9	1.4	1.4	2.2	**2.0**
Average			**1.1**	**5.3**	**4.5**	**14.3**	**1.4**	**4.4**	**2.4**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	98	96	95	94	99	93	97	**97**
2	AVT-MB-6	DWRB 221	97	94	94	95	98	94	99	**96**
3	AVT-MB-4	DWRUB 52 ©	96	94	92	92	97	94	96	**95**
4	AVT-MB-5	RD 2849 ©	94	92	94	92	96	92	96	**94**
5	AVT-MB-1	DWRB 182 ©	96	90	92	92	98	92	98	**95**
6	AVT-MB-2	DWRB 137 ©**	98	96	94	92	99	94	99	**97**
Average			**97**	**94**	**94**	**93**	**98**	**93**	**98**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana	Durgapura	Bathinda	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	9.9	12.8	11.5	13.0	10.0	12.3	10.9	**11.0**
2	AVT-MB-6	DWRB 221	9.7	12.5	10.8	11.8	9.5	12.1	10.9	**10.7**
3	AVT-MB-4	DWRUB 52 ©	9.0	12.7	11.6	12.2	9.2	12.9	10.6	**10.6**
4	AVT-MB-5	RD 2849 ©	8.6	13.6	11.3	12.3	8.7	13.0	10.7	**10.6**
5	AVT-MB-1	DWRB 182 ©	9.3	13.8	9.7	13.4	10.5	11.4	9.9	**10.6**
6	AVT-MB-2	DWRB 137 ©**	7.3	12.0	9.7	13.0	8.3	11.9	8.3	**9.1**
Average			**9.0**	**12.9**	**10.8**	**12.6**	**9.4**	**12.3**	**10.2**	

*Not included in zonal mean **= 6 row barley # Predicted values through NIR

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana	Durgapura	Bathinda	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	12.4	13.0	13.6	12.9	9.9	13.4	7.3	**11.8**
2	AVT-MB-6	DWRB 221	12.3	9.9	11.9	10.8	10.1	12.8	7.2	**10.7**
3	AVT-MB-4	DWRUB 52 ©	12.6	9.9	13.9	11.4	11.3	12.1	8.7	**11.4**
4	AVT-MB-5	RD 2849 ©	11.2	11.7	11.2	13.3	12.1	13.1	9.7	**11.7**
5	AVT-MB-1	DWRB 182 ©	12.8	12.2	13.4	11.9	10.0	13.5	7.8	**11.6**
6	AVT-MB-2	DWRB 137 ©**	13.8	12.4	11.5	12.1	11.2	12.1	7.5	**11.5**
Average			**12.5**	**11.5**	**12.6**	**12.0**	**10.8**	**12.8**	**8.0**	

*Not included in zonal mean **= 6 row barley

Table 5.2.8: β--Glucan Content (% dwb) of AVT (MB) entries at three locations

S.N.	Code	Genotype	Navgaon	Hisar	Durgapura	Mean
1	AVT-MB-3	DWRB 219	3.2	5.0	5.5	**4.6**
2	AVT-MB-6	DWRB 221	4.0	3.4	5.0	**4.1**
3	AVT-MB-4	DWRUB 52 ©	4.2	3.9	5.1	**4.4**
4	AVT-MB-5	RD 2849 ©	4.9	5.2	5.0	**5.0**
5	AVT-MB-1	DWRB 182 ©	4.4	3.6	5.1	**4.3**
6	AVT-MB-2	DWRB 137 ©*	4.6	5.5	5.4	**5.2**
Average			**4.2**	**4.4**	**5.2**	

*= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	9.2	8.4	8.6	8.3	6.6	7.3	10.2	**8.6**
2	AVT-MB-6	DWRB 221	9.0	8.4	8.0	8.1	6.4	7.4	9.9	**8.3**
3	AVT-MB-4	DWRUB 52 ©	9.1	8.5	7.5	8.5	6.6	7.6	10.3	**8.4**
4	AVT-MB-5	RD 2849 ©	8.2	8.6	8.1	8.4	6.3	7.3	10.1	**8.3**
5	AVT-MB-1	DWRB 182 ©	8.3	8.8	8.1	8.1	6.5	7.7	10.2	**8.4**
6	AVT-MB-2	DWRB 137 ©**	8.4	8.5	7.9	8.5	6.8	9.4	10.3	**8.4**
Average			**8.7**	**8.5**	**8.0**	**8.3**	**6.5**	**7.8**	**10.2**	

*Not included in zonal mean **= 6 row barley # Predicted values through NIR

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	61.4	62.4	61.1	61.7	65.6	60.8	62.2	**62.2**
2	AVT-MB-6	DWRB 221	61.7	62.7	62.8	63.2	67.3	60.5	62.6	**63.0**
3	AVT-MB-4	DWRUB 52 ©	61.8	62.7	62.3	62.4	67.0	59.7	63.1	**62.7**
4	AVT-MB-5	RD 2849 ©	62.6	61.4	61.4	62.0	64.6	60.4	63.0	**62.2**
5	AVT-MB-1	DWRB 182 ©	61.3	60.1	62.2	61.4	66.4	60.3	63.2	**62.1**
6	AVT-MB-2	DWRB 137 ©**	62.9	61.1	61.9	60.7	65.4	60.8	62.8	**62.2**
Average			**62.0**	**61.7**	**62.0**	**61.9**	**66.1**	**60.4**	**62.8**	

*Not included in zonal mean **= 6 row barley # Predicted values through NIR

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	92	92	92	88	92	91	91	**92**
2	AVT-MB-6	DWRB 221	90	82	91	88	86	91	89	**88**
3	AVT-MB-4	DWRUB 52 ©	91	90	90	88	91	90	89	**90**
4	AVT-MB-5	RD 2849 ©	91	91	92	87	92	89	88	**91**
5	AVT-MB-1	DWRB 182 ©	91	91	90	86	93	90	88	**90**
6	AVT-MB-2	DWRB 137 ©**	91	91	91	87	91	89	89	**91**
Average			**91**	**90**	**91**	**87**	**91**	**90**	**89**	

*****Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Hisar	Durgapura	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	29	50	39	46	**41**
2	AVT-MB-6	DWRB 221	49	41	45	56	**48**
3	AVT-MB-4	DWRUB 52 ©	53	62	50	61	**56**
4	AVT-MB-5	RD 2849 ©	45	53	60	63	**55**
5	AVT-MB-1	DWRB 182 ©	52	67	42	74	**59**
6	AVT-MB-2	DWRB 137 ©**	59	39	47	56	**50**
Average			**48**	**52**	**47**	**59**	

*= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Hisar	Durgapura	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	66	90	84	85	**81**
2	AVT-MB-6	DWRB 221	88	81	89	92	**87**
3	AVT-MB-4	DWRUB 52 ©	89	93	58	94	**83**
4	AVT-MB-5	RD 2849 ©	94	89	93	89	**91**
5	AVT-MB-1	DWRB 182 ©	77	92	65	96	**83**
6	AVT-MB-2	DWRB 137 ©**	88	64	75	77	**76**
Average			**83**	**85**	**77**	**89**	

*= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	72.3	78.0	76.6	78.0	75.7	72.3	78.8	**76.3**
2	AVT-MB-6	DWRB 221	80.7	76.8	77.3	82.5	76.0	73.0	81.0	**78.3**
3	AVT-MB-4	DWRUB 52 ©	75.5	79.1	76.8	78.8	75.1	73.3	80.4	**77.4**
4	AVT-MB-5	RD 2849 ©	75.1	78.7	77.5	83.6	75.2	71.7	79.9	**77.3**
5	AVT-MB-1	DWRB 182 ©	75.0	83.0	84.2	76.7	75.6	71.9	79.2	**79.4**
6	AVT-MB-2	DWRB 137 ©**	75.3	79.0	80.9	77.1	76.2	75.4	74.0	**77.1**
Average			**75.7**	**79.1**	**78.9**	**79.5**	**75.6**	**72.9**	**78.9**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	310	305	310	255	305	280	320	**310**
2	AVT-MB-6	DWRB 221	235	310	115	125	315	240	320	**259**
3	AVT-MB-4	DWRUB 52 ©	310	305	290	305	315	305	290	**302**
4	AVT-MB-5	RD 2849 ©	270	285	245	260	305	230	235	**268**
5	AVT-MB-1	DWRB 182 ©	305	320	200	235	325	315	310	**292**
6	AVT-MB-2	DWRB 137 ©**	300	320	245	285	315	300	275	**291**
Average			**288**	**308**	**234**	**244**	**313**	**278**	**292**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	65	75	68	93	63	106	81	**70**
2	AVT-MB-6	DWRB 221	66	111	104	83	53	93	89	**85**
3	AVT-MB-4	DWRUB 52 ©	68	68	109	86	59	98	74	**76**
4	AVT-MB-5	RD 2849 ©	88	63	76	116	91	111	111	**86**
5	AVT-MB-1	DWRB 182 ©	88	100	106	111	104	109	106	**101**
6	AVT-MB-2	DWRB 137 ©**	98	102	104	122	106	111	104	**103**
Average			**79**	**86**	**95**	**102**	**79**	**105**	**94**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	6.0	5.84	5.8	10.0	5.7	5.0	5.0	**5.7**
2	AVT-MB-6	DWRB 221	6.0	5.98	6.0	5.0	5.8	5.0	5.0	**5.8**
3	AVT-MB-4	DWRUB 52 ©	6.0	5.86	6.0	10.0	5.8	5.0	5.0	**5.7**
4	AVT-MB-5	RD 2849 ©	6.1	5.83	5.9	5.0	6.0	10.0	5.0	**5.8**
5	AVT-MB-1	DWRB 182 ©	6.1	6.05	6.0	5.0	5.9	5.0	10.0	**6.8**
6	AVT-MB-2	DWRB 137 ©**	6.2	6.15	6.1	5.0	6.1	5.0	5.0	**5.9**
Average			**6.1**	**6.0**	**6.0**	**6.7**	**5.9**	**5.8**	**5.8**	

*Not included in zonal mean **= 6 row barley

Table 5.2.18: Wort pH of AVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	6.0	5.8	5.8	5.8	5.7	5.8	5.8	**5.8**
2	AVT-MB-6	DWRB 221	6.0	6.0	6.0	5.8	5.8	5.9	5.8	**5.9**
3	AVT-MB-4	DWRUB 52 ©	6.0	5.9	6.0	5.8	5.8	5.8	5.8	**5.9**
4	AVT-MB-5	RD 2849 ©	6.1	5.8	5.9	5.8	6.0	5.9	5.9	**5.9**
5	AVT-MB-1	DWRB 182 ©	6.1	6.1	6.0	5.8	5.9	5.9	6.0	**6.0**
6	AVT-MB-2	DWRB 137 ©**	6.2	6.2	6.1	5.9	6.1	6.0	6.0	**6.1**
Average			**6.1**	**6.0**	**6.0**	**5.8**	**5.9**	**5.9**	**5.9**	

*Not included in zonal mean *= 6 row barley

Table 5.2.19: Kolbach Index (KI) # of AVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	39	34	37	37	38	36	38	**37**
2	AVT-MB-6	DWRB 221	36	34	41	41	37	35	38	**37**
3	AVT-MB-4	DWRUB 52 ©	40	34	38	35	38	36	42	**38**
4	AVT-MB-5	RD 2849 ©	38	34	41	40	37	38	43	**39**
5	AVT-MB-1	DWRB 182 ©	37	36	34	38	34	38	39	**36**
6	AVT-MB-2	DWRB 137 ©**	38	35	39	37	40	40	36	**38**
Average			**38**	**34**	**38**	**38**	**37**	**37**	**39**	

*Not included in zonal mean **= 6 row barley #NIR predicted values

Table 5.2.20: Wort FAN content (ppm) of AVT (MB) entries from different locations

SN	Code	Genotype	Navgaon	Karnal	Hisar	Ludhiana*	Durgapura	Bathinda*	Pant Nagar	Mean
1	AVT-MB-3	DWRB 219	116	121	124	157	111	130	138	**122**
2	AVT-MB-6	DWRB 221	163	141	111	173	129	167	156	**140**
3	AVT-MB-4	DWRUB52©	139	157	138	203	124	176	168	**145**
4	AVT-MB-5	RD 2849©	126	144	138	202	127	191	161	**139**
5	AVT-MB-1	DWRB182©	123	122	123	244	101	164	164	**127**
6	AVT-MB-2	DWRB137©**	112	112	104	191	95	137	133	**111**
Average			**130**	**133**	**123**	**195**	**114**	**161**	**153**	

*Not included in zonal mean **= 6 row barley

Table 5.2.21: Wort β--Glucan Content (ppm) of AVT (MB) entries at one location

S.N.	Code	Genotype	Navgaon
1	AVT-MB-3	DWRB 219	**924**
2	AVT-MB-6	DWRB 221	**618**
3	AVT-MB-4	DWRUB 52 ©	**728**
4	AVT-MB-5	RD 2849 ©	**661**
5	AVT-MB-1	DWRB 182 ©	**788**
6	AVT-MB-2	DWRB 137 ©*	**328**

**= 6 row barley

Annexure 3: IVT-TS-MALT BARLEY
GRAIN PARAMETERS

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

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	43	45	42	50	41	49	47	**46**
2	IVT-MB-1	BH 1041	43	41	40	45	40	39	47	**44**
3	IVT-MB-23	BH 1042	47	43	43	53	40	47	45	**47**
4	IVT-MB-12	BH 1043	43	36	29	47	37	36	43	**42**
5	IVT-MB-17	DWRB 229	44	39	37	46	40	42	45	**43**
6	IVT-MB-15	DWRB 230	54	48	39	54	43	47	50	**51**
7	IVT-MB-24	DWRB 231	44	45	39	52	44	43	45	**47**
8	IVT-MB-7	DWRB 232	53	50	45	61	46	52	51	**54**
9	IVT-MB-19	DWRB 233	56	53	45	60	43	53	56	**56**
10	IVT-MB-4	DWRB 234	49	43	38	52	41	36	47	**48**
11	IVT-MB-8	PL 933	47	49	41	57	45	51	56	**52**
12	IVT-MB-5	PL 934	48	47	41	50	42	49	49	**48**
13	IVT-MB-21	PL 935	57	49	42	59	41	47	49	**53**
14	IVT-MB-6	PL 938	49	43	41	51	41	46	46	**47**
15	IVT-MB-14	RD 3055	46	47	41	51	43	48	49	**48**
16	IVT-MB-22	RD 3056	43	40	35	53	39	41	42	**45**
17	IVT-MB-16	RD 3057	48	43	38	50	42	46	48	**47**
18	IVT-MB-10	RD 3058	48	46	42	54	41	45	48	**49**
19	IVT-MB-25	RD 3063	42	45	36	51	39	41	48	**47**
20	IVT-MB-9	UPB 1107	45	41	30	44	39	43	42	**43**
21	IVT-MB-13	UPB 1108	49	52	42	58	42	45	51	**52**
22	IVT-MB-2	DWRUB 52 ©	53	42	40	54	45	47	49	**50**
23	IVT-MB-11	RD 2849©	44	45	39	49	41	44	46	**46**
24	IVT-MB-20	DWRB 182 ©	46	47	41	48	42	42	48	**47**
25	IVT-MB-3	DWRB 137 ©**	49	46	39	49	40	45	47	**48**
	Average		**48**	**45**	**39**	**52**	**41**	**45**	**48**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	54	58	64	70	56	62	57	**60**
2	IVT-MB-1	BH 1041	60	64	66	71	58	64	62	**64**
3	IVT-MB-23	BH 1042	62	64	66	74	86	65	64	**66**
4	IVT-MB-12	BH 1043	60	58	52	66	54	54	58	**61**
5	IVT-MB-17	DWRB 229	61	62	68	73	57	69	63	**65**
6	IVT-MB-15	DWRB 230	61	62	63	71	57	65	60	**63**
7	IVT-MB-24	DWRB 231	60	65	65	73	58	66	64	**65**
8	IVT-MB-7	DWRB 232	52	62	63	71	55	59	58	**61**
9	IVT-MB-19	DWRB 233	64	63	64	71	56	66	58	**64**
10	IVT-MB-4	DWRB 234	57	61	61	70	56	58	61	**63**
11	IVT-MB-8	PL 933	58	63	66	71	56	63	65	**64**
12	IVT-MB-5	PL 934	57	63	67	70	56	68	65	**64**
13	IVT-MB-21	PL 935	55	55	60	68	52	58	52	**57**
14	IVT-MB-6	PL 938	59	60	68	72	60	66	63	**63**
15	IVT-MB-14	RD 3055	60	63	64	70	57	66	63	**64**
16	IVT-MB-22	RD 3056	57	59	60	71	52	55	60	**62**
17	IVT-MB-16	RD 3057	61	62	66	71	59	67	66	**65**
18	IVT-MB-10	RD 3058	60	63	65	71	57	64	60	**64**
19	IVT-MB-25	RD 3063	57	62	60	69	54	60	60	**62**
20	IVT-MB-9	UPB 1107	61	60	59	70	58	60	58	**63**
21	IVT-MB-13	UPB 1108	59	62	65	69	56	64	60	**63**
22	IVT-MB-2	DWRUB 52 ©	58	61	63	70	54	65	63	**63**
23	IVT-MB-11	RD 2849©	66	65	70	75	61	70	65	**68**
24	IVT-MB-20	DWRB 182 ©	62	65	67	72	60	68	66	**66**
25	IVT-MB-3	DWRB 137 ©**	62	65	67	72	59	69	64	**66**
	Average		**59**	**62**	**64**	**71**	**58**	**64**	**62**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	69	77	77	88	67	87	85	**80**
2	IVT-MB-1	BH 1041	72	57	44	92	61	40	85	**76**
3	IVT-MB-23	BH 1042	88	78	68	98	50	80	81	**86**
4	IVT-MB-12	BH 1043	82	46	36	90	73	50	80	**74**
5	IVT-MB-17	DWRB 229	62	34	31	75	38	53	62	**58**
6	IVT-MB-15	DWRB 230	99	93	72	99	86	86	96	**97**
7	IVT-MB-24	DWRB 231	87	87	64	97	76	70	88	**90**
8	IVT-MB-7	DWRB 232	91	84	75	98	80	78	90	**91**
9	IVT-MB-19	DWRB 233	94	88	77	98	70	90	90	**93**
10	IVT-MB-4	DWRB 234	92	56	45	95	69	39	79	**80**
11	IVT-MB-8	PL 933	94	89	77	97	79	89	96	**94**
12	IVT-MB-5	PL 934	87	74	69	75	69	83	92	**82**
13	IVT-MB-21	PL 935	80	51	45	94	32	62	70	**74**
14	IVT-MB-6	PL 938	78	57	60	94	58	72	72	**75**
15	IVT-MB-14	RD 3055	97	96	80	99	85	83	96	**97**
16	IVT-MB-22	RD 3056	97	82	61	99	81	78	96	**93**
17	IVT-MB-16	RD 3057	86	72	63	97	75	78	93	**87**
18	IVT-MB-10	RD 3058	26	72	44	95	71	63	84	**69**
19	IVT-MB-25	RD 3063	83	89	63	95	84	75	92	**90**
20	IVT-MB-9	UPB 1107	83	67	37	58	68	69	76	**71**
21	IVT-MB-13	UPB 1108	98	96	78	97	77	85	97	**97**
22	IVT-MB-2	DWRUB 52 ©	76	37	38	79	70	59	77	**67**
23	IVT-MB-11	RD 2849©	94	83	76	97	76	81	95	**92**
24	IVT-MB-20	DWRB 182 ©	81	78	65	90	71	65	88	**84**
25	IVT-MB-3	DWRB 137 ©**	84	78	62	89	63	74	83	**83**
	Average		**83**	**73**	**60**	**91**	**69**	**71**	**86**	

*Not included in zonal mean **= 6 row barley

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

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	6.3	2.9	4.4	1.0	4.2	2.1	1.6	**2.9**
2	IVT-MB-1	BH 1041	3.1	4.8	11.9	1.6	3.1	14.5	1.1	**2.6**
3	IVT-MB-23	BH 1042	0.6	1.9	9.7	0.2	2.8	3.3	2.3	**1.2**
4	IVT-MB-12	BH 1043	1.3	9.4	28.4	1.2	4.6	12.2	3.5	**3.8**
5	IVT-MB-17	DWRB 229	2.1	8.7	21.3	1.6	8.0	5.5	2.1	**3.6**
6	IVT-MB-15	DWRB 230	0.1	0.5	5.5	0.0	3.0	2.5	0.6	**0.3**
7	IVT-MB-24	DWRB 231	0.7	0.8	7.1	0.3	3.4	6.4	1.3	**0.8**
8	IVT-MB-7	DWRB 232	0.5	2.4	4.7	0.2	2.7	5.8	1.2	**1.1**
9	IVT-MB-19	DWRB 233	0.9	2.0	5.1	0.6	5.9	1.6	1.4	**1.2**
10	IVT-MB-4	DWRB 234	0.4	6.6	17.8	0.5	4.4	21.7	2.8	**2.6**
11	IVT-MB-8	PL 933	0.5	1.3	3.7	0.6	3.3	2.0	0.4	**0.7**
12	IVT-MB-5	PL 934	0.7	2.8	4.3	1.0	6.8	3.5	0.5	**1.2**
13	IVT-MB-21	PL 935	2.0	7.6	12.5	0.7	12.6	8.7	3.8	**3.5**
14	IVT-MB-6	PL 938	1.0	6.0	5.3	0.3	4.9	2.8	2.0	**2.3**
15	IVT-MB-14	RD 3055	0.2	0.9	4.4	0.1	2.3	2.8	1.2	**0.6**
16	IVT-MB-22	RD 3056	0.3	1.6	8.9	0.3	3.0	4.3	0.5	**0.7**
17	IVT-MB-16	RD 3057	0.5	3.4	10.2	0.3	11.8	5.4	0.4	**1.2**
18	IVT-MB-10	RD 3058	0.8	2.6	7.1	0.5	3.6	5.2	2.1	**1.5**
19	IVT-MB-25	RD 3063	3.4	1.5	12.5	0.7	2.2	5.0	1.3	**1.7**
20	IVT-MB-9	UPB 1107	1.2	4.5	23.4	1.8	5.2	6.6	3.5	**2.8**
21	IVT-MB-13	UPB 1108	0.1	0.5	3.9	0.3	3.6	2.3	0.4	**0.3**
22	IVT-MB-2	DWRUB 52 ©	2.5	11.9	15.4	1.1	4.6	7.9	2.6	**4.6**
23	IVT-MB-11	RD 2849©	0.3	2.2	3.4	0.6	2.4	2.9	0.6	**0.9**
24	IVT-MB-20	DWRB 182 ©	0.8	2.2	5.4	0.8	4.9	6.2	0.8	**1.2**
25	IVT-MB-3	DWRB 137 ©**	0.9	1.8	7.2	1.2	6.9	5.0	2.1	**1.5**
	Average		**1.2**	**3.6**	**9.7**	**0.7**	**4.8**	**5.8**	**1.6**	

*Not included in zonal mean **= 6 row barley

Table 5.3.5: Germinative energy (% 72hrs) of IVT (TS-MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	92	95	96	96	96	96	96	**95**
2	IVT-MB-1	BH 1041	98	94	92	98	94	92	98	**97**
3	IVT-MB-23	BH 1042	96	98	94	99	96	92	99	**98**
4	IVT-MB-12	BH 1043	97	96	94	98	96	92	99	**98**
5	IVT-MB-17	DWRB 229	96	96	91	97	94	94	98	**97**
6	IVT-MB-15	DWRB 230	96	99	98	96	96	98	98	**97**
7	IVT-MB-24	DWRB 231	98	97	96	99	91	94	98	**98**
8	IVT-MB-7	DWRB 232	96	94	98	98	94	94	99	**97**
9	IVT-MB-19	DWRB 233	94	94	94	96	94	98	98	**96**
10	IVT-MB-4	DWRB 234	99	96	96	97	94	92	96	**97**
11	IVT-MB-8	PL 933	98	96	92	98	96	92	98	**98**
12	IVT-MB-5	PL 934	94	94	94	96	92	96	98	**96**
13	IVT-MB-21	PL 935	98	98	92	98	94	96	96	**98**
14	IVT-MB-6	PL 938	93	98	92	98	92	96	99	**97**
15	IVT-MB-14	RD 3055	99	94	95	98	94	96	99	**98**
16	IVT-MB-22	RD 3056	94	95	96	98	92	94	99	**97**
17	IVT-MB-16	RD 3057	98	98	92	98	98	96	98	**98**
18	IVT-MB-10	RD 3058	96	92	94	96	96	96	99	**96**
19	IVT-MB-25	RD 3063	98	98	94	99	93	96	96	**98**
20	IVT-MB-9	UPB 1107	95	94	93	96	94	92	98	**96**
21	IVT-MB-13	UPB 1108	99	92	96	96	94	92	99	**97**
22	IVT-MB-2	DWRUB 52 ©	96	96	96	99	92	96	98	**97**
23	IVT-MB-11	RD 2849©	98	98	96	99	94	94	98	**98**
24	IVT-MB-20	DWRB 182 ©	96	96	98	98	96	94	98	**97**
25	IVT-MB-3	DWRB 137 ©**	98	94	94	98	96	94	97	**97**
	Average		**96**	**96**	**95**	**98**	**94**	**94**	**98**	

*Not included in zonal mean **= 6 row barley

Table 5.3.6: Protein content (%) # of IVT (TS-MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	13.8	10.3	11.5	9.9	12.9	13.7	9.8	**11.0**
2	IVT-MB-1	BH 1041	10.1	8.9	14.8	10.5	12.2	15.6	12.8	**10.6**
3	IVT-MB-23	BH 1042	9.5	11.7	14.0	9.7	12.4	15.1	9.7	**10.2**
4	IVT-MB-12	BH 1043	7.8	11.2	14.5	8.5	11.0	13.1	9.0	**9.1**
5	IVT-MB-17	DWRB 229	9.6	10.3	12.8	10.4	12.0	12.2	11.0	**10.3**
6	IVT-MB-15	DWRB 230	9.5	9.5	11.9	9.0	12.3	12.7	9.8	**9.5**
7	IVT-MB-24	DWRB 231	9.1	10.0	11.2	9.2	12.1	14.3	11.1	**9.9**
8	IVT-MB-7	DWRB 232	10.0	10.3	10.7	9.2	13.5	15.1	10.0	**9.9**
9	IVT-MB-19	DWRB 233	11.0	10.1	12.2	10.9	12.8	13.0	11.6	**10.9**
10	IVT-MB-4	DWRB 234	8.3	9.1	12.1	8.9	13.2	13.9	10.8	**9.3**
11	IVT-MB-8	PL 933	11.4	11.0	13.2	12.2	12.4	14.0	11.7	**11.6**
12	IVT-MB-5	PL 934	9.2	11.6	11.1	9.7	12.2	12.4	9.5	**10.0**
13	IVT-MB-21	PL 935	10.0	9.6	12.4	8.9	12.2	13.9	10.9	**9.9**
14	IVT-MB-6	PL 938	10.3	13.2	12.9	11.5	13.9	14.8	10.9	**11.5**
15	IVT-MB-14	RD 3055	9.3	9.2	10.9	9.0	11.3	13.2	9.6	**9.3**
16	IVT-MB-22	RD 3056	10.1	11.8	14.4	9.7	13.0	14.6	10.2	**10.5**
17	IVT-MB-16	RD 3057	11.8	11.7	13.4	10.1	13.5	15.0	9.4	**10.8**
18	IVT-MB-10	RD 3058	10.1	10.7	11.0	9.6	13.2	13.2	10.7	**10.3**
19	IVT-MB-25	RD 3063	9.4	9.1	11.5	7.5	12.4	12.9	10.5	**9.1**
20	IVT-MB-9	UPB 1107	10.2	10.8	12.5	10.1	13.0	13.5	11.3	**10.6**
21	IVT-MB-13	UPB 1108	9.6	10.6	12.0	11.2	12.3	15.1	10.0	**10.4**
22	IVT-MB-2	DWRUB 52 ©	11.3	10.9	12.5	11.4	13.3	13.3	11.0	**11.2**
23	IVT-MB-11	RD 2849©	11.6	13.1	12.8	12.8	13.3	15.4	11.5	**12.3**
24	IVT-MB-20	DWRB 182 ©	10.0	10.7	10.6	8.8	12.2	13.3	9.6	**9.8**
25	IVT-MB-3	DWRB 137 ©**	9.7	10.6	11.4	10.2	11.9	12.5	11.5	**10.5**
	Average		**10.1**	**10.6**	**12.3**	**10.0**	**12.6**	**13.8**	**10.6**	

*Not included in zonal mean **= 6 row barley # Predicted values through NIR

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

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	15.6	13.0	10.8	12.2	14.4	11.9	11.1	**12.9**
2	IVT-MB-1	BH 1041	12.8	9.6	10.6	12.6	12.7	10.0	9.1	**11.0**
3	IVT-MB-23	BH 1042	12.5	11.8	11.0	8.5	13.3	13.3	10.7	**10.9**
4	IVT-MB-12	BH 1043	13.7	13.9	14.9	15.1	13.5	13.6	11.1	**13.5**
5	IVT-MB-17	DWRB 229	14.6	13.5	9.1	11.0	15.5	11.9	12.6	**12.9**
6	IVT-MB-15	DWRB 230	11.1	11.5	12.3	11.6	13.2	14.7	10.4	**11.1**
7	IVT-MB-24	DWRB 231	12.4	12.0	9.8	9.1	12.6	12.5	9.4	**10.7**
8	IVT-MB-7	DWRB 232	12.2	11.9	9.0	12.8	14.5	12.3	10.6	**11.9**
9	IVT-MB-19	DWRB 233	10.7	9.1	11.6	12.1	14.8	11.5	11.4	**10.8**
10	IVT-MB-4	DWRB 234	12.0	11.3	11.1	10.1	12.9	11.8	9.7	**10.8**
11	IVT-MB-8	PL 933	11.4	11.7	11.0	10.5	12.2	13.3	10.1	**10.9**
12	IVT-MB-5	PL 934	12.0	10.4	11.7	11.0	14.6	10.4	11.9	**11.3**
13	IVT-MB-21	PL 935	11.4	13.2	13.3	11.7	16.0	14.8	12.0	**12.1**
14	IVT-MB-6	PL 938	13.8	13.0	9.3	9.3	14.8	12.3	11.4	**11.9**
15	IVT-MB-14	RD 3055	10.3	11.9	10.5	10.9	11.6	11.9	11.0	**11.1**
16	IVT-MB-22	RD 3056	14.1	9.7	9.1	10.3	13.0	14.2	10.5	**11.1**
17	IVT-MB-16	RD 3057	12.5	11.5	11.6	9.2	13.9	13.4	10.7	**11.0**
18	IVT-MB-10	RD 3058	14.9	8.5	10.9	14.2	15.0	13.1	11.8	**12.3**
19	IVT-MB-25	RD 3063	12.4	12.6	11.2	11.4	12.8	14.8	10.2	**11.7**
20	IVT-MB-9	UPB 1107	12.2	7.1	9.1	12.3	12.7	13.3	9.4	**10.2**
21	IVT-MB-13	UPB 1108	15.4	11.2	10.7	14.0	13.3	12.5	11.8	**13.1**
22	IVT-MB-2	DWRUB 52 ©	13.8	9.8	12.8	10.3	13.9	13.2	10.8	**11.2**
23	IVT-MB-11	RD 2849©	9.9	10.0	8.6	9.7	12.0	8.1	8.8	**9.6**
24	IVT-MB-20	DWRB 182 ©	13.7	13.3	9.8	10.5	13.3	11.8	10.0	**11.9**
25	IVT-MB-3	DWRB 137 ©**	13.1	9.8	8.3	9.8	12.2	11.2	7.9	**10.2**
	Average		**12.7**	**11.3**	**10.7**	**11.2**	**13.6**	**12.5**	**10.6**	

*Not included in zonal mean **= 6 row barley

Table 5.3.8: β--Glucan Content (% dwb) of IVT (MB) entries at two locations

S.N.	Code	Genotype	Navgaon	Hisar	Mean
1	IVT-MB-18	BH 1040	3.7	4.5	**4.1**
2	IVT-MB-1	BH 1041	3.9	6.1	**5.0**
3	IVT-MB-23	BH 1042	4.4	6.2	**5.3**
4	IVT-MB-12	BH 1043	3.9	6.1	**5.0**
5	IVT-MB-17	DWRB 229	3.7	4.8	**4.2**
6	IVT-MB-15	DWRB 230	5.3	6.0	**5.6**
7	IVT-MB-24	DWRB 231	4.1	5.8	**5.0**
8	IVT-MB-7	DWRB 232	4.6	5.8	**5.2**
9	IVT-MB-19	DWRB 233	3.7	4.7	**4.2**
10	IVT-MB-4	DWRB 234	4.2	5.8	**5.0**
11	IVT-MB-8	PL 933	3.9	5.3	**4.6**
12	IVT-MB-5	PL 934	3.7	5.7	**4.7**
13	IVT-MB-21	PL 935	4.0	5.1	**4.5**
14	IVT-MB-6	PL 938	3.5	5.6	**4.5**
15	IVT-MB-14	RD 3055	4.8	6.0	**5.4**
16	IVT-MB-22	RD 3056	5.5	6.8	**6.1**
17	IVT-MB-16	RD 3057	4.7	5.0	**4.8**
18	IVT-MB-10	RD 3058	4.9	7.2	**6.0**
19	IVT-MB-25	RD 3063	4.2	6.1	**5.1**
20	IVT-MB-9	UPB 1107	3.5	4.9	**4.2**
21	IVT-MB-13	UPB 1108	4.3	5.9	**5.1**
22	IVT-MB-2	DWRUB 52 ©	5.8	6.2	**6.0**
23	IVT-MB-11	RD 2849©	4.4	5.9	**5.2**
24	IVT-MB-20	DWRB 182 ©	3.6	5.0	**4.3**
25	IVT-MB-3	DWRB 137 ©*	3.9	5.2	**4.6**
	Average		**4.2**	**5.7**	

*= 6 row barley

Table 5.3.9: Moisture content in grains (%) # of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	8.6	7.7	8.3	6.2	7.1	8.4	10.8	**8.3**
2	IVT-MB-1	BH 1041	8.4	7.3	8.3	6.1	7.7	8.6	10.9	**8.2**
3	IVT-MB-23	BH 1042	8.5	7.3	8.2	6.1	7.2	8.4	11.6	**8.4**
4	IVT-MB-12	BH 1043	8.9	7.8	8.2	6.4	7.2	8.6	10.5	**8.4**
5	IVT-MB-17	DWRB 229	8.2	7.1	8.0	6.6	7.6	8.5	10.4	**8.1**
6	IVT-MB-15	DWRB 230	8.4	7.5	8.1	6.2	7.3	8.4	10.9	**8.3**
7	IVT-MB-24	DWRB 231	8.9	7.2	8.5	6.5	7.3	8.6	11.3	**8.5**
8	IVT-MB-7	DWRB 232	8.7	8.5	8.0	6.2	8.2	8.4	10.3	**8.4**
9	IVT-MB-19	DWRB 233	8.1	7.4	8.1	6.2	7.2	8.3	10.6	**8.1**
10	IVT-MB-4	DWRB 234	9.2	7.7	8.4	6.0	7.2	8.5	10.6	**8.4**
11	IVT-MB-8	PL 933	8.0	7.2	8.3	6.3	7.2	8.3	10.5	**8.0**
12	IVT-MB-5	PL 934	8.0	7.3	8.2	6.4	8.0	8.4	10.4	**8.0**
13	IVT-MB-21	PL 935	8.3	8.8	8.4	6.7	9.2	8.6	10.7	**8.6**
14	IVT-MB-6	PL 938	7.9	7.6	8.4	6.4	9.9	8.3	10.5	**8.1**
15	IVT-MB-14	RD 3055	9.5	7.3	8.2	6.3	7.5	8.4	10.4	**8.4**
16	IVT-MB-22	RD 3056	8.6	7.0	8.4	6.4	7.1	8.5	10.5	**8.1**
17	IVT-MB-16	RD 3057	8.5	7.1	8.1	5.9	7.2	8.5	10.3	**8.0**
18	IVT-MB-10	RD 3058	10.0	7.4	8.1	6.3	7.3	8.5	10.8	**8.6**
19	IVT-MB-25	RD 3063	9.1	7.7	8.3	6.2	7.4	8.6	11.0	**8.5**
20	IVT-MB-9	UPB 1107	9.1	7.8	8.2	6.5	7.2	8.4	10.6	**8.5**
21	IVT-MB-13	UPB 1108	11.0	9.3	8.0	6.1	7.2	8.5	11.4	**9.5**
22	IVT-MB-2	DWRUB 52 ©	8.6	7.3	8.1	6.1	8.0	8.3	10.6	**8.2**
23	IVT-MB-11	RD 2849©	8.6	7.4	8.2	6.3	8.2	8.5	10.8	**8.3**
24	IVT-MB-20	DWRB 182 ©	9.1	7.2	8.2	6.4	7.3	8.2	10.6	**8.3**
25	IVT-MB-3	DWRB 137 ©**	8.8	7.8	8.3	6.5	8.0	8.5	10.7	**8.5**
	Average		**8.8**	**7.6**	**8.2**	**6.3**	**7.6**	**8.4**	**10.7**	

*Not included in zonal mean **= 6 row barley # Predicted values through NIR

Table 5.3.10: Starch content in grains (%dwt basis) # of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Hisar	Ludhiana*	Durgapura	Bathinda*	Karnal*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	62.4	63.9	61.8	67.4	61.3	61.4	61.4	**63.8**
2	IVT-MB-1	BH 1041	61.2	62.2	61.6	64.5	59.9	61.2	62.0	**62.5**
3	IVT-MB-23	BH 1042	61.6	62.6	63.5	66.9	61.4	63.1	62.2	**63.3**
4	IVT-MB-12	BH 1043	62.2	62.7	61.9	67.8	60.0	60.1	62.2	**63.7**
5	IVT-MB-17	DWRB 229	61.6	62.0	64.1	66.2	59.6	63.1	62.6	**63.1**
6	IVT-MB-15	DWRB 230	61.0	61.5	63.4	66.6	60.1	61.9	62.0	**62.8**
7	IVT-MB-24	DWRB 231	59.2	62.1	61.4	65.2	59.6	58.9	60.7	**61.8**
8	IVT-MB-7	DWRB 232	60.6	60.7	62.7	64.8	59.5	60.7	61.8	**62.0**
9	IVT-MB-19	DWRB 233	61.7	61.8	61.5	66.5	60.8	61.3	61.6	**62.9**
10	IVT-MB-4	DWRB 234	61.0	61.5	62.6	67.0	60.0	61.6	61.6	**62.8**
11	IVT-MB-8	PL 933	61.4	61.8	63.2	65.2	60.7	61.1	61.9	**62.6**
12	IVT-MB-5	PL 934	62.6	61.1	59.0	66.3	60.6	59.7	62.2	**63.1**
13	IVT-MB-21	PL 935	62.0	62.8	63.7	64.9	59.7	61.7	62.7	**63.1**
14	IVT-MB-6	PL 938	61.8	62.4	63.0	66.4	60.3	62.6	62.4	**63.3**
15	IVT-MB-14	RD 3055	61.8	62.5	62.2	65.9	60.0	62.0	62.0	**63.1**
16	IVT-MB-22	RD 3056	60.0	62.3	62.6	66.5	61.0	61.0	63.1	**63.0**
17	IVT-MB-16	RD 3057	61.6	61.8	63.1	67.3	60.8	63.3	62.0	**63.2**
18	IVT-MB-10	RD 3058	57.9	62.2	63.0	67.1	59.9	61.0	61.2	**62.1**
19	IVT-MB-25	RD 3063	61.6	61.5	62.5	65.7	60.0	62.1	60.6	**62.4**
20	IVT-MB-9	UPB 1107	61.4	62.1	64.0	67.7	61.8	62.5	62.6	**63.5**
21	IVT-MB-13	UPB 1108	59.9	60.6	61.4	65.4	59.5	59.8	59.8	**61.4**
22	IVT-MB-2	DWRUB 52 ©	60.5	61.2	60.5	66.6	59.2	60.1	62.3	**62.7**
23	IVT-MB-11	RD 2849©	61.9	61.3	61.3	66.5	60.1	59.9	63.3	**63.3**
24	IVT-MB-20	DWRB 182 ©	61.3	62.3	64.2	68.6	61.2	61.5	62.2	**63.6**
25	IVT-MB-3	DWRB 137 ©**	62.3	62.8	61.9	66.7	60.3	61.3	61.4	**63.3**
	Average		**61.2**	**62.0**	**62.4**	**66.4**	**60.3**	**61.3**	**61.9**	

*Not included in zonal mean **= 6 row barley # Predicted values through NIR

Table 5.3.11: Malt yield of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	87	91	91	88	92	88	90	**90**
2	IVT-MB-1	BH 1041	90	86	91	86	92	90	NA	**91**
3	IVT-MB-23	BH 1042	90	91	90	89	93	90	87	**90**
4	IVT-MB-12	BH 1043	91	90	91	89	92	90	88	**91**
5	IVT-MB-17	DWRB 229	90	90	92	90	93	92	89	**91**
6	IVT-MB-15	DWRB 230	90	90	91	90	91	89	90	**91**
7	IVT-MB-24	DWRB 231	90	92	92	90	92	90	87	**90**
8	IVT-MB-7	DWRB 232	91	90	90	88	93	91	NA	**92**
9	IVT-MB-19	DWRB 233	91	91	90	87	92	87	88	**90**
10	IVT-MB-4	DWRB 234	91	87	93	88	93	90	NA	**92**
11	IVT-MB-8	PL 933	91	91	91	89	93	91	NA	**92**
12	IVT-MB-5	PL 934	92	91	91	90	91	92	NA	**91**
13	IVT-MB-21	PL 935	89	90	91	86	91	88	90	**90**
14	IVT-MB-6	PL 938	91	90	93	89	93	91	NA	**92**
15	IVT-MB-14	RD 3055	91	90	91	89	92	89	90	**91**
16	IVT-MB-22	RD 3056	88	90	92	86	91	87	89	**90**
17	IVT-MB-16	RD 3057	91	91	94	90	93	88	90	**92**
18	IVT-MB-10	RD 3058	89	91	91	89	92	90	NA	**91**
19	IVT-MB-25	RD 3063	90	88	92	87	93	90	88	**91**
20	IVT-MB-9	UPB 1107	91	91	91	87	93	90	NA	**92**
21	IVT-MB-13	UPB 1108	91	91	91	90	91	90	88	**90**
22	IVT-MB-2	DWRUB 52 ©	91	89	92	88	92	90	NA	**92**
23	IVT-MB-11	RD 2849©	92	91	91	91	93	90	NA	**92**
24	IVT-MB-20	DWRB 182 ©	91	91	92	88	92	88	89	**91**
25	IVT-MB-3	DWRB 137 ©**	91	90	91	90	93	91	NA	**92**
	Average		**91**	**90**	**91**	**89**	**92**	**90**	**89**	

*Not included in zonal mean **= 6 row barley

Table 5.3.12: Malt friability (%) and homogeneity (%) of IVT (MB) entries from different locations

S.N.	Code	Genotype	Malt friability (%)					Malt homogeneity (%)				
			Navgaon	Hisar	Durgapura	Pantnagar	Mean	Navgaon	Hisar	Durgapura	Pantnagar	Mean
1	IVT-MB-18	BH 1040	29	57	54	64	**51**	69	81	46	89	**71**
2	IVT-MB-1	BH 1041	46	42	47	60	**49**	73	81	76	89	**80**
3	IVT-MB-23	BH 1042	55	56	38	59	**52**	88	89	62	84	**81**
4	IVT-MB-12	BH 1043	63	59	60	61	**61**	86	87	92	82	**87**
5	IVT-MB-17	DWRB 229	48	44	39	56	**47**	81	67	61	86	**74**
6	IVT-MB-15	DWRB 230	63	65	50	69	**62**	95	95	50	93	**84**
7	IVT-MB-24	DWRB 231	55	51	50	63	**55**	93	78	50	93	**79**
8	IVT-MB-7	DWRB 232	37	27	43	61	**42**	54	59	70	82	**66**
9	IVT-MB-19	DWRB 233	29	59	40	62	**48**	49	88	61	87	**71**
10	IVT-MB-4	DWRB 234	42	43	41	48	**43**	67	82	65	70	**71**
11	IVT-MB-8	PL 933	35	61	31	49	**44**	55	92	56	71	**68**
12	IVT-MB-5	PL 934	47	41	24	60	**43**	92	71	54	93	**78**
13	IVT-MB-21	PL 935	65	52	51	54	**56**	97	88	49	84	**79**
14	IVT-MB-6	PL 938	49	32	39	60	**45**	81	54	77	86	**74**
15	IVT-MB-14	RD 3055	61	60	56	68	**61**	96	95	44	92	**82**
16	IVT-MB-22	RD 3056	66	45	57	81	**62**	97	71	43	99	**78**
17	IVT-MB-16	RD 3057	41	44	40	75	**50**	69	76	60	98	**76**
18	IVT-MB-10	RD 3058	57	36	46	62	**50**	88	58	92	91	**82**
19	IVT-MB-25	RD 3063	50	53	55	49	**52**	78	89	45	69	**70**
20	IVT-MB-9	UPB 1107	49	35	40	75	**50**	74	61	65	96	**74**
21	IVT-MB-13	UPB 1108	64	48	44	63	**55**	92	78	81	84	**84**
22	IVT-MB-2	DWRUB 52 ©	26	54	25	55	**40**	45	92	48	79	**66**
23	IVT-MB-11	RD 2849©	29	52	13	67	**40**	47	89	26	88	**62**
24	IVT-MB-20	DWRB 182 ©	47	61	50	64	**56**	87	97	50	96	**83**
25	IVT-MB-3	DWRB 137 ©*	52	39	37	62	**47**	93	68	76	95	**83**
	Average		**48**	**49**	**43**	**62**			**78**	**79**	**60**	**87**

*= 6 row barley

Table 5.3.13: Hot water extract (% fgdb) of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	70.2	72.3	75.2	75.8	82.2	80.3	77.5	**76.3**
2	IVT-MB-1	BH 1041	75.4	76.0	75.1	77.9	83.2	74.5	69.4	**75.8**
3	IVT-MB-23	BH 1042	77.0	78.3	71.5	76.0	76.5	71.6	83.7	**77.2**
4	IVT-MB-12	BH 1043	76.2	71.8	72.1	80.6	74.4	71.8	73.3	**74.0**
5	IVT-MB-17	DWRB 229	75.5	77.4	73.0	77.9	75.4	81.3	77.4	**75.3**
6	IVT-MB-15	DWRB 230	83.1	75.2	73.5	77.8	76.9	73.5	78.2	**77.9**
7	IVT-MB-24	DWRB 231	77.3	79.0	71.8	77.0	75.8	68.9	78.5	**75.8**
8	IVT-MB-7	DWRB 232	72.7	77.1	69.0	75.7	73.3	66.4	74.1	**72.3**
9	IVT-MB-19	DWRB 233	73.8	76.0	75.8	76.6	82.5	81.2	77.6	**77.4**
10	IVT-MB-4	DWRB 234	74.2	67.7	73.8	74.9	77.7	68.6	75.4	**75.3**
11	IVT-MB-8	PL 933	75.5	83.0	75.8	79.4	76.8	62.4	79.7	**76.9**
12	IVT-MB-5	PL 934	74.8	75.3	70.8	76.2	77.8	69.2	79.5	**75.7**
13	IVT-MB-21	PL 935	75.1	74.0	75.5	72.4	80.0	69.9	79.0	**77.4**
14	IVT-MB-6	PL 938	79.2	76.0	69.1	77.5	75.3	67.7	75.8	**74.9**
15	IVT-MB-14	RD 3055	80.5	78.4	72.2	78.5	79.0	72.6	76.9	**77.1**
16	IVT-MB-22	RD 3056	78.2	74.1	72.9	72.7	78.2	70.6	82.8	**78.0**
17	IVT-MB-16	RD 3057	79.0	78.8	74.1	75.1	78.2	74.1	79.7	**77.8**
18	IVT-MB-10	RD 3058	74.7	74.1	78.6	78.0	76.5	67.2	74.1	**76.0**
19	IVT-MB-25	RD 3063	73.2	83.3	69.4	78.4	75.5	73.3	77.3	**73.8**
20	IVT-MB-9	UPB 1107	77.5	76.5	71.9	78.3	77.9	69.8	76.0	**75.8**
21	IVT-MB-13	UPB 1108	79.7	72.6	69.2	85.2	75.7	69.6	78.8	**75.9**
22	IVT-MB-2	DWRUB 52 ©	71.1	84.4	71.2	75.0	78.4	69.2	76.5	**74.3**
23	IVT-MB-11	RD 2849©	75.7	74.8	74.3	81.7	78.3	73.8	79.6	**77.0**
24	IVT-MB-20	DWRB 182 ©	73.1	78.4	73.7	76.0	79.8	80.0	84.5	**77.8**
25	IVT-MB-3	DWRB 137 ©**	78.0	76.0	70.8	74.6	82.3	71.1	78.8	**77.5**
	Average		**76.0**	**76.4**	**72.8**	**77.2**	**77.9**	**71.9**	**77.8**	

*Not included in zonal mean **= 6 row barley

Table 5.3.14: Wort filtration rate (ml/hr.) of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	250	295	280	250	295	290	290	**279**
2	IVT-MB-1	BH 1041	310	300	320	175	310	210	195	**284**
3	IVT-MB-23	BH 1042	325	305	235	325	95	320	325	**245**
4	IVT-MB-12	BH 1043	315	295	230	265	280	286	320	**286**
5	IVT-MB-17	DWRB 229	265	300	220	225	310	275	255	**263**
6	IVT-MB-15	DWRB 230	220	200	190	200	270	265	245	**231**
7	IVT-MB-24	DWRB 231	275	310	180	270	310	245	275	**260**
8	IVT-MB-7	DWRB 232	205	190	245	180	305	160	255	**253**
9	IVT-MB-19	DWRB 233	275	300	300	250	310	290	270	**289**
10	IVT-MB-4	DWRB 234	305	300	250	225	310	155	270	**284**
11	IVT-MB-8	PL 933	285	310	285	225	305	300	220	**274**
12	IVT-MB-5	PL 934	320	325	285	175	265	190	315	**296**
13	IVT-MB-21	PL 935	275	205	295	165	305	205	225	**275**
14	IVT-MB-6	PL 938	285	310	240	260	320	165	280	**281**
15	IVT-MB-14	RD 3055	195	160	140	200	250	190	255	**210**
16	IVT-MB-22	RD 3056	255	200	325	295	155	220	285	**255**
17	IVT-MB-16	RD 3057	280	170	270	325	150	325	330	**258**
18	IVT-MB-10	RD 3058	200	180	320	225	110	240	285	**229**
19	IVT-MB-25	RD 3063	230	265	320	280	315	260	300	**291**
20	IVT-MB-9	UPB 1107	315	305	250	270	300	300	230	**274**
21	IVT-MB-13	UPB 1108	270	305	325	200	310	180	250	**289**
22	IVT-MB-2	DWRUB 52 ©	215	150	215	125	295	160	225	**238**
23	IVT-MB-11	RD 2849©	325	320	205	300	305	285	315	**288**
24	IVT-MB-20	DWRB 182 ©	245	325	225	250	185	310	305	**240**
25	IVT-MB-3	DWRB 137 ©**	320	330	185	225	290	200	240	**259**
	Average		**270**	**266**	**253**	**235**	**266**	**241**	**270**	

*Not included in zonal mean **= 6 row barley

Table 5.3.15: Diastatic power (^{0}L) of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	116	100	109	111	94	116	104	**106**
2	IVT-MB-1	BH 1041	109	125	76	125	109	109	119	**103**
3	IVT-MB-23	BH 1042	104	104	116	102	96	98	109	**106**
4	IVT-MB-12	BH 1043	96	106	116	114	94	116	106	**103**
5	IVT-MB-17	DWRB 229	98	89	114	104	76	98	106	**98**
6	IVT-MB-15	DWRB 230	100	94	104	100	76	89	111	**98**
7	IVT-MB-24	DWRB 231	75	78	139	85	58	81	106	**95**
8	IVT-MB-7	DWRB 232	79	116	109	111	82	82	111	**95**
9	IVT-MB-19	DWRB 233	119	89	111	114	70	106	109	**102**
10	IVT-MB-4	DWRB 234	89	111	102	106	94	104	119	**101**
11	IVT-MB-8	PL 933	98	111	106	111	104	109	122	**108**
12	IVT-MB-5	PL 934	65	77	106	79	55	89	91	**79**
13	IVT-MB-21	PL 935	106	98	74	109	82	111	109	**93**
14	IVT-MB-6	PL 938	104	122	114	122	109	98	114	**110**
15	IVT-MB-14	RD 3055	98	104	102	104	94	89	100	**99**
16	IVT-MB-22	RD 3056	109	111	111	111	111	106	100	**108**
17	IVT-MB-16	RD 3057	96	98	89	122	111	100	109	**101**
18	IVT-MB-10	RD 3058	104	114	125	119	100	119	122	**113**
19	IVT-MB-25	RD 3063	111	111	70	119	109	116	109	**100**
20	IVT-MB-9	UPB 1107	106	106	109	116	91	104	NA	**102**
21	IVT-MB-13	UPB 1108	109	104	114	116	109	119	116	**112**
22	IVT-MB-2	DWRUB 52 ©	96	122	76	114	106	116	100	**95**
23	IVT-MB-11	RD 2849©	106	109	111	116	109	111	119	**111**
24	IVT-MB-20	DWRB 182 ©	57	66	111	67	63	104	62	**73**
25	IVT-MB-3	DWRB 137 ©**	65	98	98	93	58	83	89	**78**
	Average		**97**	**103**	**104**	**108**	**90**	**103**	**107**	

*Not included in zonal mean **= 6 row barley

Table 5.3.16: Saccharification rate (minutes) of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	5	10	5	5	5	10	5	**5**
2	IVT-MB-1	BH 1041	5	10	5	10	10	5	10	**8**
3	IVT-MB-23	BH 1042	5	5	10	5	5	5	5	**6**
4	IVT-MB-12	BH 1043	5	5	5	5	5	10	5	**5**
5	IVT-MB-17	DWRB 229	5	10	5	5	10	5	10	**8**
6	IVT-MB-15	DWRB 230	5	5	10	5	5	5	5	**6**
7	IVT-MB-24	DWRB 231	5	5	5	5	10	5	5	**6**
8	IVT-MB-7	DWRB 232	5	5	10	5	5	5	5	**6**
9	IVT-MB-19	DWRB 233	5	5	5	5	5	5	5	**5**
10	IVT-MB-4	DWRB 234	5	5	10	5	5	10	5	**6**
11	IVT-MB-8	PL 933	5	5	5	5	5	5	10	**6**
12	IVT-MB-5	PL 934	5	5	5	5	5	5	5	**5**
13	IVT-MB-21	PL 935	5	5	5	5	5	5	5	**5**
14	IVT-MB-6	PL 938	10	10	5	10	10	5	10	**9**
15	IVT-MB-14	RD 3055	5	5	5	10	10	5	5	**6**
16	IVT-MB-22	RD 3056	5	10	5	5	5	10	10	**6**
17	IVT-MB-16	RD 3057	5	5	10	5	5	10	5	**6**
18	IVT-MB-10	RD 3058	10	10	10	5	10	5	5	**9**
19	IVT-MB-25	RD 3063	5	5	5	5	5	5	5	**5**
20	IVT-MB-9	UPB 1107	5	5	5	5	5	5	5	**5**
21	IVT-MB-13	UPB 1108	5	10	5	10	5	5	5	**5**
22	IVT-MB-2	DWRUB 52 ©	5	5	5	10	5	10	5	**5**
23	IVT-MB-11	RD 2849©	10	5	10	5	10	5	5	**9**
24	IVT-MB-20	DWRB 182 ©	5	5	5	5	10	5	10	**8**
25	IVT-MB-3	DWRB 137 ©**	5	5	10	5	5	5	5	**6**
	Average		**6**	**6**	**7**	**6**	**7**	**6**	**6**	

*Not included in zonal mean **= 6 row barley

Table 5.3.17: Wort pH of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	6.0	5.8	5.9	5.9	6.0	5.9	5.9	**5.9**
2	IVT-MB-1	BH 1041	5.9	5.8	5.7	5.9	6.0	5.9	5.9	**5.9**
3	IVT-MB-23	BH 1042	6.0	5.8	5.9	5.8	6.0	5.9	5.9	**5.9**
4	IVT-MB-12	BH 1043	6.1	5.9	6.0	5.8	5.9	6.0	6.0	**6.0**
5	IVT-MB-17	DWRB 229	6.0	5.7	5.9	5.8	5.8	5.9	5.8	**5.9**
6	IVT-MB-15	DWRB 230	6.0	5.8	5.9	5.8	5.9	5.9	5.9	**5.9**
7	IVT-MB-24	DWRB 231	6.0	5.6	6.1	5.8	5.8	5.8	5.9	**5.9**
8	IVT-MB-7	DWRB 232	5.9	5.7	5.9	5.8	5.8	5.9	5.9	**5.9**
9	IVT-MB-19	DWRB 233	6.0	5.7	6.0	5.7	5.9	5.8	5.8	**5.9**
10	IVT-MB-4	DWRB 234	6.0	5.9	5.9	5.9	6.0	5.9	6.0	**6.0**
11	IVT-MB-8	PL 933	5.9	5.7	6.2	5.8	5.8	5.9	5.9	**6.0**
12	IVT-MB-5	PL 934	5.9	5.7	6.0	5.8	5.8	5.9	6.0	**5.9**
13	IVT-MB-21	PL 935	6.1	5.8	5.9	5.8	6.0	6.0	6.0	**6.0**
14	IVT-MB-6	PL 938	5.9	5.8	5.9	5.8	5.8	5.9	5.9	**5.9**
15	IVT-MB-14	RD 3055	6.0	5.8	5.9	5.8	6.0	5.9	5.9	**5.9**
16	IVT-MB-22	RD 3056	6.0	5.8	5.9	5.7	5.9	5.8	5.9	**5.9**
17	IVT-MB-16	RD 3057	6.0	5.8	5.9	5.8	6.0	6.0	5.9	**5.9**
18	IVT-MB-10	RD 3058	6.0	5.9	5.9	5.9	6.0	5.9	5.9	**6.0**
19	IVT-MB-25	RD 3063	6.2	6.1	5.8	5.8	6.0	5.9	6.0	**6.0**
20	IVT-MB-9	UPB 1107	6.0	5.9	6.0	5.9	5.9	5.9	5.9	**6.0**
21	IVT-MB-13	UPB 1108	6.0	5.9	5.9	5.9	5.9	5.9	5.9	**6.0**
22	IVT-MB-2	DWRUB 52 ©	5.8	5.8	5.9	6.0	5.8	5.9	6.0	**5.8**
23	IVT-MB-11	RD 2849©	5.9	5.8	6.0	5.8	5.7	5.9	5.9	**5.9**
24	IVT-MB-20	DWRB 182 ©	6.0	5.6	6.0	5.7	5.9	5.8	5.9	**5.9**
25	IVT-MB-3	DWRB 137©**	5.8	5.7	5.9	5.7	5.7	5.9	5.9	**5.8**
	Average		**6.0**	**5.8**	**5.9**	**5.8**	**5.9**	**5.9**	**5.9**	

*Not included in zonal mean **= 6 row barley

Table 5.3.18: Kolbach Index (KI) # of IVT (MB) entries from different locations

S.N.	Code	Genotype	Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean
1	IVT-MB-18	BH 1040	35	36	38	40	39	38	37	**37**
2	IVT-MB-1	BH 1041	40	36	39	37	36	35	40	**39**
3	IVT-MB-23	BH 1042	37	33	38	40	37	37	39	**38**
4	IVT-MB-12	BH 1043	38	38	38	38	38	39	39	**38**
5	IVT-MB-17	DWRB 229	38	36	36	35	35	38	40	**37**
6	IVT-MB-15	DWRB 230	38	37	38	40	39	38	40	**39**
7	IVT-MB-24	DWRB 231	37	34	40	40	39	38	40	**39**
8	IVT-MB-7	DWRB 232	37	36	34	40	40	32	39	**37**
9	IVT-MB-19	DWRB 233	36	35	37	38	34	38	38	**36**
10	IVT-MB-4	DWRB 234	42	35	38	43	38	39	41	**40**
11	IVT-MB-8	PL 933	35	32	41	37	33	37	38	**37**
12	IVT-MB-5	PL 934	38	33	37	40	35	38	40	**38**
13	IVT-MB-21	PL 935	40	36	39	38	43	36	42	**41**
14	IVT-MB-6	PL 938	39	35	37	38	33	35	39	**37**
15	IVT-MB-14	RD 3055	36	37	41	40	41	36	41	**39**
16	IVT-MB-22	RD 3056	40	36	40	36	38	38	40	**40**
17	IVT-MB-16	RD 3057	38	32	40	36	35	37	40	**38**
18	IVT-MB-10	RD 3058	41	38	37	39	40	37	40	**39**
19	IVT-MB-25	RD 3063	39	36	41	42	40	39	38	**40**
20	IVT-MB-9	UPB 1107	37	35	37	38	34	36	40	**37**
21	IVT-MB-13	UPB 1108	38	35	38	37	36	37	40	**38**
22	IVT-MB-2	DWRUB 52 ©	37	40	38	41	37	37	39	**38**
23	IVT-MB-11	RD 2849©	35	33	39	37	33	35	38	**36**
24	IVT-MB-20	DWRB 182 ©	38	34	39	39	38	34	38	**38**
25	IVT-MB-3	DWRB 137 ©**	39	34	41	41	37	35	36	**38**
	Average		**38**	**35**	**38**	**39**	**37**	**37**	**39**	

#NIR predicted values *Not included in zonal mean **= 6 row barley

Table 5.3.19: Wort FAN and β--Glucan Contents (ppm) of IVT (MB) entries from different locations

S.N.	Code	Genotype	FAN content								β-Glucan
			Navgaon	Karnal*	Hisar	Ludhiana*	Durgapura	Bathinda*	Pantnagar	Mean	Navgaon
1	IVT-MB-18	BH 1040	165	149	125	181	108	179	172	**143**	361
2	IVT-MB-1	BH 1041	138	160	122	181	124	178	179	**141**	818
3	IVT-MB-23	BH 1042	129	128	165	193	94	122	150	**135**	504
4	IVT-MB-12	BH 1043	110	139	119	188	125	136	156	**127**	543
5	IVT-MB-17	DWRB 229	148	144	102	188	114	153	174	**135**	336
6	IVT-MB-15	DWRB 230	162	175	157	141	143	160	193	**164**	256
7	IVT-MB-24	DWRB 231	140	138	102	228	119	136	161	**131**	811
8	IVT-MB-7	DWRB 232	124	162	154	161	101	160	162	**135**	1037
9	IVT-MB-19	DWRB 233	140	137	132	195	111	140	173	**139**	628
10	IVT-MB-4	DWRB 234	136	131	125	171	117	180	146	**131**	527
11	IVT-MB-8	PL 933	108	144	128	158	110	150	141	**122**	974
12	IVT-MB-5	PL 934	113	125	106	158	100	137	140	**115**	1346
13	IVT-MB-21	PL 935	131	137	135	216	102	147	162	**133**	522
14	IVT-MB-6	PL 938	134	164	112	185	123	161	168	**134**	802
15	IVT-MB-14	RD 3055	146	188	149	191	136	159	180	**153**	687
16	IVT-MB-22	RD 3056	176	170	109	249	141	212	217	**161**	432
17	IVT-MB-16	RD 3057	129	142	125	121	97	130	157	**127**	455
18	IVT-MB-10	RD 3058	148	161	117	189	131	146	196	**148**	654
19	IVT-MB-25	RD 3063	117	124	115	224	94	130	141	**117**	541
20	IVT-MB-9	UPB 1107	112	130	119	187	107	145	190	**132**	1019
21	IVT-MB-13	UPB 1108	125	140	105	172	130	157	145	**126**	843
22	IVT-MB-2	DWRUB 52 ©	132	136	133	164	118	161	160	**136**	1313
23	IVT-MB-11	RD 2849©	133	149	133	163	122	161	191	**144**	776
24	IVT-MB-20	DWRB 182 ©	147	153	119	212	114	135	162	**136**	736
25	IVT-MB-3	DWRB137©**	159	152	98	182	126	162	188	**143**	1239
	Average		**136**	**147**	**124**	**184**	**116**	**153**	**168**		

*Not included in zonal mean **= 6 row barley

BARLEY QUALITY SCREENING NURSERY

The *Barley Quality Screening Nursery* was conducted for finding better sources of hulless and malt barley for different quality traits. The Nursery was conducted at six locations i.e., Karnal, Hisar, Pantnagar, Durgapura, Ludhiana and Kanpur. The nursery was sent under four categories i.e., low protein barley, naked/hulless barley, evaluation of protein/beta glucan content in entries contributed by malt barley & molecular breeding programme and for higher anti-oxidant activity. The promising genotypes from the different nurseries are given in following tables

Table-5.4.1 Details of grain samples analyzed for quality

Nursery	Trait	Locations	No. of Samples
BQSN-1	Low Protein content	Karnal, Hisar, Durgapura, Pantnagar, Ludhiana, Kanpur	174
BQSN-2	Beta Glucan Content		30
BQSN-3	Hulless Quality		96
BQSN-4	High Protein Content		168
BQSN-5	Antioxidant Activity	Karnal, Hisar, Ludhiana	21
		TOTAL	**489**

Promising sources for different traits for each nursery are given below.

BQSN 1: Low Protein Genotypes

Traits	Promising entries#
Low Protein Content	BCU 6315, BCU 6316, BCU 6369
Higher Starch Content	BCU 6400*, BCU 5968*
Higher Friability	BCU 6369, BCU 6316, BCU 5968*, BCU 6444*, BCU 5969*, BCU 6315, BCU 6398*, BCU 6482*
Higher Hot Water Extract	BCU 6400*, BCU 5968*, BCU 6444*, BCU 6316, BCU 6398*, BCU 5969*, BCU 5915**
Higher Diastatic Power	BCU 6398*, BCU 6482*
Higher Free Amino Nitrogen	BCU 5709, BCU 6482*

*#At par or better than Indian check variety *Hulless barley **Black colored grain*

BQSN 2: Marker Assisted Molecular Breeding for low grain beta glucan

Traits	Promising entries*
Low Grain Beta Glucan Content	RMB 2103

**At par or better than registered genetic stock DWR 37*

BQSN 3: Hulless Genotypes

Traits	Promising entries*
Higher Beta Glucan Content	HLR-90, HLR-240
Higher Protein Content	HLR-136, HLR-24, HLR-34, HLR-10
Higher Starch Content	HLR-196, HLR-64, HLR-322, HLR-90

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

BQSN 5: Antioxidant Activity

Traits	Promising entries*
Higher Antioxidant Activity	BCU 2336

**At par or better than Indian check variety*

BQSN 1: (Low Protein Genotypes)

Table 5.4.2: Protein content (% dwb) in different genotypes at different locations#

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
PL-1	**BCU 5595**	9.5	10.7	15.3	12.5	13.1	12.1	**12.2**
PL-2	**BCU 5670****	11.7	12.6	15.3	13.6	14.4	12.6	**13.4**
PL-3	**BCU 5709**	15.6	13.5	16.8	11.9	15.5	16.3	**14.9**
PL-4	**BCU 5732**	11.0	9.8	15.6	13.8	9.8	9.6	**11.6**
PL-5	**BCU 5915****	NA	NA	13.9	12.3	12.6	NA	**12.9**
PL-6	**BCU 5924**	8.3	8.4	13.4	13.2	8.4	9.4	**10.2**
PL-7	**BCU 5936**	9.4	8.7	14.1	11.2	9.0	8.3	**10.1**
PL-8	**BCU 5957**	11.8	10.4	14.7	14.4	10.8	10.4	**12.1**
PL-9	**BCU 5968***	10.6	11.1	NA	15.0	10.9	9.3	**11.4**
PL-10	**BCU 5969***	9.7	9.9	13.3	11.7	9.5	9.3	**10.6**
PL-11	**BCU 6040**	10.3	11.1	15.0	14.0	13.3	11.1	**12.5**
PL-12	**BCU 6057****	NA	NA	NA	11.7	NA	NA	**11.7**
PL-13	**BCU 6151**	9.7	9.3	15.9	11.9	12.8	12.5	**12.0**
PL-14	**BCU 6167**	9.2	9.7	15.5	11.7	9.6	10.9	**11.1**
PL-15	**BCU 6304**	11.9	14.1	14.2	13.5	13.6	12.0	**13.2**
PL-16	**BCU 6306**	10.8	9.1	14.3	13.7	11.3	9.8	**11.5**
PL-17	**BCU 6307**	9.6	9.9	14.8	13.4	9.7	9.5	**11.2**
PL-18	**BCU 6315**	8.8	7.7	10.9	12.2	7.8	8.0	**9.2**
PL-19	**BCU 6316**	8.4	7.5	10.4	13.5	8.3	7.6	**9.3**
PL-20	**BCU 6369**	8.7	7.6	10.1	13.7	8.0	8.0	**9.4**
PL-21	**BCU 6398***	9.5	10.2	14.6	10.6	10.7	12.0	**11.3**
PL-22	**BCU 6400***	8.2	9.0	12.6	10.3	9.9	11.6	**10.3**
PL-23	**BCU 6440***	10.6	11.1	14.5	10.6	12.8	12.5	**12.0**
PL-24	**BCU 6444***	9.9	10.0	14.9	12.0	10.3	12.8	**11.7**
PL-25	**BCU 6477***	9.6	8.8	13.1	8.7	8.5	10.2	**9.8**
PL-26	**BCU 6482***	12.3	10.5	14.7	10.7	NA	12.6	**12.2**
PL-27	**DWRUB 64 (c)**	10.2	8.9	11.5	10.0	9.3	9.0	**9.8**
PL-28	**DWRUB 52 (c)**	11.4	12.0	12.1	9.2	9.8	11.9	**11.1**
PL-29	**DWRB 101 (c)**	11.8	11.9	14.1	9.0	9.9	12.8	**11.6**
	Average	**10.3**	**10.1**	**13.9**	**12.1**	**10.7**	**10.8**	

#Predicted values through Near Infrared Reflectance Instrument *Hulless barley **Black colored grain

Table 5.4.3: Starch content (% dwb) in different genotypes at different locations#

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	64.3	58.6	59.0	61.7	58.8	59.0	**60.2**
LP-2	**BCU 5670****	60.8	58.9	60.8	62.8	60.9	60.8	**60.8**
LP-3	**BCU 5709**	59.3	58.8	58.7	64	58.2	58.7	**59.6**
LP-4	**BCU 5732**	62.9	60.4	61.9	59.5	60.9	61.9	**61.3**
LP-5	**BCU 5915****	NA	NA	60.7	59.8	64.1	NA	**61.5**
LP-6	**BCU 5924**	66	61.9	64.3	57.8	63.3	64.3	**62.9**
LP-7	**BCU 5936**	65.4	61.4	63.9	59.7	62.3	63.9	**62.8**
LP-8	**BCU 5957**	65.2	60.6	64.7	57.8	62.4	64.7	**62.6**
LP-9	**BCU 5968***	69.3	61.5	70.1	59.6	64.3	70.1	**65.8**
LP-10	**BCU 5969***	69.4	60.8	64.5	60.4	64.0	64.5	**63.9**
LP-11	**BCU 6040**	67.1	61.5	64.0	62.7	62.3	64.0	**63.6**
LP-12	**BCU 6057****	NA	NA	NA	62.3	NA	NA	**62.3**
LP-13	**BCU 6151**	64.4	61.5	61.8	60.1	61.7	61.8	**61.9**
LP-14	**BCU 6167**	66.1	61.4	62.7	62.9	61.6	62.7	**62.9**
LP-15	**BCU 6304**	57.7	58.6	60.7	61.7	60.0	60.7	**59.9**
LP-16	**BCU 6306**	65.2	62.0	64.7	58.8	63.5	64.7	**63.2**
LP-17	**BCU 6307**	67.7	61.5	65.9	58.7	64.9	65.9	**64.1**
LP-18	**BCU 6315**	67.4	62.3	65.8	61.4	63.7	65.8	**64.4**
LP-19	**BCU 6316**	69.1	62.7	66.0	60.2	64.6	66.0	**64.8**
LP-20	**BCU 6369**	67.9	61.7	62.9	58.5	63.1	62.9	**62.8**
LP-21	**BCU 6398***	72.4	62.2	65.3	62.7	64.9	65.3	**65.5**
LP-22	**BCU 6400***	72.8	64.7	66.3	63.3	64.7	66.3	**66.4**
LP-23	**BCU 6440***	70.3	60.8	64.0	61.9	63.4	64.0	**64.1**
LP-24	**BCU 6444***	71.3	63.4	65.1	63.4	66.1	65.1	**65.7**
LP-25	**BCU 6477***	67.8	61.4	62.3	65.2	62.3	62.3	**63.6**
LP-26	**BCU 6482***	68.9	60.0	62.9	62.5	NA	62.9	**63.4**
LP-27	**DWRUB 64 (c)**	64.5	60.4	63.2	68.6	63.0	63.2	**63.8**
LP-28	**DWRUB 52 (c)**	65.2	60.1	63.1	61.8	63.6	63.1	**62.8**
LP-29	**DWRB 101 (c)**	65.8	59.7	62.8	61.7	63.8	62.8	**62.8**
	Average	**66.5**	**61.1**	**63.5**	**61.4**	**62.8**	**63.6**	

#Predicted values through Near Infrared Reflectance Instrument *Hulless barley **Black colored grain

Table 5.4.4: Grain beta glucan content (% dwb) in selected genotypes at different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-19	**BCU 6316**	4.2	3.6	3.3	3.4	4.3	3.9	**3.8**
LP-25	**BCU 6477***	5.0	4.7	4.7	NA	5.4	4.5	**4.9**

*Hulless barley

Table 5.4.5: Thousand grain weight in different genotypes at different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	46.5	47.9	44.2	37.1	47.0	37.3	**43.3**
LP-2	**BCU 5670****	35.3	33.8	35.7	23.8	32.6	34.1	**32.6**
LP-3	**BCU 5709**	20.9	27.2	27.3	17.3	24.3	22.2	**23.2**
LP-4	**BCU 5732**	49.1	48.0	38.1	40.0	49.3	48.1	**45.4**
LP-5	**BCU 5915****	46.0	41.4	39.4	35.8	43.1	43.5	**41.5**
LP-6	**BCU 5924**	41.3	38.8	28.0	30.0	38.8	33.3	**35.0**
LP-7	**BCU 5936**	40.7	38.5	30.6	31.7	36.3	39.0	**36.1**
LP-8	**BCU 5957**	52.1	48.6	43.7	37.6	47.9	47.7	**46.3**
LP-9	**BCU 5968***	36.5	33.9	31.1	24.8	38.2	34.7	**33.2**
LP-10	**BCU 5969***	41.8	36.3	32.4	24.1	36.5	39.1	**35.0**
LP-11	**BCU 6040**	48.1	41.5	34.9	34.0	40.4	42.0	**40.1**
LP-12	**BCU 6057****	21.1	24.7	23.5	18.6	22.1	25.9	**22.7**
LP-13	**BCU 6151**	38.8	35.6	32.8	26.7	35.1	31.2	**33.4**
LP-14	**BCU 6167**	41.8	36.9	32.0	30.7	35.5	35.1	**35.3**
LP-15	**BCU 6304**	54.7	48.9	50.0	33.1	40.2	47.3	**45.7**
LP-16	**BCU 6306**	52.7	48.9	46.3	34.6	54.0	48.8	**47.6**
LP-17	**BCU 6307**	43.6	38.9	32.4	27.9	40.3	37.2	**36.7**
LP-18	**BCU 6315**	39.8	36.8	27.9	30.3	35.8	33.0	**33.9**
LP-19	**BCU 6316**	40.9	35.9	25.1	25.4	36.3	35.7	**33.2**
LP-20	**BCU 6369**	37.3	34.0	24.6	22.5	30.7	28.2	**29.6**
LP-21	**BCU 6398***	37.4	37.2	27.6	25.7	34.1	32.7	**32.5**
LP-22	**BCU 6400***	34.2	33.5	28.6	19.4	30.5	30.0	**29.4**
LP-23	**BCU 6440***	37.0	34.3	30.5	27.4	34.7	32.5	**32.7**
LP-24	**BCU 6444***	35.5	30.9	27.2	23.4	31.7	30.2	**29.8**
LP-25	**BCU 6477***	43.7	43.0	36.5	31.1	40.4	40.2	**39.2**
LP-26	**BCU 6482***	40.1	41.9	34.1	30.9	38.9	34.0	**36.6**
LP-27	**DWRUB 64 (c)**	50.5	43.1	41.5	38.2	46.5	45.0	**44.1**
LP-28	**DWRUB 52 (c)**	51.3	49.8	45.0	36.4	48.5	44.1	**45.8**
LP-29	**DWRB 101 (c)**	52.2	49.9	40.8	31.6	46.4	43.1	**44.0**
	Average	**41.8**	**39.3**	**34.2**	**29.3**	**38.5**	**37.1**	

*Hulless barley **Black colored grain

Table 5.4.6: Hectoliter weight (Test weight in kg/hl) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	59.6	52.4	53.9	51.8	51.2	50.3	**53.2**
LP-2	**BCU 5670****	68.1	60.0	61.0	57.3	61.0	61.9	**61.5**
LP-3	**BCU 5709**	53.3	54.2	57.9	NA	54.9	53.3	**54.7**
LP-4	**BCU 5732**	63.2	57.0	55.4	56.9	59.1	62.3	**59.0**
LP-5	**BCU 5915****	67.5	63.0	63.8	60.4	61.8	64.2	**63.5**
LP-6	**BCU 5924**	64.2	56.0	55.9	56.2	58.2	60.5	**58.5**
LP-7	**BCU 5936**	63.8	58.4	54.1	56.7	57.0	61.4	**58.6**
LP-8	**BCU 5957**	69.6	60.2	62.7	61.9	63.7	67.4	**64.3**
LP-9	**BCU 5968***	79.1	64.9	71.9	70.7	75.3	77.6	**73.2**
LP-10	**BCU 5969***	75.1	58.7	60.0	NA	60.4	65.7	**64.0**
LP-11	**BCU 6040**	71.9	61.2	61.6	63.7	67.4	66.9	**65.4**
LP-12	**BCU 6057****	69.9	60.3	71.1	NA	70.4	67.4	**67.8**
LP-13	**BCU 6151**	63.5	59.4	58.7	56.8	60.4	59.0	**59.6**
LP-14	**BCU 6167**	66.0	59.8	58.3	58.9	56.6	62.6	**60.4**
LP-15	**BCU 6304**	68.8	61.7	62.7	54.4	57.4	64.9	**61.7**
LP-16	**BCU 6306**	69.2	61.2	64.5	56.8	68.5	66.3	**64.4**
LP-17	**BCU 6307**	69.1	60.2	59.8	58.2	66.8	64.7	**63.1**
LP-18	**BCU 6315**	68.7	58.8	59.0	61.1	63.0	65.1	**62.6**
LP-19	**BCU 6316**	67.6	60.6	57.4	56.8	64.3	65.6	**62.0**
LP-20	**BCU 6369**	65.3	55.0	53.5	50.2	56.7	56.4	**56.2**
LP-21	**BCU 6398***	80.4	51.0	60.9	59.8	61.3	66.0	**63.2**
LP-22	**BCU 6400***	79.9	63.2	69.6	67.9	61.8	69.6	**68.7**
LP-23	**BCU 6440***	80.1	49.4	54.9	58.8	60.8	63.3	**61.2**
LP-24	**BCU 6444***	79.2	59.6	69.2	66.6	59.8	73.8	**68.0**
LP-25	**BCU 6477***	69.0	61.7	59.9	NA	61.4	62.2	**62.8**
LP-26	**BCU 6482***	80.1	48.6	58.0	59.9	NA	60.4	**61.4**
LP-27	**DWRUB 64 (c)**	67.7	58.3	62.6	62.6	62.8	61.6	**62.6**
LP-28	**DWRUB 52 (c)**	71.8	61.8	69.0	63.9	65.7	67.9	**66.7**
LP-29	**DWRB 101 (c)**	72.7	62.7	64.9	63.2	66.8	68.6	**66.5**
	Average	**69.8**	**58.6**	**61.1**	**59.7**	**61.9**	**64.0**	

*Hulless barley **Black colored grain

Table 5.4.7: Bold grain percentage of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	75.8	75.9	74.1	47.8	79.7	45.0	**66.4**
LP-2	**BCU 5670****	10.3	21.5	35.8	9.1	31.8	27.0	**22.6**
LP-3	**BCU 5709**	4.1	8.4	2.7	NA	3.6	3.0	**4.4**
LP-4	**BCU 5732**	85.2	90.3	54.3	68.8	92.2	91.2	**80.3**
LP-5	**BCU 5915****	52.5	67.9	48.2	49.7	87.6	88.7	**65.8**
LP-6	**BCU 5924**	79.2	69.9	40.6	48.5	77.4	55.5	**61.8**
LP-7	**BCU 5936**	75.1	68.8	32.1	49.0	72.5	76.8	**62.4**
LP-8	**BCU 5957**	96.7	90.8	76.6	59.6	92.0	93.6	**84.9**
LP-9	**BCU 5968***	51.0	38.8	7.2	8.8	55.5	23.4	**30.8**
LP-10	**BCU 5969***	70.9	41.4	15.7	NA	54.8	55.3	**47.6**
LP-11	**BCU 6040**	95.6	96.8	69.1	87.0	94.0	97.1	**89.9**
LP-12	**BCU 6057****	1.6	5.7	1.1	NA	0.7	5.0	**2.8**
LP-13	**BCU 6151**	54.3	32.4	14.4	11.8	32.9	15.6	**26.9**
LP-14	**BCU 6167**	56.0	37.6	18.0	15.0	40.5	32.4	**33.2**
LP-15	**BCU 6304**	93.7	85.8	76.6	29.6	69.6	84.5	**73.3**
LP-16	**BCU 6306**	89.0	85.5	72.6	46.9	95.3	89.6	**79.8**
LP-17	**BCU 6307**	71.6	67.0	24.7	27.9	80.8	68.6	**56.8**
LP-18	**BCU 6315**	75.1	49.0	17.6	41.1	67.2	48.1	**49.7**
LP-19	**BCU 6316**	79.7	53.7	13.2	26.6	65.3	61.3	**50.0**
LP-20	**BCU 6369**	68.9	59.6	13.5	21.5	50.0	36.7	**41.7**
LP-21	**BCU 6398***	61.9	75.5	16.6	22.5	46.6	41.2	**44.0**
LP-22	**BCU 6400***	13.0	36.3	8.8	4.2	24.9	15.0	**17.0**
LP-23	**BCU 6440***	60.7	73.2	40.6	37.7	64.4	45.5	**53.7**
LP-24	**BCU 6444***	26.0	32.9	8.1	11.2	37.0	12.7	**21.3**
LP-25	**BCU 6477***	91.6	87.7	56.9	NA	87.4	80.8	**80.9**
LP-26	**BCU 6482***	46.4	81.7	33.0	32.4	NA	43.9	**47.5**
LP-27	**DWRUB 64 (c)**	95.2	92.1	83.9	80.7	94.4	90.8	**89.5**
LP-28	**DWRUB 52 (c)**	91.4	87.9	57.5	53.3	88.4	72.5	**75.2**
LP-29	**DWRB 101 (c)**	89.6	89.8	53.9	55.0	87.1	76.4	**75.3**
	Average	**64.2**	**62.2**	**36.8**	**37.8**	**63.3**	**54.4**	

*Hulless barley **Black colored grain

Table 5.4.8: Thin grain percentage of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	3.0	1.9	3.2	9.9	4.4	12.2	**5.8**
LP-2	**BCU 5670****	24.4	26.1	21.1	58.2	14.0	26.1	**28.3**
LP-3	**BCU 5709**	83.5	62.2	64.3	NA	77.7	80.9	**73.7**
LP-4	**BCU 5732**	2.4	1.2	14.0	7.0	1.3	1.3	**4.5**
LP-5	**BCU 5915****	3.4	4.4	9.7	10.0	2.7	0.7	**5.1**
LP-6	**BCU 5924**	5.6	6.7	28.0	14.6	3.9	14.8	**12.3**
LP-7	**BCU 5936**	4.9	4.5	29.9	13.4	4.8	3.3	**10.1**
LP-8	**BCU 5957**	0.7	1.1	4.9	9.6	1.3	0.9	**3.1**
LP-9	**BCU 5968***	11.4	20.1	46.0	60.9	11.2	29.4	**29.8**
LP-10	**BCU 5969***	3.5	12.1	36.9	NA	9.3	8.1	**14.0**
LP-11	**BCU 6040**	0.4	0.3	5.9	2.8	14.5	0.3	**4.0**
LP-12	**BCU 6057****	86.0	79.0	91.4	NA	95.2	88.3	**88.0**
LP-13	**BCU 6151**	9.0	15.0	31.5	37.0	18.6	31.3	**23.7**
LP-14	**BCU 6167**	6.5	9.9	33.6	33.4	11.8	12.5	**17.9**
LP-15	**BCU 6304**	0.7	2.0	4.3	20.5	5.6	1.7	**5.8**
LP-16	**BCU 6306**	2.0	2.6	4.9	15.3	0.6	1.4	**4.5**
LP-17	**BCU 6307**	4.0	4.1	31.9	24.8	2.7	7.4	**12.5**
LP-18	**BCU 6315**	6.4	8.5	37.7	17.2	5.9	10.2	**14.3**
LP-19	**BCU 6316**	3.1	9.1	48.3	30.8	6.4	3.5	**16.8**
LP-20	**BCU 6369**	5.2	6.3	46.5	37.6	13.5	20.9	**21.7**
LP-21	**BCU 6398***	5.5	4.1	39.4	39.7	15.0	13.6	**19.5**
LP-22	**BCU 6400***	28.0	32.5	49.6	79.3	41.2	44.7	**45.9**
LP-23	**BCU 6440***	6.4	3.9	18.3	23.0	5.7	16.0	**12.2**
LP-24	**BCU 6444***	9.8	31.3	65.7	62.9	22.3	52.5	**40.7**
LP-25	**BCU 6477***	0.9	1.6	8.4	NA	1.1	2.8	**3.0**
LP-26	**BCU 6482***	7.9	2.4	30.5	31.9	NA	22.1	**19.0**
LP-27	**DWRUB 64 (c)**	1.1	1.3	3.1	5.4	0.9	1.9	**2.3**
LP-28	**DWRUB 52 (c)**	1.1	0.9	6.1	7.6	1.1	3.5	**3.4**
LP-29	**DWRB 101 (c)**	1.5	0.5	7.4	8.8	1.4	3.4	**3.8**
	Average	**11.3**	**12.3**	**28.4**	**26.5**	**14.1**	**17.8**	

*Hulless barley **Black colored grain

Table 5.4.9: Malt friability (%) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	33	45	27	34	26	41	**34**
LP-2	**BCU 5670****	19	28	16	34	26	33	**26**
LP-3	**BCU 5709**	71	57	40	NA	47	63	**56**
LP-4	**BCU 5732**	41	43	22	32	30	37	**34**
LP-5	**BCU 5915****	55	66	41	65	55	50	**55**
LP-6	**BCU 5924**	49	67	24	73	53	56	**54**
LP-7	**BCU 5936**	42	54	37	61	49	41	**47**
LP-8	**BCU 5957**	56	70	47	70	65	65	**62**
LP-9	**BCU 5968***	81	97	85	98	78	77	**86**
LP-10	**BCU 5969***	87	99	80	50	90	96	**84**
LP-11	**BCU 6040**	58	61	59	84	45	56	**60**
LP-12	**BCU 6057****	71	85	29	NA	55	57	**59**
LP-13	**BCU 6151**	22	28	48	47	75	41	**43**
LP-14	**BCU 6167**	36	47	28	51	90	36	**48**
LP-15	**BCU 6304**	38	38	36	43	56	45	**42**
LP-16	**BCU 6306**	52	76	52	88	61	65	**66**
LP-17	**BCU 6307**	61	83	61	94	32	74	**68**
LP-18	**BCU 6315**	72	92	76	98	41	94	**79**
LP-19	**BCU 6316**	68	82	91	98	90	96	**87**
LP-20	**BCU 6369**	79	97	89	98	91	98	**92**
LP-21	**BCU 6398***	70	85	60	88	84	76	**77**
LP-22	**BCU 6400***	80	93	70	49	77	44	**69**
LP-23	**BCU 6440***	69	59	62	63	69	71	**65**
LP-24	**BCU 6444***	87	97	78	92	75	80	**85**
LP-25	**BCU 6477***	62	81	57	41	88	74	**67**
LP-26	**BCU 6482***	74	72	59	78	NA	72	**71**
LP-27	**DWRUB 64 (c)**	37	55	49	74	59	57	**55**
LP-28	**DWRUB 52 (c)**	66	55	59	78	61	51	**62**
LP-29	**DWRB 101 (c)**	48	54	57	72	66	49	**58**
	Average	**58**	**68**	**53**	**69**	**62**	**62**	

*Hulless barley **Black colored grain

Table 5.4.10: Malt homogeneity (%) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	59.7	79.2	66.7	79.6	59.8	85.7	**71.8**
LP-2	**BCU 5670****	42.9	58.0	37.1	91.9	68.9	70.8	**61.6**
LP-3	**BCU 5709**	98.7	86.7	92.9	NA	95.0	96.2	**93.9**
LP-4	**BCU 5732**	80.7	76.1	65.1	69.2	63.8	73.5	**71.4**
LP-5	**BCU 5915****	87.8	88.3	72.6	95.5	81.6	80.8	**84.5**
LP-6	**BCU 5924**	72.6	86.3	62.2	94.4	77.0	81.3	**79.0**
LP-7	**BCU 5936**	64.3	76.5	80.7	88.0	74.4	81.6	**77.6**
LP-8	**BCU 5957**	76.9	88.9	68.2	92.5	88.9	86.1	**83.6**
LP-9	**BCU 5968***	97.9	97.8	98.0	97.9	96.9	95.4	**97.3**
LP-10	**BCU 5969***	98.5	98.9	96.7	99.4	98.1	98.5	**98.4**
LP-11	**BCU 6040**	93.3	93.0	89.6	98.9	74.3	87.8	**89.5**
LP-12	**BCU 6057****	97.9	98.7	98.3	NA	80.5	94.6	**94.0**
LP-13	**BCU 6151**	45.1	53.6	73.7	82.8	94.1	74.6	**70.7**
LP-14	**BCU 6167**	66.7	76.7	69.8	89.2	98.1	67.8	**78.1**
LP-15	**BCU 6304**	72.0	66.0	65.6	81.7	86.1	69.1	**73.4**
LP-16	**BCU 6306**	80.2	99.7	75.9	98.1	97.6	92.9	**90.7**
LP-17	**BCU 6307**	89.2	99.7	87.8	99.1	66.0	94.2	**89.3**
LP-18	**BCU 6315**	97.3	99.7	96.0	98.8	76.0	99.1	**94.5**
LP-19	**BCU 6316**	97.8	99.0	98.0	99.7	98.5	98.7	**98.6**
LP-20	**BCU 6369**	97.6	99.5	97.7	99.0	98.9	98.8	**98.6**
LP-21	**BCU 6398***	89.8	98.4	93.9	98.9	96.7	94.2	**95.3**
LP-22	**BCU 6400***	93.8	99.2	84.4	99.5	95.6	99.0	**95.3**
LP-23	**BCU 6440***	90.4	85.4	91.6	92.9	87.2	95.4	**90.5**
LP-24	**BCU 6444***	98.3	99.6	96.1	98.8	98.7	93.8	**97.5**
LP-25	**BCU 6477***	92.6	99.2	83.1	98.6	99.1	97.1	**95.0**
LP-26	**BCU 6482***	92.0	97.0	93.4	97.5	NA	97.6	**95.5**
LP-27	**DWRUB 64 (c)**	57.7	75.9	74.1	94.1	78.2	82.4	**77.1**
LP-28	**DWRUB 52 (c)**	90.5	95.8	87.9	97.2	94.0	85.4	**91.8**
LP-29	**DWRB 101 (c)**	82.0	93.3	84.7	97.3	95.0	83.0	**89.2**
	Average	**82.9**	**88.5**	**82.1**	**93.7**	**86.4**	**88.1**	

*Hulless barley **Black colored grain

Table 5.4.11: Wort filtration rate (ml/hr.) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	130	105	285	275	165	320	**213**
LP-2	**BCU 5670****	165	115	80	260	125	315	**177**
LP-3	**BCU 5709**	300	215	285	NA	270	300	**274**
LP-4	**BCU 5732**	325	310	295	315	150	330	**288**
LP-5	**BCU 5915****	170	200	260	300	280	320	**255**
LP-6	**BCU 5924**	335	210	280	250	320	330	**288**
LP-7	**BCU 5936**	330	275	230	300	295	335	**294**
LP-8	**BCU 5957**	295	295	275	305	195	315	**280**
LP-9	**BCU 5968***	315	335	325	330	275	345	**321**
LP-10	**BCU 5969***	280	320	305	280	235	320	**290**
LP-11	**BCU 6040**	320	305	280	290	145	320	**277**
LP-12	**BCU 6057****	285	250	190	NA	285	290	**260**
LP-13	**BCU 6151**	280	260	305	200	280	205	**255**
LP-14	**BCU 6167**	255	290	280	165	250	190	**238**
LP-15	**BCU 6304**	115	105	265	300	310	235	**222**
LP-16	**BCU 6306**	290	305	300	330	186	330	**290**
LP-17	**BCU 6307**	295	295	290	320	110	325	**273**
LP-18	**BCU 6315**	265	275	280	315	130	320	**264**
LP-19	**BCU 6316**	300	295	305	315	220	325	**293**
LP-20	**BCU 6369**	210	305	290	275	250	310	**273**
LP-21	**BCU 6398***	310	280	310	270	270	325	**294**
LP-22	**BCU 6400***	180	290	305	280	245	300	**267**
LP-23	**BCU 6440***	180	200	295	295	255	295	**253**
LP-24	**BCU 6444***	310	320	310	310	200	320	**295**
LP-25	**BCU 6477***	305	320	315	220	325	325	**302**
LP-26	**BCU 6482***	265	300	320	295	NA	315	**299**
LP-27	**DWRUB 64 (c)**	315	250	260	180	275	315	**266**
LP-28	**DWRUB 52 (c)**	320	320	320	210	300	325	**299**
LP-29	**DWRB 101 (c)**	330	215	310	190	255	320	**270**
	Average	**268**	**261**	**281**	**273**	**236**	**308**	

*Hulless barley **Black colored grain

Table 5.4.12: Malt Diastatic power (°L) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	52	62	62	96	68	111	**75**
LP-2	**BCU 5670****	79	94	86	100	109	106	**96**
LP-3	**BCU 5709**	109	111	98	NA	111	102	**106**
LP-4	**BCU 5732**	104	100	114	98	109	96	**103**
LP-5	**BCU 5915****	82	104	102	109	106	89	**99**
LP-6	**BCU 5924**	109	111	109	104	109	104	**108**
LP-7	**BCU 5936**	111	109	114	116	111	94	**109**
LP-8	**BCU 5957**	116	111	111	111	104	106	**110**
LP-9	**BCU 5968***	100	109	119	100	109	104	**107**
LP-10	**BCU 5969***	106	100	111	109	111	109	**108**
LP-11	**BCU 6040**	104	111	111	119	104	98	**108**
LP-12	**BCU 6057****	106	109	NA	NA	111	111	**109**
LP-13	**BCU 6151**	106	89	102	100	109	109	**103**
LP-14	**BCU 6167**	76	98	106	104	119	100	**101**
LP-15	**BCU 6304**	94	106	116	106	116	109	**108**
LP-16	**BCU 6306**	109	109	119	109	104	106	**109**
LP-17	**BCU 6307**	106	109	114	111	109	98	**108**
LP-18	**BCU 6315**	104	111	111	106	100	100	**105**
LP-19	**BCU 6316**	100	104	119	104	109	111	**108**
LP-20	**BCU 6369**	98	100	114	106	111	109	**106**
LP-21	**BCU 6398***	109	109	119	116	116	116	**114**
LP-22	**BCU 6400***	100	109	100	111	106	122	**108**
LP-23	**BCU 6440***	106	111	111	111	109	109	**110**
LP-24	**BCU 6444***	100	116	109	109	111	109	**109**
LP-25	**BCU 6477***	104	109	106	109	109	106	**107**
LP-26	**BCU 6482***	106	116	114	111	NA	111	**112**
LP-27	**DWRUB 64 (c)**	66	89	102	109	98	106	**95**
LP-28	**DWRUB 52 (c)**	40	55	72	79	59	96	**67**
LP-29	**DWRB 101 (c)**	47	59	65	62	68	100	**67**
	Average	**95**	**101**	**105**	**105**	**104**	**105**	

*Hulless barley **Black colored grain

Table 5.4.13: Hot water extract (%fgdw) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	71.1	69.2	66.3	71.6	67.8	70.1	**69.4**
LP-2	**BCU 5670****	66.1	73.1	84.3	70.4	75.7	73.4	**73.8**
LP-3	**BCU 5709**	68.7	72.6	71.1	NA	69.2	74.4	**71.2**
LP-4	**BCU 5732**	75.5	73.8	72.8	75.0	77.1	77.8	**75.3**
LP-5	**BCU 5915****	78.3	80.9	79.1	76.0	85.3	83.6	**80.5**
LP-6	**BCU 5924**	76.5	81.4	80.4	75.2	81.7	75.3	**78.4**
LP-7	**BCU 5936**	76.5	72.8	78.9	70.4	79.2	84.1	**77.0**
LP-8	**BCU 5957**	79.9	75.5	77.4	76.2	79.0	51.6	**73.3**
LP-9	**BCU 5968***	81.8	79.9	84.3	83.6	86.2	86.0	**83.6**
LP-10	**BCU 5969***	76.0	80.6	80.1	76.5	83.4	86.7	**80.6**
LP-11	**BCU 6040**	76.7	72.6	77.9	75.5	71.9	82.6	**76.2**
LP-12	**BCU 6057****	75.7	76.2	79.4	NA	81.0	86.0	**79.7**
LP-13	**BCU 6151**	72.8	70.6	77.7	74.0	83.9	84.3	**77.2**
LP-14	**BCU 6167**	72.6	68.0	74.3	76.0	83.8	86.3	**76.8**
LP-15	**BCU 6304**	73.1	71.4	73.8	64.2	79.1	84.3	**74.3**
LP-16	**BCU 6306**	76.5	80.6	79.6	77.4	77.7	76.5	**78.1**
LP-17	**BCU 6307**	81.4	81.8	85.3	81.8	71.5	76.8	**79.8**
LP-18	**BCU 6315**	85.8	80.6	79.4	83.8	72.1	77.5	**79.9**
LP-19	**BCU 6316**	86.3	81.4	82.3	80.6	81.0	79.4	**81.8**
LP-20	**BCU 6369**	80.9	81.8	79.9	79.4	81.0	77.3	**80.0**
LP-21	**BCU 6398***	83.6	78.2	79.4	80.1	85.1	79.0	**80.9**
LP-22	**BCU 6400***	86.5	82.3	83.8	84.8	83.6	83.8	**84.1**
LP-23	**BCU 6440***	83.8	68.5	77.4	81.1	76.7	77.5	**77.5**
LP-24	**BCU 6444***	83.3	77.9	80.9	87.0	85.0	85.8	**83.3**
LP-25	**BCU 6477***	79.1	73.8	75.2	74.8	75.5	79.0	**76.2**
LP-26	**BCU 6482***	84.8	73.1	80.1	79.4	NA	79.4	**79.4**
LP-27	**DWRUB 64 (c)**	78.4	73.1	75.5	78.4	82.1	74.4	**77.0**
LP-28	**DWRUB 52 (c)**	85.0	74.0	76.5	78.4	80.4	77.8	**78.7**
LP-29	**DWRB 101 (c)**	75.2	74.0	79.1	76.7	76.7	74.1	**76.0**
	Average	**78.3**	**75.9**	**78.4**	**77.3**	**79.0**	**78.8**	

*Hulless barley **Black colored grain

Table 5.4.14: Wort free amino nitrogen (ppm) of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	75	185	114	127	92	138	**122**
LP-2	**BCU 5670****	83	143	105	194	82	142	**125**
LP-3	**BCU 5709**	332	170	384	NA	219	304	**282**
LP-4	**BCU 5732**	121	145	197	114	76	126	**130**
LP-5	**BCU 5915****	139	193	174	177	122	136	**157**
LP-6	**BCU 5924**	89	169	137	144	94	123	**126**
LP-7	**BCU 5936**	110	169	201	145	103	113	**140**
LP-8	**BCU 5957**	139	171	173	232	162	170	**174**
LP-9	**BCU 5968***	118	177	207	217	139	168	**171**
LP-10	**BCU 5969***	160	92	305	236	175	209	**196**
LP-11	**BCU 6040**	125	78	175	188	104	142	**135**
LP-12	**BCU 6057****	159	55	178	NA	139	157	**138**
LP-13	**BCU 6151**	92	125	141	86	180	117	**123**
LP-14	**BCU 6167**	89	114	158	98	144	92	**116**
LP-15	**BCU 6304**	102	211	177	126	142	124	**147**
LP-16	**BCU 6306**	147	167	161	223	129	170	**166**
LP-17	**BCU 6307**	129	151	194	231	76	183	**161**
LP-18	**BCU 6315**	177	106	212	175	59	181	**152**
LP-19	**BCU 6316**	169	120	234	197	170	186	**179**
LP-20	**BCU 6369**	192	124	274	225	146	203	**194**
LP-21	**BCU 6398***	122	106	221	227	169	189	**172**
LP-22	**BCU 6400***	161	217	165	224	173	208	**191**
LP-23	**BCU 6440***	146	86	204	229	169	189	**170**
LP-24	**BCU 6444***	146	88	216	253	197	191	**182**
LP-25	**BCU 6477***	143	188	173	154	160	164	**164**
LP-26	**BCU 6482***	183	187	262	225	NA	200	**211**
LP-27	**DWRUB 64 (c)**	112	105	121	139	109	120	**118**
LP-28	**DWRUB 52 (c)**	175	189	142	193	144	177	**170**
LP-29	**DWRB 101 (c)**	182	192	188	123	155	191	**172**
	Average	**142**	**146**	**193**	**182**	**137**	**166**	

*Hulless barley **Black colored grain

Table 5.4.15: Wort pH of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	6.0	6.0	5.8	5.9	5.8	5.9	**5.9**
LP-2	**BCU 5670****	6.0	6.0	5.8	5.9	5.9	5.9	**5.9**
LP-3	**BCU 5709**	5.9	5.9	5.7	NA	5.9	5.8	**5.8**
LP-4	**BCU 5732**	5.9	5.9	5.8	5.9	5.9	5.9	**5.9**
LP-5	**BCU 5915****	5.8	5.9	5.8	5.9	5.9	5.9	**5.9**
LP-6	**BCU 5924**	5.9	5.9	5.7	5.9	5.9	5.9	**5.9**
LP-7	**BCU 5936**	5.9	6.0	5.8	5.9	5.9	6.0	**5.9**
LP-8	**BCU 5957**	5.9	5.9	5.9	5.8	5.9	5.9	**5.9**
LP-9	**BCU 5968***	6.0	5.9	5.9	5.7	5.9	5.9	**5.9**
LP-10	**BCU 5969***	5.9	5.9	5.8	5.9	5.9	5.9	**5.9**
LP-11	**BCU 6040**	5.8	5.9	5.8	5.8	6.0	5.8	**5.8**
LP-12	**BCU 6057****	5.9	5.9	5.8	NA	5.8	5.9	**5.9**
LP-13	**BCU 6151**	6.0	6.0	5.7	6.0	5.9	5.9	**5.9**
LP-14	**BCU 6167**	6.0	6.0	5.8	6.0	5.9	6.0	**6.0**
LP-15	**BCU 6304**	6.0	6.1	5.8	6.0	5.7	6.0	**5.9**
LP-16	**BCU 6306**	5.9	5.9	5.9	5.8	5.8	5.9	**5.8**
LP-17	**BCU 6307**	6.0	6.0	6.0	5.8	5.9	5.9	**5.9**
LP-18	**BCU 6315**	6.0	6.0	6.0	5.9	6.0	5.9	**6.0**
LP-19	**BCU 6316**	6.0	6.0	6.0	5.8	5.9	5.9	**5.9**
LP-20	**BCU 6369**	5.9	5.8	5.9	5.9	5.9	5.9	**5.9**
LP-21	**BCU 6398***	6.0	6.0	6.0	5.8	5.9	5.9	**5.9**
LP-22	**BCU 6400***	5.9	5.9	5.9	5.8	5.9	5.9	**5.9**
LP-23	**BCU 6440***	6.0	6.0	5.9	5.8	5.8	5.9	**5.9**
LP-24	**BCU 6444***	6.0	5.9	5.9	5.8	NA	5.9	**5.9**
LP-25	**BCU 6477***	6.0	6.0	6.0	5.8	5.8	6.0	**5.9**
LP-26	**BCU 6482***	5.8	5.9	5.8	5.8	6.0	5.9	**5.9**
LP-27	**DWRUB 64 (c)**	5.9	6.1	5.9	5.9	6.0	6.0	**6.0**
LP-28	**DWRUB 52 (c)**	5.8	5.8	5.9	5.9	5.9	5.8	**5.8**
LP-29	**DWRB 101 (c)**	5.8	5.8	5.8	5.8	5.9	5.8	**5.8**
	Average	**5.9**	**5.9**	**5.9**	**5.9**	**5.9**	**5.9**	

*Hulless barley **Black colored grain

Table 5.4.16: Wort saccharification rate of genotypes from different locations

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
LP-1	**BCU 5595**	5.0	5.0	10.0	5.0	5.0	5.0	**5.8**
LP-2	**BCU 5670****	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-3	**BCU 5709**	10.0	10.0	10.0	5.0	5.0	5.0	**7.5**
LP-4	**BCU 5732**	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-5	**BCU 5915****	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-6	**BCU 5924**	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-7	**BCU 5936**	10.0	5.0	5.0	5.0	5.0	5.0	**5.8**
LP-8	**BCU 5957**	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-9	**BCU 5968***	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-10	**BCU 5969***	10.0	10.0	5.0	10.0	5.0	10.0	**8.3**
LP-11	**BCU 6040**	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-12	**BCU 6057****	5.0	5.0	10.0	5.0	10.0	5.0	**6.7**
LP-13	**BCU 6151**	5.0	5.0	5.0	5.0	10.0	5.0	**5.8**
LP-14	**BCU 6167**	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-15	**BCU 6304**	10.0	10.0	5.0	5.0	5.0	5.0	**6.7**
LP-16	**BCU 6306**	5.0	10.0	5.0	5.0	5.0	10.0	**6.7**
LP-17	**BCU 6307**	5.0	5.0	5.0	5.0	5.0	10.0	**5.8**
LP-18	**BCU 6315**	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-19	**BCU 6316**	5.0	5.0	10.0	5.0	5.0	5.0	**5.8**
LP-20	**BCU 6369**	10.0	10.0	10.0	5.0	5.0	5.0	**7.5**
LP-21	**BCU 6398***	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-22	**BCU 6400***	5.0	10.0	5.0	10.0	5.0	10.0	**7.5**
LP-23	**BCU 6440***	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
LP-24	**BCU 6444***	5.0	10.0	5.0	10.0	10.0	5.0	**7.5**
LP-25	**BCU 6477***	5.0	5.0	10.0	5.0	10.0	5.0	**6.7**
LP-26	**BCU 6482***	5.0	10.0	5.0	5.0	NA	10.0	**7.0**
LP-27	**DWRUB 64 (c)**	10.0	5.0	5.0	5.0	5.0	5.0	**5.8**
LP-28	**DWRUB 52 (c)**	5.0	5.0	5.0	5.0	5.0	10.0	**5.8**
LP-29	**DWRB 101 (c)**	5.0	5.0	5.0	5.0	10.0	10.0	**6.7**
	Average	**6.0**	**6.4**	**6.0**	**5.5**	**5.9**	**6.2**	

*Hulless barley **Black colored grain

BQSN 2: Marker Assisted Molecular Breeding for low grain beta glucan

Table 5.5.1: Beta glucan (% dwb) in grains of different genotypes from different locations

Code	Genotype	Durgapura	Karnal	Hisar	Kanpur	Ludhiana	Pantnagar	Mean
MB-1	RMB2101	4.6	5.9	4.5	5.2	5.7	5.4	**5.2**
MB-2	RMB2102	4.3	4.5	4.6	4.3	5.6	5.4	**4.8**
MB-3	RMB2103	3.7	3.9	3.2	3.5	4.1	4.0	**3.7**
MB-4	RMB2104	3.9	4.8	4.0	4.3	4.1	3.8	**4.1**
MB-5	DWR37 ©	4.3	4.5	4.5	4.3	4.4	5.4	**4.6**
MB-6	DWR39 ©*	NA	NA	NA	NA	NA	NA	**NA**
	Average	**4.2**	**4.7**	**4.2**	**4.3**	**4.8**	**4.8**	

**Not Analyzed because of observation of few off type plants in field*

Table 5.5.2: Protein content (% dwb) in grains of different genotypes from different locations#

Code	Genotype	Durgapura	Karnal	Hisar	Kanpur	Ludhiana	Pantnagar	Mean
MB-1	RMB2101	12.1	14.0	11.4	12.0	9.7	10.1	**11.6**
MB-2	RMB2102	12.0	14.3	10.2	11.0	9.8	9.9	**11.2**
MB-3	RMB2103	11.6	14.2	8.9	11.1	10.2	9.1	**10.9**
MB-4	RMB2104	12.0	13.8	9.7	10.4	10.1	9.6	**10.9**
MB-5	DWR37 ©	14.1	16.5	9.9	11.5	10.2	12.0	**12.4**
MB-6	DWR39 ©*	NA	NA	NA	NA	NA	NA	**NA**
	Average	**12.4**	**14.6**	**10.0**	**11.2**	**10.0**	**10.1**	

**Not Analyzed because of observation of few off type plants in field #Predicted values through NIR*

Table 5.5.3: Starch content (% dwb) in grains of different genotypes from different locations#

Code	Genotype	Durgapura	Karnal	Hisar	Kanpur	Ludhiana	Pantnagar	Mean
MB-1	RMB2101	65.3	61.1	61.5	62.2	63.8	63.7	**62.9**
MB-2	RMB2102	66.5	61.4	61.5	62.5	64.1	64.1	**63.4**
MB-3	RMB2103	64.5	61.4	61.8	64.4	61.5	63.8	**62.9**
MB-4	RMB2104	65.4	61.6	61.2	63.5	63.7	63.4	**63.1**
MB-5	DWR37 ©	63.6	59.9	61.7	64.0	63.5	65.3	**63.0**
MB-6	DWR39 ©*	NA	NA	NA	NA	NA	NA	**NA**
	Average	**65.1**	**61.1**	**61.5**	**63.3**	**63.3**	**64.1**	

**Not Analyzed because of observation of few off type plants in field #Predicted values through NIR*

BQSN 3: Hulless Genotypes

Table 5.6.1: Beta glucan content (% dwb) in different genotypes at different locations

Code	Genotype	Karnal	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	6.7	5.4	6.2	4.2	6.2	5.5	**5.7**
NB-2	HLR-24	5.8	4.8	5.6	4.7	5.7	5.7	**5.4**
NB-3	HLR-34	5.3	5.4	5.7	5.1	5.7	5.8	**5.5**
NB-4	HLR-64	4.4	4.9	5.4	5.0	6.5	4.3	**5.1**
NB-5	HLR-90	6.8	6.4	6.8	6.1	7.0	5.6	**6.4**
NB-6	HLR-136	5.6	5.6	6.1	6.3	7.1	5.3	**6.0**
NB-7	HLR-153	5.9	5.9	5.9	4.8	6.5	5.3	**5.7**
NB-8	HLR-196	5.3	5.1	4.9	4.6	5.2	5.4	**5.1**
NB-10	HLR-240	6.3	6.1	6.1	6.4	6.6	5.2	**6.1**
NB-11	HLR-310	7.4	5.5	6.0	4.6	6.3	5.4	**5.9**
NB-12	HLR-322	6.3	5.0	5.0	5.2	5.7	4.7	**5.3**
NB-13	HLR-355	6.6	5.6	5.7	4.7	6.2	3.6	**5.4**
NB-14	Karan-16 ©	5.2	5.2	6.3	5.5	NA	4.5	**5.3**
NB-15	NDB-943 ©	5.6	5.1	5.9	5.8	5.6	4.5	**5.4**
NB-16	PL-891 ©	5.8	5.2	6.3	6.2	6.5	5.1	**5.9**
	Average	**5.9**	**5.4**	**5.9**	**5.3**	**6.2**	**5.1**	

Table 5.6.2: Protein content (% dwb) in different genotypes at different locations#

Code	Genotype	Karnal*	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	18.3	12.1	11.6	13.8	15.5	13.2	13.2
NB-2	HLR-24	17.0	14.8	12.8	14.7	14.1	14.3	14.1
NB-3	HLR-34	17.1	14.6	13.5	14.6	NA	13.2	14.0
NB-4	HLR-64	16.9	12.0	13.1	12.9	12.7	12.3	12.6
NB-5	HLR-90	15.9	11.2	12.1	11.2	10.5	11.7	11.3
NB-6	HLR-136	17.7	15.1	13.6	12.2	14.3	17.9	14.6
NB-7	HLR-153	18.0	12.5	11.9	9.2	11.1	13.2	11.6
NB-8	HLR-196	15.0	12.2	10.3	11.6	12.8	14.7	12.3
NB-10	HLR-240	19.2	12.1	11.9	11.0	10.7	14.1	12.0
NB-11	HLR-310	18.5	11.0	13.6	10.4	14.4	13.6	12.6
NB-12	HLR-322	17.5	10.6	11.7	11.0	10.3	13.3	11.4
NB-13	HLR-355	19.9	9.2	13.3	11.3	11.6	12.7	11.6
NB-14	Karan-16 ©	16.5	10.4	11.1	10.3	NA	10.8	10.7
NB-15	NDB-943 ©	17.3	12.1	11.7	11.3	11.3	12.5	11.8
NB-16	PL-891 ©	14.7	11.1	10.0	12.4	12.8	11.7	11.6
	Average	**17.3**	**12.1**	**12.1**	**11.9**	**12.5**	**13.3**	

#Predicted values through Near Infrared Reflectance Instrument *Not included in mean due to abnormally higher values only at one location

Table 5.6.3: Starch content (% dwb) in different genotypes at different locations#

Code	Genotype	Karnal	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	58.3	64.4	65.9	63.0	61.6	63.4	**62.8**
NB-2	HLR-24	61.6	63.7	66.4	66.8	63.4	63.4	**64.2**
NB-3	HLR-34	60.9	62.4	64.2	66.0	NA	65.3	**63.8**
NB-4	HLR-64	61.7	66.0	65.8	67.7	65.3	66.5	**65.5**
NB-5	HLR-90	61.2	65.2	65.2	67.6	66.2	67.0	**65.4**
NB-6	HLR-136	58.0	60.5	59.4	64.6	57.5	58.5	**59.8**
NB-7	HLR-153	58.7	64.2	65.5	70.3	65.4	64.4	**64.8**
NB-8	HLR-196	62.2	65.2	71.0	69.5	65.0	63.0	**66.0**
NB-10	HLR-240	58.7	63.7	65.1	69.1	66.2	64.0	**64.5**
NB-11	HLR-310	58.7	65.2	63.7	69.6	65.7	63.5	**64.4**
NB-12	HLR-322	60.5	66.7	66.9	70.4	63.1	64.9	**65.4**
NB-13	HLR-355	57.3	66.9	64.4	68.1	64.9	64.2	**64.3**
NB-14	Karan-16 ©	59.3	61.4	63.6	68.8	NA	64.5	**63.5**
NB-15	NDB-943 ©	59.7	59.7	65.5	68.3	60.5	64.2	**63.0**
NB-16	PL-891 ©	61.0	60.0	64.6	66.8	62.9	64.5	**63.3**
	Average	**59.9**	**63.7**	**65.1**	**67.8**	**63.7**	**64.1**	

#Predicted values through Near Infrared Reflectance Instrument

Table 5.6.4: Thousand grain weight in different genotypes at different locations

Code	Genotype	Karnal	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	32.9	34.5	28.0	29.5	34.0	34.0	**32.2**
NB-2	HLR-24	28.0	29.4	27.4	29.5	30.7	31.3	**29.4**
NB-3	HLR-34	19.0	25.5	22.4	25.6	19.2	28.1	**23.3**
NB-4	HLR-64	27.6	30.3	22.6	32.1	32.0	29.4	**29.0**
NB-5	HLR-90	28.4	31.7	22.9	31.2	52.0	26.6	**32.1**
NB-6	HLR-136	33.6	31.0	47.2	37.9	26.8	31.7	**34.7**
NB-7	HLR-153	27.0	28.9	21.2	33.7	48.4	30.0	**31.5**
NB-8	HLR-196	20.0	21.5	19.2	28.4	41.1	23.7	**25.6**
NB-10	HLR-240	31.4	36.9	26.1	39.2	36.4	34.1	**34.0**
NB-11	HLR-310	28.6	27.8	21.6	29.6	27.3	28.7	**27.3**
NB-12	HLR-322	27.6	32.2	27.7	33.0	48.6	33.5	**33.8**
NB-13	HLR-355	21.6	31.1	20.1	28.0	49.6	33.9	**30.7**
NB-14	Karan-16 ©	32.5	35.6	27.8	39.4	NA	33.2	**33.7**
NB-15	NDB-943 ©	30.9	38.4	27.4	39.1	32.7	35.7	**34.1**
NB-16	PL-891 ©	39.6	45.9	35.9	47.5	51.8	42.1	**43.8**
	Average	**28.6**	**32.0**	**26.5**	**33.6**	**37.9**	**31.7**	

Table 5.6.5: Bold grain percentage (≥ 2.5 mm) in different genotypes at different locations

Code	Genotype	Karnal	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	7.4	23.8	NA	8.6	NA	20.6	**15.1**
NB-2	HLR-24	1.8	3.2	2.5	6.2	16.2	9.9	**6.6**
NB-3	HLR-34	NA	NA	NA	1.6	NA	10.4	**6.0**
NB-4	HLR-64	4.1	7.1	1.2	10.9	21.4	3.7	**8.1**
NB-5	HLR-90	4.4	9.0	2.1	13.1	18.4	2.2	**8.2**
NB-6	HLR-136	10.8	9.5	NA	24.9	NA	13.1	**14.6**
NB-7	HLR-153	2.1	1.3	1.5	2.1	2.2	1.2	**1.7**
NB-8	HLR-196	1.6	1.8	NA	6.7	4.3	2.3	**3.3**
NB-10	HLR-240	29.9	42.0	NA	52.9	40.5	31.9	**39.4**
NB-11	HLR-310	2.0	0.9	1.4	2.3	1.1	1.0	**1.5**
NB-12	HLR-322	10.6	11.4	2.8	19.0	94.3	9.8	**24.7**
NB-13	HLR-355	NA	6.0	NA	8.8	73.4	11.4	**24.9**
NB-14	Karan-16 ©	27.3	43.1	30.8	36.9	NA	34.2	**34.4**
NB-15	NDB-943 ©	29.6	67.4	23.5	38.8	60.1	35.8	**42.5**
NB-16	PL-891 ©	39.9	68.4	35.9	72.8	67.1	33.3	**52.9**
	Average	**13.2**	**21.1**	**11.3**	**20.4**	**36.3**	**14.7**	

Table 5.6.6: Thin grain percentage (≤ 2.2 mm) in different genotypes at different locations

Code	Genotype	Karnal	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	44.8	37.0	NA	61.6	NA	42.1	**46.4**
NB-2	HLR-24	58.5	51.2	61.9	39.1	25.6	37.8	**45.7**
NB-3	HLR-34	NA	NA	NA	56.3	NA	60.3	**58.3**
NB-4	HLR-64	52.6	32.5	74.3	25.4	21.8	45.9	**42.1**
NB-5	HLR-90	61.4	53.2	78.3	51.6	39.9	75.2	**59.9**
NB-6	HLR-136	41.5	46.4	NA	13.8	NA	45.2	**36.7**
NB-7	HLR-153	81.5	77.8	92.6	50.1	84.3	82.3	**78.1**
NB-8	HLR-196	79.9	83.2	NA	40.4	79.4	74.3	**71.4**
NB-10	HLR-240	25.1	14.3	NA	11.0	13.0	21.0	**16.9**
NB-11	HLR-310	78.4	89.9	90.1	67.9	86.4	80.9	**82.3**
NB-12	HLR-322	58.7	40.0	51.6	17.6	1.8	22.7	**32.0**
NB-13	HLR-355	NA	62.6	NA	59.6	49.4	52.5	**56.0**
NB-14	Karan-16 ©	31.8	37.5	29.6	15.2	NA	23.7	**27.6**
NB-15	NDB-943 ©	26.3	6.4	33.5	8.5	19.4	6.3	**16.7**
NB-16	PL-891 ©	17.7	8.5	21.3	4.2	10.2	15.8	**13.0**
	Average	**50.6**	**45.8**	**59.2**	**34.8**	**39.2**	**45.7**	

Table 5.6.7: Hectoliter weight (kg/hl) in different genotypes at different locations

Code	Genotype	Karnal	Hisar	Ludhiana	Durgapura	Pantnagar	Kanpur	Mean
NB-1	HLR-10	73.2	73.4	NA	70.8	72.6	70.9	**72.2**
NB-2	HLR-24	74.6	72.7	75.6	76.8	73.9	73.2	**74.5**
NB-3	HLR-34	73.0	NA	NA	76.1	NA	72.8	**74.0**
NB-4	HLR-64	74.3	74.4	71.7	77.9	77.7	75.5	**75.3**
NB-5	HLR-90	70.6	69.0	72.2	76.1	73.3	73.3	**72.4**
NB-6	HLR-136	75.4	72.2	NA	77.4	NA	72.8	**74.4**
NB-7	HLR-153	70.3	66.9	70.9	76.2	72.9	73.5	**71.8**
NB-8	HLR-196	71.0	69.7	73.6	78.5	71.3	72.2	**72.7**
NB-10	HLR-240	72.1	70.8	NA	77.6	73.2	73.5	**73.4**
NB-11	HLR-310	70.6	69.1	71.6	75.9	72.5	72.6	**72.0**
NB-12	HLR-322	74.5	74.2	75.8	80.1	62.3	77.2	**74.0**
NB-13	HLR-355	NA	72.1	NA	74.4	73.4	75.4	**73.9**
NB-14	Karan-16 ©	68.9	58.5	66.1	79.9	NA	59.1	**66.5**
NB-15	NDB-943 ©	61.9	55.6	66.4	81.3	60.1	59.3	**64.1**
NB-16	PL-891 ©	54.1	51.8	64.9	77.2	67.1	59.5	**62.4**
	Average	**70.3**	**67.9**	**70.9**	**77.1**	**70.8**	**70.7**	

BQSN 4: Malt Barley Genotypes for higher Protein Content

Table 5.7.1: Protein content (% dwb) in different genotypes at different locations#

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
M-1	**MBGS-21/1**	10.8	10.3	15.3	12.4	10.0	11.3	**11.7**
M-2	**MBGS-21/2**	9.9	9.5	15.2	11.7	10.1	10.4	**11.1**
M-3	**MBGS-21/3**	9.7	9.4	13.8	11.8	10.0	10.6	**10.9**
M-4	**MBGS-21/4**	10.3	10.4	13.2	12.0	10.1	10.7	**11.1**
M-5	**MBGS-21/5**	9.7	11.1	15.5	12.6	8.7	10.2	**11.3**
M-6	**MBGS-21/6**	9.4	11.2	15.0	12.1	9.5	10.2	**11.2**
M-7	**MBGS-21/7**	10.9	10.7	14.7	11.4	11.5	12.3	**11.9**
M-8	**PL 930**	12.2	11.1	16.1	12.5	12.0	12.9	**12.8**
M-9	**RD 3028**	12.1	12.6	15.9	12.5	12.3	13.5	**13.2**
M-10	**UPB 1097**	11.3	11.6	15.3	11.2	11.8	11.5	**12.1**
M-11	**PL 931**	10.4	10.9	15.0	11.2	11.6	12.3	**11.9**
M-12	**BH 1034**	10.5	10.7	16.0	11.1	10.9	13.6	**12.1**
M-13	**BH 1036**	11.8	12.5	15.0	11.9	11.2	12.4	**12.5**
M-14	**RD 3027**	10.2	9.9	15.1	12.2	11.0	12.6	**11.8**
M-15	**BH 1035**	10.5	10.0	16.7	14.0	9.4	14.1	**12.5**
M-16	**RD 3029**	11.5	11.3	16.1	12.7	10.7	14.0	**12.7**
M-17	**RD 3030**	11.7	12.5	15.1	12.3	11.4	14.8	**13.0**
MB-7	**RMB2105**	9.8	7.9	14.4	10.8	9.8	11.7	**10.7**
MB-8	**RMB2106**	9.9	10.7	14.0	10.3	9.8	10.7	**10.9**
MB-9	**RMB2107**	11.3	10.9	15.0	12.0	10.8	11.8	**12.0**
MB-10	**RMB2108**	9.9	9.4	13.6	10.7	10.4	11.8	**11.0**
MB-11	**BK-1127 ©**	12.0	11.9	16.6	15.3	12.9	12.2	**13.5**
MB-12	**RMB2109**	9.3	10.5	13.4	11.4	9.3	14.0	**11.3**
MB-13	**RMB2110**	9.4	11.2	13.0	12.1	9.2	11.4	**11.1**
MB-14	**RMB2111**	10.0	11.4	13.3	11.4	10.1	12.7	**11.5**
MB-15	**RMB2112**	10.5	10.6	14.6	12.3	11.4	13.1	**12.1**
MB-16	**RMB2113**	10.7	11.8	15.0	12.1	9.0	13.3	**12.0**
MB-17	**RMB2114**	11.0	11.4	13.9	12.4	9.7	12.8	**11.9**
Average		**10.6**	**10.8**	**14.9**	**12.0**	**10.5**	**12.2**	

#Predicted values through Near Infrared Reflectance Instrument

Table 5.7.2: Starch content (% dwb) in different genotypes at different locations#

Code	Genotype	Durgapura	Hisar	Karnal	Ludhiana	Pantnagar	Kanpur	Mean
M-1	**MBGS-21/1**	64.8	61.5	61.9	62.2	64.6	63.6	**63.1**
M-2	**MBGS-21/2**	66.3	61.5	59.6	61.7	62.5	63.3	**62.5**
M-3	**MBGS-21/3**	66.0	61.8	60.9	62.7	63.2	63.4	**63.0**
M-4	**MBGS-21/4**	64.7	61.2	61.0	61.4	61.5	61.7	**61.9**
M-5	**MBGS-21/5**	66.4	61.7	60.7	62.0	63.6	64.2	**63.1**
M-6	**MBGS-21/6**	65.3	62.4	60.0	61.0	63.1	63.4	**62.5**
M-7	**MBGS-21/7**	65.1	61.3	60.3	62.6	61.6	61.5	**62.1**
M-8	**PL 930**	65.8	61.0	59.6	61.9	64.3	63.6	**62.7**
M-9	**RD 3028**	63.9	59.6	58.6	62.6	62.4	61.4	**61.4**
M-10	**UPB 1097**	63.7	62.0	59.8	61.9	62.5	63.1	**62.2**
M-11	**PL 931**	66.5	59.4	60.2	62.7	61.8	63.0	**62.3**
M-12	**BH 1034**	66.6	59.8	60.1	63.1	63.4	62.0	**62.5**
M-13	**BH 1036**	65.4	61.3	60.8	62.5	61.5	62.1	**62.3**
M-14	**RD 3027**	66.3	60.7	60.4	62.1	62.1	61.3	**62.2**
M-15	**BH 1035**	66.3	60.5	60.0	61.7	61.1	60.4	**61.7**
M-16	**RD 3029**	65.6	60.2	59.5	61.1	61.1	61.5	**61.5**
M-17	**RD 3030**	63.4	60.9	60.1	62.3	62.5	60.8	**61.7**
MB-7	**RMB2105**	65.7	61.3	60.4	63.4	62.2	63.5	**62.8**
MB-8	**RMB2106**	67.9	61.0	61.2	64.6	63.2	65.5	**63.9**
MB-9	**RMB2107**	64.4	59.6	59.9	61.6	62.9	63.6	**62.0**
MB-10	**RMB2108**	66.9	62.0	61.2	63.7	63.3	64.8	**63.7**
MB-11	**BK-1127 ©**	61.2	59.4	59.0	60.1	61.2	64.5	**60.9**
MB-12	**RMB2109**	66.8	59.8	61.5	62.6	64.5	61.8	**62.8**
MB-13	**RMB2110**	67.1	61.3	61.4	62.0	63.3	63.9	**63.2**
MB-14	**RMB2111**	66.4	60.7	62.9	63.5	62.2	62.9	**63.1**
MB-15	**RMB2112**	63.7	60.5	60.5	62.3	63.0	62.8	**62.1**
MB-16	**RMB2113**	66.0	60.2	60.7	62.0	63.7	63.0	**62.6**
MB-17	**RMB2114**	65.2	60.9	61.0	62.5	63.1	61.6	**62.4**
Average		**65.5**	**60.8**	**60.5**	**62.3**	**62.7**	**62.8**	

#Predicted values through Near Infrared Reflectance Instrument

Table 5.7.3: Test weight/Hectoliter weight kg/hl) in different genotypes at different locations

Code	Genotype	**Durgapura**	**Hisar**	**Karnal**	**Ludhiana**	**Pantnagar**	**Kanpur**	**Mean**
M-1	MBGS-21/1	70	59	65	59	66	57	**63**
M-2	MBGS-21/2	69	60	58	58	63	65	**62**
M-3	MBGS-21/3	70	62	62	61	66	66	**64**
M-4	MBGS-21/4	70	62	65	59	61	65	**64**
M-5	MBGS-21/5	71	64	64	62	64	66	**65**
M-6	MBGS-21/6	71	61	58	54	61	69	**62**
M-7	MBGS-21/7	69	63	66	65	63	65	**65**
M-8	PL 930	70	64	61	60	65	68	**65**
M-9	RD 3028	69	61	61	64	63	69	**64**
M-10	UPB 1097	71	62	62	59	66	70	**65**
M-11	PL 931	70	62	62	61	65	69	**65**
M-12	BH 1034	68	61	60	61	62	68	**63**
M-13	BH 1036	68	60	61	60	63	69	**63**
M-14	RD 3027	69	59	59	59	62	69	**63**
M-15	BH 1035	68	58	61	60	63	69	**63**
M-16	RD 3029	68	59	60	58	56	70	**62**
M-17	RD 3030	70	59	65	65	65	68	**65**
MB-7	RMB2105	70	61	62	62	59	65	**63**
MB-8	RMB2106	74	64	65	66	68	69	**67**
MB-9	RMB2107	70	63	61	64	NA	69	**65**
MB-10	RMB2108	71	73	65	66	66	71	**69**
MB-11	BK-1127 ©	67	61	63	62	68	70	**65**
MB-12	RMB2109	71	63	65	61	66	68	**66**
MB-13	RMB2110	70	63	63	62	66	69	**66**
MB-14	RMB2111	72	61	69	66	63	69	**67**
MB-15	RMB2112	70	64	65	65	66	69	**66**
MB-16	RMB2113	71	62	65	65	66	71	**67**
MB-17	RMB2114	69	62	63	63	64	68	**65**
Average		**70**	**62**	**63**	**62**	**64**	**68**	

Table 5.7.4: Thousand grain weight (g) in different genotypes at different locations

Code	Genotype	**Durgapura**	**Hisar**	**Karnal**	**Ludhiana**	**Pantnagar**	**Kanpur**	**Mean**
M-1	MBGS-21/1	60.3	60.3	50.0	39.9	54.5	54.0	**53.2**
M-2	MBGS-21/2	59.6	59.6	47.7	43.1	54.9	58.9	**54.0**
M-3	MBGS-21/3	55.5	55.5	43.7	40.5	48.5	48.9	**48.7**
M-4	MBGS-21/4	57.1	57.1	54.9	46.8	52.9	60.3	**54.8**
M-5	MBGS-21/5	55.1	55.1	50.5	42.1	51.3	52.1	**51.0**
M-6	MBGS-21/6	55.1	55.1	36.5	32.5	45.1	52.9	**46.2**
M-7	MBGS-21/7	58.9	58.9	57.1	49.3	53.1	57.9	**55.9**
M-8	PL 930	40.9	40.9	37.4	29.5	37.7	36.8	**37.2**
M-9	RD 3028	56.8	56.8	49.8	50.2	53.0	56.1	**53.8**
M-10	UPB 1097	51.1	51.1	44.5	38.0	51.2	48.8	**47.4**
M-11	PL 931	46.3	46.3	43.5	38.7	48.3	46.0	**44.9**
M-12	BH 1034	57.5	57.5	48.1	46.2	54.6	53.5	**52.9**
M-13	BH 1036	53.4	53.4	50.5	42.4	52.0	53.1	**50.8**
M-14	RD 3027	53.1	53.1	42.8	41.1	50.3	51.3	**48.6**
M-15	BH 1035	42.0	42.0	41.8	30.7	39.6	36.7	**38.8**
M-16	RD 3029	51.4	51.4	47.4	40.6	47.9	56.8	**49.2**
M-17	RD 3030	53.5	52.3	46.0	44.6	48.7	49.1	**49.0**
MB-7	RMB2105	49.9	45.6	34.6	35.1	40.1	38.6	**40.6**
MB-8	RMB2106	52.2	49.0	38.2	36.5	46.4	37.0	**43.2**
MB-9	RMB2107	62.8	59.0	46.2	51.8	40.1	48.8	**51.5**
MB-10	RMB2108	53.2	48.2	40.7	39.7	53.2	40.7	**46.0**
MB-11	BK-1127 ©	68.1	62.0	54.6	57.8	51.2	56.3	**58.3**
MB-12	RMB2109	52.3	46.2	40.5	36.8	46.0	43.2	**44.2**
MB-13	RMB2110	53.9	50.3	42.4	36.2	49.9	45.6	**46.4**
MB-14	RMB2111	51.4	53.2	42.4	38.9	48.8	44.2	**46.5**
MB-15	RMB2112	57.6	47.3	46.6	47.9	50.0	50.1	**49.9**
MB-16	RMB2113	58.0	56.3	49.0	46.7	46.0	47.5	**50.6**
MB-17	RMB2114	58.2	53.3	44.3	42.2	48.4	50.4	**49.5**
Average		**54.5**	**52.7**	**45.4**	**41.6**	**48.7**	**49.1**	

BQSN 5: Antioxidant Activity

A: Antioxidant activity in grains sown in last week of December, 2021

Germplasm	Karnal	Ludhiana	Hisar	Mean
BCU 2336	83.4	47.3*	89.7	73.5
BCU 8173	20.6	22.2	17.8	20.2
BCU 8176	25.5	30.3	NA	27.9
BH 902	26.3	27.8	26.4	26.8
BH 946	30.6	27.9	24.7	27.7
DWRB 91	18.3	26.4	21.5	22.1
DWRB 92	19.3	20.7	17.3	19.1
DWRB 137	23.5	23.0	20.2	22.3
Average	**31.0**	**28.2**	**31.1**	

(*BCU2336 flour from Ludhiana center was lighter in color as compared to Karnal and Hisar)

B: Antioxidant activity in grains sown in third week of November, 2021

Germplasm	Pantnagar	Hisar	Karnal	Kanpur	Ludhiana	Durgapura	Mean
BCU 5915	27.5	38.4	39.9	31.6	35.1	35.1	34.6
BCU 6040	31.6	36.2	28.9	31.4	30.9	36.0	32.5

FEED BARLEY QUALITY EVALUATION

The feed 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-5.8.1: Details of grain samples analyzed for quality

Trial	Zone	Locations	Total No. of Samples
IVT (IR)	NWPZ	Karnal, Hisar, Durgapura, Pantnagar, Ludhiana	125
IVT (IR)	NEPZ	Sabour, Kanpur, Varanasi	75
IVT (IR)	CZ	Vijapur, Udaipur	50
AVT (RF)	NHZ	Almora, Bajaura, Malan, Shimla	92
IVT (RF)	NEPZ	Sabour, Kanpur, Saini Farm, Varanasi	52
IVT-SAL/ALK	NWPZ/NEPZ/CZ	Kanpur, Hisar	28
IVT-IRTS-NB	NWPZ/NEPZ/CZ	Karnal, Hisar, Durgapura, Pantnagar, Ludhiana, Vijapur, Udaipur, Kanpur, Varanasi	63
AVT-IRFB	NEPZ	Sabour, Kanpur	12
		TOTAL	**497**

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.2.

Table 5.8.2: Entries having highest thousand grain weight, protein content and hectoliter weight in respective trials

No.	Trial	Zone	Thousand grain weight	Protein content	Hectoliter weight
1	IVT (IR)	NWPZ	HUB 281	UPB 1105	HUB 281
2	IVT (IR)	NEPZ	PL 937	KB 2015	UPB 1105
3	IVT (IR)	CZ	PL 936	HUB 281, BH 1045	UPB 1105
4	AVT (RF)	NHZ	HBL 876	BHS 400 ©	VLB 179, HBL 877
5	IVT (RF)	NEPZ	RD 3050	NDB 1789	RD 3050
6	IVT-SAL/ALK	NWPZ/NEPZ/CZ	KB 2013	KB 3060	RD 2907 ©
7	IVT-IRTS-NB	NWPZ/NEPZ/CZ	KB 2019 ©	KB 2019 ©	Karan 16 ©
8	AVT-IRFB	NEPZ	RD 3034	DWRB 137 ©	RD 3034

Annexure -1

IVT-IR-FB-NWPZ/CZ/NEPZ

Table 5.8.3: Thousand grain weight (g) of different entries

Genotype	Code	Karnal	Hisar	Ludhiana	Pantnagar	Durgapura	Mean	Vijapur	Udaipur	Mean	Kanpur	Varanasi	Sabour	Mean	OM
BH 1044	IVT-IRFB-3	26	34	25	33	37	**31**	39	36	**38**	41	31	30	**34**	**34**
BH 1045	IVT-IRFB-17	39	42	38	45	43	**41**	45	37	**41**	46	38	37	**40**	**41**
DWRB 225	IVT-IRFB-25	35	36	31	37	37	**35**	43	35	**39**	30	35	33	**33**	**36**
DWRB 226	IVT-IRFB-23	37	42	32	37	40	**37**	50	29	**40**	38	31	40	**36**	**38**
Filler	IVT-IRFB-9	35	40	32	37	44	**37**	47	34	**41**	32	33	32	**32**	**37**
HUB 281	IVT-IRFB-5	43	51	39	48	54	**47**	54	41	**48**	38	44	45	**43**	**46**
KB 2004	IVT-IRFB-20	32	39	30	41	38	**36**	43	38	**40**	39	33	35	**35**	**37**
KB 2015	IVT-IRFB-7	30	41	27	34	31	**32**	45	40	**42**	32	31	27	**30**	**35**
KB 2031	IVT-IRFB-12	32	33	28	32	39	**33**	40	32	**36**	43	25	22	**30**	**33**
NDB 1793	IVT-IRFB-13	37	37	30	40	40	**37**	45	34	**40**	41	37	33	**37**	**38**
NDB 1800	IVT-IRFB-10	35	37	30	41	43	**37**	42	35	**38**	35	34	30	**33**	**36**
PL 936	IVT-IRFB-6	47	46	37	44	43	**43**	56	42	**49**	40	45	40	**42**	**45**
PL 937	IVT-IRFB-21	44	45	39	46	47	**44**	51	42	**47**	43	49	46	**46**	**46**
PL 939	IVT-IRFB-2	34	38	31	57	37	**39**	52	28	**40**	41	35	29	**35**	**38**
PL 940	IVT-IRFB-8	30	38	25	35	33	**32**	40	33	**37**	33	30	23	**29**	**33**
RD 2899	IVT-IRFB-22	30	40	32	40	48	**38**	44	34	**39**	47	30	29	**35**	**37**
RD 3051	IVT-IRFB-16	30	36	30	38	43	**35**	43	34	**39**	34	31	30	**32**	**35**
RD 3052	IVT-IRFB-18	31	38	28	39	38	**35**	40	41	**40**	36	30	32	**33**	**36**
RD 3053	IVT-IRFB-1	37	42	34	44	49	**41**	53	44	**48**	31	41	39	**37**	**42**
RD 3054	IVT-IRFB-11	43	47	34	47	49	**44**	54	42	**48**	39	45	43	**42**	**45**
UPB 1105	IVT-IRFB-4	40	48	36	44	51	**44**	53	43	**48**	35	51	47	**44**	**45**
UPB 1106	IVT-IRFB-19	25	29	26	31	32	**28**	34	21	**27**	27	24	27	**26**	**27**
BH 946 ©	IVT-IRFB-24	25	25	23	32	30	**27**	34	20	**27**	35	24	26	**28**	**27**
DWRB137©	IVT-IRFB-14	32	37	30	38	37	**35**	46	30	**38**	44	32	29	**35**	**36**
HUB113©	IVT-IRFB-15	38	43	33	42	46	**41**	49	35	**42**	37	38	36	**37**	**40**
Average		**35**	**39**	**31**	**40**	**41**		**46**	**35**		**37**	**35**	**34**		

Table 5.8.4: Protein content (%dwb) different entries

Genotype	Code	Karnal	Hisar	Ludhiana	Pantnagar	Durgapura	Mean	Vijapur	Udaipur	Mean	Kanpur	Varanasi	Sabour	Mean	OM
BH 1044	IVT-IRFB-3	12.1	8.8	11.4	10.3	8.8	**10.3**	11.0	9.8	**10.4**	9.5	10.6	13.7	**11.3**	**10.6**
BH 1045	IVT-IRFB-17	12.9	9.9	11.6	9.3	10.5	**10.8**	13.8	12.0	**12.9**	10.0	10.8	13.1	**11.3**	**11.7**
DWRB 225	IVT-IRFB-25	11.2	8.6	9.1	9.3	10.4	**9.7**	10.1	10.3	**10.2**	11.4	9.1	12.4	**11.0**	**10.3**
DWRB 226	IVT-IRFB-23	11.3	8.9	11.2	8.9	10.3	**10.1**	10.3	10.9	**10.6**	11.9	10.5	10.3	**10.9**	**10.5**
Filler	IVT-IRFB-9	13.0	8.5	10.5	9.0	10.2	**10.2**	10.3	10.6	**10.5**	10.0	11.4	11.9	**11.1**	**10.6**
HUB 281	IVT-IRFB-5	12.7	10.4	11.8	10.7	10.2	**11.2**	12.1	13.7	**12.9**	10.2	11.8	12.3	**11.4**	**11.8**
KB 2004	IVT-IRFB-20	10.1	8.8	9.3	9.0	9.5	**9.3**	9.9	8.4	**9.2**	9.4	9.7	10.5	**9.9**	**9.5**
KB 2015	IVT-IRFB-7	11.6	8.1	10.9	8.7	10.7	**10.0**	8.2	9.3	**8.8**	10.8	9.9	15.1	**11.9**	**10.2**
KB 2031	IVT-IRFB-12	12.6	9.0	12.0	10.2	9.3	**10.6**	11.0	10.4	**10.7**	12.3	10.8	11.8	**11.6**	**11.0**
NDB 1793	IVT-IRFB-13	11.6	9.1	11.7	9.4	11.9	**10.7**	8.5	8.8	**8.7**	10.8	10.0	13.2	**11.3**	**10.2**
NDB 1800	IVT-IRFB-10	10.3	8.1	11.7	9.3	8.5	**9.6**	11.0	10.1	**10.6**	10.5	9.6	11.4	**10.5**	**10.2**
PL 936	IVT-IRFB-6	11.5	8.6	12.3	8.5	9.4	**10.1**	6.2	8.7	**7.5**	12.3	10.4	12.5	**11.7**	**9.7**
PL 937	IVT-IRFB-21	12.4	8.6	11.8	9.2	8.8	**10.2**	12.1	10.0	**11.1**	10.5	11.0	12.7	**11.4**	**10.9**
PL 939	IVT-IRFB-2	10.8	9.3	11.5	9.7	10.4	**10.3**	10.9	11.4	**11.2**	12.0	10.3	12.9	**11.7**	**11.1**
PL 940	IVT-IRFB-8	10.9	8.0	11.8	7.7	9.3	**9.5**	10.0	8.9	**9.5**	9.8	10.1	13.0	**11.0**	**10.0**
RD 2899	IVT-IRFB-22	13.5	8.8	10.9	8.7	8.5	**10.1**	12.0	12.0	**12.0**	11.4	10.2	12.1	**11.2**	**11.1**
RD 3051	IVT-IRFB-16	12.2	8.6	10.2	8.7	8.2	**9.6**	10.8	10.2	**10.5**	10.2	9.7	13.4	**11.1**	**10.4**
RD 3052	IVT-IRFB-18	11.7	8.1	11.3	8.2	10.7	**10.0**	10.2	8.8	**9.5**	10.0	11.0	11.0	**10.7**	**10.1**
RD 3053	IVT-IRFB-1	12.4	9.8	11.0	9.7	10.6	**10.7**	12.3	10.9	**11.6**	11.5	11.0	11.3	**11.3**	**11.2**
RD 3054	IVT-IRFB-11	11.6	7.8	12.1	8.9	9.0	**9.9**	10.2	9.1	**9.7**	10.4	9.5	11.5	**10.5**	**10.0**
UPB 1105	IVT-IRFB-4	14.1	10.3	11.3	9.7	10.5	**11.2**	12.8	11.5	**12.2**	10.3	10.4	10.6	**10.4**	**11.3**
UPB 1106	IVT-IRFB-19	12.0	8.0	10.7	7.7	8.1	**9.3**	10.6	11.2	**10.9**	9.9	10.5	12.7	**11.0**	**10.4**
BH 946 ©	IVT-IRFB-24	10.8	9.4	10.5	9.3	9.2	**9.8**	10.6	13.1	**11.9**	11.3	9.7	13.2	**11.4**	**11.0**
DWRB137©	IVT-IRFB-14	11.3	7.3	10.4	7.9	9.6	**9.3**	12.9	10.2	**11.6**	8.7	9.3	13.4	**10.5**	**10.4**
HUB 113©	IVT-IRFB-15	11.3	8.6	11.6	9.3	11.0	**10.4**	10.0	11.8	**10.9**	11.3	10.0	12.4	**11.2**	**10.8**
Average		**11.8**	**8.8**	**11.1**	**9.1**	**9.7**		**10.7**	**10.5**		**10.7**	**10.3**	**12.3**		

Table 5.8.5: Hectoliter weight/Test weight (kg/hl) different entries

Genotype	Code	Karnal	Hisar	Ludhiana	Pantnagar	Durgapura	Mean	Vijapur	Udaipur	Mean	Kanpur	Varanasi	Sabour	Mean	OM
BH 1044	IVT-IRFB-3	60	62	57	62	68	**62**	63	68	**66**	59	54	47	**53**	**60**
BH 1045	IVT-IRFB-17	50	56	54	58	62	**56**	53	58	**56**	62	50	46	**53**	**55**
DWRB 225	IVT-IRFB-25	60	59	59	60	63	**60**	62	64	**63**	61	54	51	**56**	**60**
DWRB 226	IVT-IRFB-23	57	58	56	50	65	**57**	60	54	**57**	62	47	49	**53**	**56**
Filler	IVT-IRFB-9	59	57	59	54	66	**59**	58	61	**59**	56	48	40	**48**	**55**
HUB 281	IVT-IRFB-5	63	64	64	63	70	**65**	65	66	**66**	60	59	53	**57**	**62**
KB 2004	IVT-IRFB-20	58	59	58	62	67	**61**	62	65	**64**	59	51	62	**57**	**61**
KB 2015	IVT-IRFB-7	54	57	50	51	57	**54**	59	65	**62**	63	47	42	**51**	**56**
KB 2031	IVT-IRFB-12	60	58	56	52	67	**59**	59	61	**60**	62	50	42	**52**	**57**
NDB 1793	IVT-IRFB-13	61	59	56	59	64	**60**	60	63	**61**	61	53	51	**55**	**59**
NDB 1800	IVT-IRFB-10	60	58	56	63	66	**61**	60	60	**60**	62	46	45	**51**	**57**
PL 936	IVT-IRFB-6	62	63	62	57	62	**61**	65	65	**65**	57	57	51	**55**	**60**
PL 937	IVT-IRFB-21	61	62	60	61	67	**62**	63	64	**64**	64	59	55	**59**	**62**
PL 939	IVT-IRFB-2	59	60	57	59	64	**60**	61	57	**59**	55	55	47	**52**	**57**
PL 940	IVT-IRFB-8	52	57	49	56	60	**55**	58	60	**59**	57	48	48	**51**	**55**
RD 2899	IVT-IRFB-22	53	62	58	58	67	**60**	63	63	**63**	67	48	48	**54**	**59**
RD 3051	IVT-IRFB-16	60	61	60	57	71	**62**	63	66	**64**	56	51	52	**53**	**60**
RD 3052	IVT-IRFB-18	53	56	52	57	64	**56**	55	63	**59**	60	44	45	**49**	**55**
RD 3053	IVT-IRFB-1	57	58	58	54	66	**58**	56	63	**59**	61	46	47	**51**	**56**
RD 3054	IVT-IRFB-11	61	63	57	57	68	**61**	63	67	**65**	59	56	52	**56**	**61**
UPB 1105	IVT-IRFB-4	59	65	63	62	71	**64**	65	68	**67**	60	60	58	**59**	**63**
UPB 1106	IVT-IRFB-19	56	61	58	60	67	**60**	64	57	**61**	62	53	53	**56**	**59**
BH 946 ©	IVT-IRFB-24	54	58	59	60	66	**60**	63	55	**59**	60	52	52	**55**	**58**
DWRB 137 ©	IVT-IRFB-14	57	56	53	56	62	**57**	59	59	**59**	64	49	48	**54**	**56**
HUB 113 ©	IVT-IRFB-15	56	59	55	54	66	**58**	58	59	**58**	60	46	49	**52**	**56**
Average		**58**	**59**	**57**	**58**	**65**		**61**	**62**		**60**	**51**	**49**		

AVT-RF-NHZ

Table 5.9.1: Thousand grain weight (g) of different entries

Genotype	Code	Shimla	Malan	Bajaura	Katrain	Almora	Mean
BHS488	AVT-RF-NHZ-21	28	40	34	40	36	**36**
BHS489	AVT-RF-NHZ-20	32	45	34	41	36	**37**
BHS490	AVT-RF-NHZ-11	32	37	39	38	36	**37**
BHS491	AVT-RF-NHZ-4	29	32	30	30	31	**30**
BHS492	AVT-RF-NHZ-6	28	35	29	35	31	**32**
HBL874	AVT-RF-NHZ-23	36	41	35	40	31	**36**
HBL875	AVT-RF-NHZ-16	38	43	39	40	37	**39**
HBL876	AVT-RF-NHZ-2	41	45	42	46	50	**45**
HBL877	AVT-RF-NHZ-12	27	32	32	31	24	**29**
HBL878	AVT-RF-NHZ-17	32	37	36	40	37	**36**
UPB1101	AVT-RF-NHZ-13	38	43	40	38	39	**39**
UPB1102	AVT-RF-NHZ-5	38	38	38	36	37	**37**
UPB1103	AVT-RF-NHZ-9	29	37	28	36	36	**33**
VLB175	AVT-RF-NHZ-1	30	43	32	30	30	**33**
VLB176	AVT-RF-NHZ-18	27	32	35	40	31	**33**
VLB177	AVT-RF-NHZ-3	35	38	35	39	37	**37**
VLB178	AVT-RF-NHZ-7	30	34	24	30	26	**29**
VLB179	AVT-RF-NHZ-14	26	33	30	31	28	**30**
BHS352 ©	AVT-RF-NHZ-10	35	35	35	33	36	**35**
BHS380 ©	AVT-RF-NHZ-22	36	39	38	43	35	**38**
BHS400 ©	AVT-RF-NHZ-8	31	32	29	37	27	**31**
HBL113 ©	AVT-RF-NHZ-19	30	31	29	33	35	**31**
VLB118©	AVT-RF-NHZ-15	34	39	35	40	33	**36**
Average		**32**	**37**	**34**	**37**	**34**	

Table 5.9.2: Crude protein content (% dry weight) of different entries

Genotype	Code	Shimla	Malan	Bajaura	Katrain	Almora	Mean
BHS488	AVT-RF-NHZ-21	11.8	11.8	9.0	8.5	11.6	**10.5**
BHS489	AVT-RF-NHZ-20	9.3	10.4	9.3	8.5	8.3	**9.2**
BHS490	AVT-RF-NHZ-11	10.6	12.3	9.4	8.5	10.2	**10.2**
BHS491	AVT-RF-NHZ-4	10.1	13.4	9.2	8.3	10.7	**10.3**
BHS492	AVT-RF-NHZ-6	10.5	14.0	9.0	8.6	10.5	**10.5**
HBL874	AVT-RF-NHZ-23	10.0	12.5	9.6	9.0	12.1	**10.6**
HBL875	AVT-RF-NHZ-16	9.3	10.9	8.6	9.1	10.7	**9.7**
HBL876	AVT-RF-NHZ-2	10.9	12.7	9.5	9.6	11.1	**10.8**
HBL877	AVT-RF-NHZ-12	10.1	11.8	10.0	9.3	12.5	**10.7**
HBL878	AVT-RF-NHZ-17	10.6	12.0	9.0	10.3	10.8	**10.5**
UPB1101	AVT-RF-NHZ-13	9.1	12.1	10.1	8.3	9.5	**9.8**
UPB1102	AVT-RF-NHZ-5	9.0	11.7	9.9	8.2	10.6	**9.9**
UPB1103	AVT-RF-NHZ-9	12.4	12.0	12.8	7.9	12.3	**11.5**
VLB175	AVT-RF-NHZ-1	11.2	11.0	10.5	9.3	10.3	**10.5**
VLB176	AVT-RF-NHZ-18	12.3	12.6	8.8	8.6	11.4	**10.7**
VLB177	AVT-RF-NHZ-3	9.4	11.9	10.1	9.0	11.0	**10.3**
VLB178	AVT-RF-NHZ-7	11.5	13.8	11.0	9.2	13.3	**11.8**
VLB179	AVT-RF-NHZ-14	11.3	12.1	10.7	9.1	11.3	**10.9**
BHS352 ©	AVT-RF-NHZ-10	10.3	12.6	10.0	8.7	10.9	**10.5**
BHS380 ©	AVT-RF-NHZ-22	11.0	12.7	10.3	8.6	11.4	**10.8**
BHS400 ©	AVT-RF-NHZ-8	17.7	13.5	9.3	8.8	12.0	**12.3**
HBL113 ©	AVT-RF-NHZ-19	9.0	12.3	9.2	8.0	10.7	**9.8**
VLB118©	AVT-RF-NHZ-15	10.3	13.4	8.5	8.9	10.3	**10.3**
Average		**10.8**	**12.3**	**9.7**	**8.8**	**11.0**	

Table 5.9.3: Hectoliter weight (kg/hl) in different entries

Genotype	Code	Shimla	Malan	Bajaura	Katrain	Almora	Mean
BHS488	AVT-RF-NHZ-21	56	62	55	61	60	**59**
BHS489	AVT-RF-NHZ-20	55	64	50	55	54	**56**
BHS490	AVT-RF-NHZ-11	56	59	54	54	57	**56**
BHS491	AVT-RF-NHZ-4	63	62	60	60	62	**61**
BHS492	AVT-RF-NHZ-6	63	62	57	58	61	**60**
HBL874	AVT-RF-NHZ-23	59	61	56	57	56	**58**
HBL875	AVT-RF-NHZ-16	57	59	54	55	57	**56**
HBL876	AVT-RF-NHZ-2	59	63	58	55	62	**59**
HBL877	AVT-RF-NHZ-12	74	75	71	74	74	**74**
HBL878	AVT-RF-NHZ-17	50	56	54	54	55	**54**
UPB1101	AVT-RF-NHZ-13	58	61	57	62	60	**60**
UPB1102	AVT-RF-NHZ-5	59	60	55	59	59	**58**
UPB1103	AVT-RF-NHZ-9	61	63	59	60	62	**61**
VLB175	AVT-RF-NHZ-1	60	64	57	56	58	**59**
VLB176	AVT-RF-NHZ-18	53	57	57	60	55	**56**
VLB177	AVT-RF-NHZ-3	57	62	53	57	58	**58**
VLB178	AVT-RF-NHZ-7	59	57	49	57	53	**55**
VLB179	AVT-RF-NHZ-14	75	76	70	73	75	**74**
BHS352 ©	AVT-RF-NHZ-10	52	51	49	54	53	**52**
BHS380 ©	AVT-RF-NHZ-22	61	62	59	61	60	**60**
BHS400 ©	AVT-RF-NHZ-8	61	60	58	51	60	**58**
HBL113 ©	AVT-RF-NHZ-19	61	58	56	59	61	**59**
VLB118©	AVT-RF-NHZ-15	62	63	60	61	59	**61**
Average		**60**	**62**	**57**	**59**	**60**	

IVT-RF-NEPZ

Table 5.10.1: Thousand grain weight (g) of different entries

Genotype	Code	Sabour	Kanpur	Saini (Kanpur)	Varanasi	Mean
DWRB 225	IVT-RF-10	43	45	44	39	**43**
KB 2008	IVT-RF-2	28	43	36	26	**33**
KB 2018	IVT-RF-7	38	44	43	38	**41**
NDB 1784	IVT-RF-4	44	52	46	42	**46**
NDB 1785	IVT-RF-12	43	43	41	23	**38**
NDB 1789	IVT-RF-6	28	43	39	32	**35**
RD 3037	IVT-RF-1	37	36	36	34	**36**
RD 3047	IVT-RF-8	37	40	38	36	**38**
RD 3048	IVT-RF-3	37	43	38	27	**36**
RD 3049	IVT-RF-9	38	43	43	35	**40**
RD 3050	IVT-RF-13	57	48	46	37	**47**
K 603 ©	IVT-RF-11	22	48	44	32	**36**
Lakhan ©	IVT-RF-5	23	45	40	30	**34**
Average		**37**	**44**	**41**	**33**	

Table 5.10.2: Crude protein content (% dry weight) of different entries

Genotype	Code	Sabour	Kanpur	Saini (Kanpur)	Varanasi	Mean
DWRB 225	IVT-RF-10	8.5	8.9	8.1	10.9	**9.1**
KB 2008	IVT-RF-2	10.9	7.4	8.9	12.2	**9.9**
KB 2018	IVT-RF-7	10.0	8.3	7.7	10.0	**9.0**
NDB 1784	IVT-RF-4	9.0	8.6	7.5	11.0	**9.0**
NDB 1785	IVT-RF-12	10.2	7.2	7.6	12.2	**9.3**
NDB 1789	IVT-RF-6	14.0	8.1	9.5	12.6	**11.1**
RD 3037	IVT-RF-1	11.5	9.6	9.0	12.4	**10.6**
RD 3047	IVT-RF-8	9.1	8.9	8.2	12.8	**9.8**
RD 3048	IVT-RF-3	10.5	8.3	8.0	11.1	**9.5**
RD 3049	IVT-RF-9	9.8	7.2	8.8	10.4	**9.1**
RD 3050	IVT-RF-13	10.2	9.7	8.8	13.0	**10.4**
K 603 ©	IVT-RF-11	11.8	8.1	7.4	11.8	**9.8**
Lakhan ©	IVT-RF-5	13.6	8.0	8.7	11.9	**10.6**
	Average	**10.7**	**8.3**	**8.3**	**11.7**	

Table 5.10.3: Hectoliter weight of different entries

Genotype	Code	Sabour	Kanpur	Saini (Kanpur)	Varanasi	Mean
DWRB 225	IVT-RF-10	52	62	61	52	**57**
KB 2008	IVT-RF-2	43	60	58	46	**52**
KB 2018	IVT-RF-7	51	62	62	51	**57**
NDB 1784	IVT-RF-4	56	63	62	52	**58**
NDB 1785	IVT-RF-12	56	66	65	47	**58**
NDB 1789	IVT-RF-6	45	60	57	43	**51**
RD 3037	IVT-RF-1	51	58	54	44	**52**
RD 3047	IVT-RF-8	56	65	68	56	**61**
RD 3048	IVT-RF-3	54	64	62	47	**57**
RD 3049	IVT-RF-9	54	62	62	49	**57**
RD 3050	IVT-RF-13	60	67	66	60	**63**
K 603 ©	IVT-RF-11	39	63	62	48	**53**
Lakhan ©	IVT-RF-5	41	63	62	47	**53**
Average		**50**	**63**	**62**	**49**	

AVT-IRFB-NEPZ

Table 5.11: Thousand grain weight (g), protein content (%dwb) and hectoliter weight of different entries

Genotype	Code	Thousand grain weight (g)			Protein content (% dwb)			Hectoliter weight (kg/hl)		
		Kanpur	Sabour	Mean	Kanpur	Sabour	Mean	Kanpur	Sabour	Mean
NDB 1756	AVT-IRFB-NEP-1	35.4	32.9	**34.2**	10.0	11.8	**10.9**	61.0	49.8	**55.4**
PL 917	AVT-IRFB-NEP-4	44.4	29.1	**36.8**	11.3	13.3	**12.3**	61.4	52.0	**56.7**
RD 3034	AVT-IRFB-NEP-2	41.3	35.5	**38.4**	10.1	10.8	**10.5**	63.1	52.4	**57.7**
UPB 1095	AVT-IRFB-NEP-3	33.8	30.1	**31.9**	10.3	11.8	**11.1**	62.1	47.7	**54.9**
DWRB 137 ©	AVT-IRFB-NEP-6	37.9	25.8	**31.8**	10.9	14.7	**12.8**	61.3	42.6	**52.0**
HUB 113 ©	AVT-IRFB-NEP-5	33.8	36.9	**35.3**	11.2	10.4	**10.8**	58.7	49.4	**54.0**
	Average	**37.8**	**31.7**		**10.6**	**12.1**		**61.3**	**49.0**	

IVT-SAL/ALK- Plains

Table 5.12. Thousand grain weight (g), protein content (%dwb) and hectoliter weight of different entries

Genotype	Code	Thousand grain weight (g)			Protein content (% dwb)			Hectoliter weight (kg/hl)		
		Kanpur	Hisar	Mean	Kanpur	Hisar	Mean	Kanpur	Hisar	Mean
BH 1046	AVT-SST-10	42.1	42.4	**42.2**	10.3	8.9	**9.6**	61.0	59.0	**60.0**
DWRB 228	AVT-SST-4	40.7	40.3	**40.5**	8.4	8.7	**8.6**	62.5	59.8	**61.1**
KB 2013	AVT-SST-6	41.0	45.8	**43.4**	10.2	9.1	**9.7**	58.7	57.2	**58.0**
KB 2031	AVT-SST-1	41.8	44.3	**43.0**	10.9	10.0	**10.5**	57.8	55.9	**56.9**
NDB 1776	AVT-SST-13	34.6	40.0	**37.3**	9.9	10.5	**10.2**	60.4	58.6	**59.5**
NDB 1782	AVT-SST-11	35.9	38.4	**37.1**	10.9	9.4	**10.2**	58.0	56.2	**57.1**
NDB 1783	AVT-SST-3	36.5	38.5	**37.5**	10.7	9.1	**9.9**	60.4	60.4	**60.4**
RD 3059	AVT-SST-7	38.5	41.5	**40.0**	9.5	8.1	**8.8**	64.1	60.2	**62.1**
RD 3060	AVT-SST-8	32.3	27.4	**29.9**	10.3	12.2	**11.3**	59.1	52.5	**55.8**
RD 3061	AVT-SST-5	34.6	36.7	**35.6**	10.3	10.0	**10.2**	59.6	57.7	**58.6**
RD 3062	AVT-SST-9	34.5	31.4	**32.9**	10.3	10.4	**10.4**	53.2	49.6	**51.4**
NDB 1173 ©	AVT-SST-14	34.4	36.3	**35.3**	11.4	8.8	**10.1**	58.9	58.8	**58.8**
RD 2794 ©	AVT-SST-2	31.0	33.8	**32.4**	12.0	10.3	**11.2**	50.5	51.3	**50.9**
RD 2907 ©	AVT-SST-12	37.5	33.8	**35.6**	11.9	10.2	**11.1**	63.0	64.5	**63.7**
Mean		**36.8**	**37.9**		**10.5**	**9.7**		**59.1**	**57.3**	

IVT-IRTS-NB

Table 5.13.1: Thousand grain weight (g) of different entries

Genotype	Code	Karnal	Hisar	Durgapura	Ludhiana	Pantnagar	Mean NWPZ	Vijapur	Udaipur	Mean CZ	Kanpur	Varanasi	Mean NEPZ	OM*
DWRB 223	IVT-IR-NB-5	28.8	29.9	31.6	23.6	31.7	**29.1**	33.8	29.1	**31.4**	38.1	32.4	**35.3**	**31.9**
DWRB 227	IVT-IR-NB-1	27.4	31.4	31.5	24.5	28.1	**28.6**	37.6	30.8	**34.2**	33.2	25.6	**29.4**	**30.7**
UPB 1086	IVT-IR-NB-7	31.5	35.4	40.5	34.4	38.0	**35.9**	47.3	35.2	**41.2**	31.9	36.6	**34.3**	**37.1**
UPB 1104	IVT-IR-NB-3	26.3	32.7	33.9	21.2	33.8	**29.6**	39.8	32.1	**35.9**	31.2	30.8	**31.0**	**32.2**
Karan 16 ©	IVT-IR-NB-2	27.6	34.2	36.1	26.2	35.1	**31.8**	38.9	30.4	**34.6**	36.8	33.8	**35.3**	**33.9**
KB 2019 ©	IVT-IR-NB-4	43.9	44.0	44.9	30.6	44.9	**41.7**	42.6	36.0	**39.3**	38.8	36.0	**37.4**	**39.4**
PL 891 ©	IVT-IR-NB-6	28.9	36.0	35.3	23.5	36.1	**32.0**	42.7	38.4	**40.6**	33.3	31.3	**32.3**	**34.9**
Average		**30.6**	**34.8**	**36.3**	**26.3**	**35.4**		**40.4**	**33.1**		**34.8**	**32.3**		

*OM= Overall Mean

Table 5.13.2: Protein content (% dwb) of different entries

Genotype	Code	Karnal	Hisar	Durgapura	Ludhiana	Pantnagar	Mean NWPZ	Vijapur	Udaipur	Mean CZ	Kanpur	Varanasi	Mean NEPZ	OM*
DWRB 223	IVT-IR-NB-5	11.5	8.6	11.2	10.8	8.8	**10.2**	12.0	9.6	**10.8**	9.4	11.0	**10.2**	**10.4**
DWRB 227	IVT-IR-NB-1	15.2	9.4	9.6	12.3	10.0	**11.3**	12.2	11.9	**12.1**	10.2	10.8	**10.5**	**11.3**
UPB 1086	IVT-IR-NB-7	13.2	10.1	11.0	11.1	9.8	**11.0**	10.5	10.7	**10.6**	10.8	12.5	**11.7**	**11.1**
UPB 1104	IVT-IR-NB-3	13.8	10.5	10.7	12.7	9.8	**11.5**	12.2	10.7	**11.5**	8.4	12.6	**10.5**	**11.2**
Karan 16 ©	IVT-IR-NB-2	14.1	10.6	11.0	11.6	12.1	**11.9**	13.5	12.0	**12.8**	8.7	12.0	**10.4**	**11.7**
KB 2019 ©	IVT-IR-NB-4	13.7	10.9	12.6	11.7	12.0	**12.2**	13.8	12.0	**12.9**	11.0	11.6	**11.3**	**12.1**
PL 891 ©	IVT-IR-NB-6	15.2	10.3	11.6	11.7	10.1	**11.8**	12.2	10.4	**11.3**	8.9	12.6	**10.8**	**11.3**
Average		**13.8**	**10.1**	**11.1**	**11.7**	**10.4**		**12.3**	**11.0**		**9.6**	**11.9**		

*OM= Overall Mean

Table 5.13.3: Hectoliter weight (kg/hl) of different entries

Genotype	Code	Karnal	Hisar	Durgapura	Ludhiana	Pantnagar	Mean NWPZ	Vijapur	Udaipur	Mean CZ	Kanpur	Varanasi	Mean NEPZ	OM*
DWRB 223	IVT-IR-NB-5	56.4	56.9	75.7	59.0	66.5	**62.9**	65.6	79.4	**72.5**	66.9	47.6	**57.2**	**64.2**
DWRB 227	IVT-IR-NB-1	70.1	66.9	80.1	68.9	61.1	**69.4**	73.2	77.0	**75.1**	56.9	50.5	**53.7**	**66.1**
UPB 1086	IVT-IR-NB-7	61.6	57.1	70.0	64.4	58.6	**62.3**	68.1	67.8	**68.0**	73.6	53.1	**63.3**	**64.5**
UPB 1104	IVT-IR-NB-3	59.0	61.0	75.3	60.1	59.5	**63.0**	69.3	77.9	**73.6**	62.1	42.3	**52.2**	**62.9**
Karan 16 ©	IVT-IR-NB-2	69.3	64.5	80.3	74.4	65.6	**70.8**	78.2	77.3	**77.7**	55.7	61.3	**58.5**	**69.0**
KB 2019 ©	IVT-IR-NB-4	65.1	68.4	76.7	66.7	63.4	**68.0**	71.2	74.7	**72.9**	64.8	53.0	**58.9**	**66.6**
PL 891 ©	IVT-IR-NB-6	69.2	71.5	78.6	64.3	69.3	**70.6**	73.7	80.9	**77.3**	59.7	50.5	**55.1**	**67.7**
Average		**64.4**	**63.8**	**76.7**	**65.4**	**63.4**		**71.3**	**76.4**		**62.8**	**51.2**		

*OM= Overall Mean

Table 5.13.4: Plump grain percentage (>2.5 mm) of different entries

Genotype	Code	Karnal	Hisar	Durgapura	Ludhiana	Pantnagar	Mean NWPZ	Vijapur	Udaipur	Mean CZ	Kanpur	Varanasi	Mean NEPZ	OM*
DWRB223	IVT-IR-NB-5	32.9	36.9	73.5	18.2	28.3	**38.0**	34.5	51.5	**43.0**	43.1	51.4	**47.3**	**42.7**
DWRB227	IVT-IR-NB-1	28.1	28.8	67.5	11.0	36.4	**34.4**	31.3	39.6	**35.5**	44.5	51.0	**47.7**	**39.2**
UPB 1086	IVT-IR-NB-7	31.8	49.8	65.3	37.6	55.3	**47.9**	82.9	17.1	**50.0**	21.3	65.0	**43.1**	**47.0**
UPB 1104	IVT-IR-NB-3	31.5	33.8	60.7	9.0	39.8	**34.9**	41.1	50.6	**45.9**	40.8	44.1	**42.5**	**41.1**
Karan 16 ©	IVT-IR-NB-2	28.0	42.5	62.9	14.7	52.0	**40.0**	59.1	47.6	**53.3**	56.2	56.3	**56.3**	**49.9**
KB 2019 ©	IVT-IR-NB-4	59.9	51.2	54.6	23.4	57.4	**49.3**	39.6	65.6	**52.6**	42.4	56.7	**49.5**	**50.5**
PL 891 ©	IVT-IR-NB-6	31.1	31.9	72.8	14.6	40.9	**38.3**	41.5	19.8	**30.6**	49.6	66.7	**58.2**	**42.3**
Average		**34.7**	**39.2**	**65.3**	**18.4**	**44.3**		**47.1**	**41.7**		**42.6**	**55.9**		

*OM= Overall Mean

Zonal Monitoring Reports Rabi 2021-22

Zonal Monitoring Report 2021-22 Zone: NEPZ Team-1

Period of visit: 23 – 26 February, 2022

Name of team members:	Centres Visited:
Dr PK Gupta, CSAUA&T, Kanpur	Dalipnagar, Kanpur, Kumarganj, Varanasi and Saini
Dr Javed Bahar Khan, CSAUA&T, Kanpur	
Dr Chuni Lal, ICAR-IIWBR, Karnal	

Summary of breeding trials allocated & monitored:

Centre	Trial(s) Allotted	Trials Not Conducted / Rejected	Reason/Remark*
Dalipnagar	IVT-SAL-IR	Nil	Very good
Kanpur	IVT-FB-IR-TS, AVT-FB-IR-TS, AVT/IVT-FB-HL, IVT-RF-TS	Nil	Very Good
Kumarganj	IVT-FB-IR-TS, AVT-FB-IR-TS, AVT/IVT-FB-HL, IVT-RF-TS, IVT-SAL-IR	Rejected all the trials: IVT-FB-IR-TS, AVT-FB-IR-TS, AVT/IVT-FB-HL, IVT-RF-TS, SAL-IR	All the trials were totally grazed by animals
Varanasi	IVT-FB-IR-TS, AVT-FB-IR-TS, AVT/IVT-FB-HL, IVT-RF-TS	Nil	Very Good
Saini	IVT-RF-TS	Nil	Very good

***Evaluate trials as very good, good, average and poor based on conduction*

Entries showing promising performance in breeding trials across centres:

Trial	Entry	Remarks
AVT-FB-IR-TS	E5, E6, E3	Over all good appearance
IVT-FB-IR-TS	E20, E10, E15	Over all good appearance
AVT-FB-HL	E6, E1, E5	Over all good appearance
IVT-RF-TS	E6, E7, E10, E1	Still green
SAL-IR	E4, E7, E1	Comparatively good appearance at Dalipnagar location

Entries recommended for purification:

Trial	Entry	Remarks
AVT-FB-IR-TS	E2, E6	Variations in plant height
IVT-FB-IR-TS	E6, E12, E25	Variations for plant height, leaf size, row type (2R/6R), spike-characters (drooping spikes)

Entries recommended to be dropped from further testing:

Trial	Entry	Remarks
AVT-FB-IR-TS	E4	Mixture of plants with different plant heights, spike length, leaf size
IVT-RF (TS)	E3	Mixture of plants with variations for spike characters.

Entries exhibiting higher diseases incidence / insect infestation:

Centre	Entry	Remarks
Dalipnagar		Disease had just initiated
Kanpur		Disease had just initiated
Kumarganj		All trials were grazed
Varanasi	IVT-FB-IR:E22 (89), IVT-RF: E2 (99), E3 (78), E5 (99), E8 (57), E10 (57), E11 (99)	Leaf blight scores in parenthesis
Saini	IVT-RF: E2 (99), E5 (99), E11 (99)	Leaf blight scores in parenthesis

Report on Agronomical Trials:

Centre	Trial	Remarks
Kanpur	AVT, SPL-1, SPL-3 and SPL-4	All trials were very good. In first trial on nitrogen levels and production conditions, there was effect of sowing date and Nitrogen levels. In SPL-1 the date of sowing 25.11.21 was the best. In SPL-3 the treatment T12 was the best followed by T11 and T10.In SPL-5 T5 and T6 were better treatments
Kumarganj	As above	The conductance of all the trials was average. There was heterogeneity in the field and it was difficult to compare treatments visually as there was undulation in the plant stand. In three trials where HUB113 was one of the two checks to be used, this centre had used RD2907. Furthermore, the dates of sowing for different treatments were late as were suggested as per technical programme
Varanasi	As above	All the trials were very good

Report on Pathological Nurseries:

Centre	Nurseries	Remarks
Kanpur	NBDSN (119), EBDSN (43), IBDSN (396)	All the nurseries were sown and the disease had just initiated
Kumarganj	As above	As above
Varanasi	As above	Very high levels (up to 99) of infection of leaf blight were observed. Most of the lines were resistant or moderately resistant
Entomological screening nursery	119 + 31	After reach threshold, insecticide was already sprayed so were not able to observe any aphids infestation.

Report on Pathological and Entomological trials:

Centre	Nurseries	Remarks
Kanpur	Management of Foliar aphids	Very good
Kumarganj	Chemical control of leaf blights	Very good; disease had just initiated

Report on Barley Quality Screening Nurseries:

Centre	Nurseries	Remarks
Kanpur	BQSN 1, BQSN 2, BQSN 3, BQSN 4, BQSN 5	Very good

Report on National and International trials and nurseries:

Centre	Nurseries	Remarks
Kanpur	IBYT-ASA-2022, NBGSN, EIBGN	Very good conductance. IBYT-ASA was grown under rainfed conditions
Kumarganj	NBGSN, EIBGN	Totally grazed by animals
Varanasi	NBGSN, EIBGN	Good conductance. In some entries of EIBGN, there was lodging.

Special comments, if any (2-3 bullet points only)

- Leaf blight had just initiated at Kanpur and Kumarganj locations, but at Varanasi the disease pressure was very high to distinguish resistant and susceptible ones
- At Kumarganj all the breeding trials and nurseries were grazed by animals and in 3-agronomic trials one check used (RD 2907) was not as per the technical programme. Also the agronomic trials were planted in a field having soil heterogeneity as was evinced from the undulating growth of the crop.

Sd/- **Signature(s)**

Zonal Monitoring Report 2021-22 Zone: NEPZ Team-2

Period of visit: 22 – 26 February, 2022

Name of team members:	Centres Visited:
Dr RPS Verma	Kalyani, Ranchi, Sabour, Pusa and Varanasi
Dr. SK Bishnoi	

Summary of breeding trials allocated & monitored:

Centre	Trial(s) Allotted	Trials Not Conducted / Rejected	Reason/Remark*
Kalyani	IVT-FB-IR-TS, AVT-FB-IR-TS	Nil	Good (Sown late)
Ranchi	IVT-FB-IR-TS, AVT-FB-IR-TS, IVT-RF-TS	Nil	Very Good
Sabour	IVT-FB-IR-TS, AVT-FB-IR-TS, IVT-RF-TS, SAL-IR		Very Good
RPCAU, Pusa	IVT-RF-TS	Nil	Very good
Varanasi	IVT-FB-IR-TS, AVT-FB-IR-TS, AVT/IVT-FB-HL, IVT-RF-TS	Nil	Very Good

***Evaluate trials as very good, good, average and poor based on conduction*

Entries showing promising performance in breeding trials across centres:

Trial	Entry	Remarks
AVT-FB-IR-TS	3, 5, 6,	Over all good appearance
IVT-FB-IR-TS	1, 9, 10,19, 23	Over all good appearance
IVT-RF-TS	4, 7, 8, 10, 12	Over all good appearance

Entries recommended to be dropped from further testing:

Trial	Entry No	Remarks
AVT-FB-IR-TS	4	Mixture of plants with different plant heights, spike length, leaf size
IVT-FB-IR-TS	3, 18, 25	Mixture of plants with different plant heights, spike length, leaf size
IVT-RF (TS)	3	Mixture of plants with variations for spike characters, waxy & non waxy spikes

Entries recommended for purification:

Trial	Entry	Remarks
AVT-FB-IR-TS	1, 2, 6	Variations in spike morphology, waxy/non waxy & plant height
IVT-FB-IR-TS	6, 12, 23	Variations for plant height, leaf size, row type (2R/6R), spike-characters (drooping spikes)
IVT-RF-TS	4, 7, 8 10,	Variations in spike morphology, waxy/non waxy & plant height

Entries exhibiting higher diseases incidence / insect infestation:

Centre	Entry in Trial	Remarks
Kalyani	IVT-FB-IR: E22 (89)	Leaf blight scores in parenthesis
Ranchi	IVT-RF-TS: E2 (78)	-do-
Sabour	IVT-FB-IR: E22 (56) IVT-RF-TS: E2 (89), E5 (89), E11 (89)	-do-
RPCAU, Pusa	IVT-FB-IR: E6 (47) and E22 (79) IVT-RF-TS: E2 (79), E5 (89), E11 (89)	-do-
Varanasi	IVT-FB-IR: E22 (89) IVT-RF: E2 (99), E3 (78), E5 (99), E11 (99)	-do-

Report on Agronomical Trials:

Centre	Trial	Remarks
Varanasi	AVT-II variety evaluation	All the trials were very good, but tagging in variety trials was wrong as mentioned in remarks/special comments in the end of the report.

Report on Pathological Nurseries:

Centre	Nurseries	Remarks
Varanasi	As above	Very high levels (up to 99) of infection of leaf blight were observed. Most of the lines were resistant or moderately resistant

Report on National and International trials and nurseries:

Centre	Nurseries	Remarks
Varanasi	NBGSN, EIBGN	Good conductance. In some entries of EIBGN, there was lodging.

Special comments, if any (2-3 bullet points only)

- Leaf blight at Kalyani, Sabour, Ranchi, Pusa and Varanasi the disease pressure was very high to distinguish resistant and susceptible ones
- At Varanasi, in agronomic trials the tags are to be corrected and should be labelled as V1, V2 and V3 and not by entry names as seed was sent with entry codes. It seems that the concerned scientist has put the variety names against V1, V2 and V3 from the technical programme circulated, which are wrong to use as afterwards the coding was done while sending the seeds from IIWBR Karnal to centers in NEPZ.

Sd/-
Signature(s)

Zonal Monitoring Report 2021-22Zone: NWPZ Team 1
Period of visit: 04-07 March, 2022

Name of team members:	Centres Visited:
Dr RPS Verma, ICAR-IIWBR, Karnal	Bawal, Navgaon, Durgapura, Tabiji, Udaipur and Bhilwara
Dr Lokendra Kumar, ICAR-IIWBR, Karnal	
Dr PS Shekhawat, RARI Durgapura	
Dr MR Yadav, RARI Durgapura	

Summary of breeding trials allocated & monitored:

Centre	Trial(s) Allotted	Trials Not Conducted/ Rejected	Remarks
Bawal	AVT-MB, IVT-MB	Nil	Very good
Navgaon	AVT-MB, IVT-MB	Nil	Very good but plot size variations in AVT and IVT malt barley, hence rejected
Durgapura	AVT-MB, IVT-MB, IVT-FB, IVT-HL, Agronomy trials (07), Pathological, national and international nurseries and BQSN	Nil	Very good
Tabiji	AVT-MB, IVT-MB and IVT-FB	Nil	Very Good
Udaipur	IVT-FB, IVT-NB Agronomy trials(03)	Nil	Very good
Bhilwara	Sal-Alk Barley trial	Nil	Trial good but lay out not followed and no visible salinity stress

Entries showing promising performance in breeding trials across centres:

Trial	Entry	Remarks
AVT-Malt	E 2, 3, 5 and 6	Over all good appearance
IVT – Malt	E 4,10,13,14, 15, 16, 25	Over all good appearance
IVT-Feed	E11,13,14,19,25	Over all good appearance
IVT- NB	E 3, 5 & 6	Over all good appearance
SAL-ALK-IR	E 1, 3, 4, & 7	Over all good appearance

Entries recommended for purification:

Trial	Entry	Remarks
AVT-MB	E1,3,6	Off types
IVT-MB	E 5, 6, 8, 12,16, 23, and 24	Off types
IVT-FB	E9,12,15	Off types
IVT -NB	E 3, 5 & 7	Off types
Salinity	2, 8, 9, 10, 11,12, 13	Off types

Entries recommended to be dropped from further testing:

Trial	Entry	Remarks
IVT - Malt	3, 7, 9, 18,19 and 20	Drooping and erect spike, rudimentary and non- rudimentary spike, dwarf plants. Different plant type (Mixtures)
IVT-FB	3, 18 and 25	
IVT-NB	1	
Salinity	14	

Entries exhibiting higher diseases incidence / insect infestation:

Centre/ Trial	Entry	Remarks
AVT-MB	2, 6	Covered Smut 5% across locations
IVT-MB	13, 17, 24, 25	
IVT-FB	2, 6, 11, 12	

Report on Pathological Nurseries:

Centre	Trial	Remarks
Durgapura	NBDSN, EBDSN (43)	All the nurseries were sown and the infectordisease was up to 80S
Durgapura	NBDSN, EBDSN	The nurseries were conducted for CCN and aphid screening

Report on Agronomical Trials:

Centre	Trial	Remarks
Durgapura	SPL-1 to 7	All trials were very good. In SPL-1 (date of sowing trial) early sowing was seems to be better as compared to late sowing. In SPL-5, application of 25 kg zinc sulphate as basal and 12.5 kg Zn as basal followed by two spray of zinc seems to at par with that of 25 kg Zinc as basal followed by two sprays. In SPL-2 1/2 N at basal+1/2 N at tillering (35-40 DAS) +5.0% urea + 0.5% $ZnSO4.7H_2O$ spray at anthesis stage (80-90DAS) treatment seems to be better. In SPL-4 N scheduling and nano nitrogen, 75% N+ spray of nano nitrogen seems to be as good as 100%RDN. In SPL-3 PGR and FYM application seems to be better over rest of the treatments. In SPL-6 silicon applied treatments are seems to better over without silicon especially at lower levels of irrigations. In SPL-7, irrespective of seed rates, crop sown under paired row planting seems to be better over line sown crop. Overall, the experiments were good and layout was proper.
Udaipur	SPL 1, 5, and 6	All trials were very good. In SPL-1 (date of sowing trial) early sowing was seems to be better as compared to late sowing. In SPL-5, application of 25 kg zinc sulphate as basal and 12.5 kg Zn as basal followed by two spray of zinc seems to at par with that of 25 kg Zinc as basal followed by two sprays. In SPL-6 there was visible difference among the irrigation levels, however, there was not much difference among silicon treatments. Overall, the experiments were good and layout was proper.

Special comments, if any (2-3 bullet points only)

- There was layout issue at Bhilwara, where the randomization was not followed in replications 2, 3 and 4 and the entries in R1 were continued behind R1 as it is. Also, there was no visible salinity stress in the trial, **hence it was rejected**.
- At Navgaon the recommended plot size in IVT and AVT were not followed (each entry sown in 5 x5 meters= 25 M^2 with seed packets supplied for IVT and AVT plot sizes, making the seed rate less than half of recommended), hence **both the trials were rejected**.

Sd/-
(RPS Verma) PI Barley

Zonal Monitoring Report 2021-22 **Zone: NWPZ TEAM-II**
Period of visit: 07-09 March, 2022

Name of team members:	Centres Visited:
Dr AS Kharub, ICAR-IIWBR, Karnal	IIWBR, Hisar, CCSHAU, Hisar, Bhatinda, Sriganganagar, Ludhiana
Dr Jogendra Singh, ICAR-IIWBR, Karnal	
Dr Ravindra Kumar, ICAR-IIWBR, Karnal	
Dr Simarjit Kaur, PAU Ludhiana	

Summary of breeding trials allocated & monitored:

Centre	Trial(s) Allotted	Trials Not Conducted/ Rejected	Remarks
IIWBR, Hisar,	SAL-IR	Nil	Very good
CCSHAU, Hisar,	AVT-MB,IVT-MB, IVT-FB, AVT/IVT-HL,SAL-IR, Agronomy trials (07), Pathological, national and international nurseries and BQSN	Nil	Very Good
Bhatinda,	AVT-MB, IVT-MB	Nil	Good
Sriganganagar,	AVT-MB, IVT-MB	IVT–MB trial rejected. Plot and entries numbers was not matching	Very Good
Ludhiana	AVT-MB, IVT-MB, IVT-FB, AVT/IVT-HL, Agronomy trials (06), Pathological, national and international nurseries and BQSN	Nil	Very good

Entries showing promising performance in breeding trials across centres:

Trial	Entry	Remarks
AVT-Malt	E3,5	Over all good appearance
IVT - Malt	E3,4,10,13,14,17,25	Over all good appearance
IVT-Feed	E11,13,14,19,25	Over all good appearance
IVT/AVT - HL	E5,6	Over all good appearance
SAL-IR	E3,4,7,10	Over all good appearance

Entries recommended for purification:

Trial	Entry	Remarks
AVT-MB	E1,3,6	Off types
IVT-MB	E4,6,12,15,19,20,23	Off types
IVT-FB	E9,12,18	Off types
IVT/AVT	E3,5	Off types
Salinity	2,8,11,13	Off types

Entries recommended to be dropped from further testing:

Trial	Entry	Remarks
IVT - Malt	E18,7	E18 for Drooping and erect spike, E7 for rudimentary and non rudimentary spike
Salinity	E14	Different plant type (Mixtures)

Entries exhibiting higher diseases incidence / insect infestation:

Centre	Entry	Remarks
Hisar	IVT feed E22 IVT Malt E13 IVT Malt E17IVT Malt E24AVT-MB-2 AVT-MB-6	Spot blotch incidence 78 Covered Smut 8% Covered Smut 5% Covered Smut 8% Covered Smut 5% Covered Smut 5%
Ludhiana	IVT feed E22 IVT –MB E12	Spot blotch incidence 58 Yellow Rust 10S
Bhatinda	IVT-MB E13, IVT-MB E24, IVT-MB E25, AVT-MB E2 AVT-MB E6	Covered Smut 8% Covered Smut 6% Covered Smut 5% Covered Smut 7% Covered Smut 6%

Report on Agronomical Trials:

Centre	Trial	Remarks
Hisar	SPL-1 to 7	All trials were very good. In date of sowing trial early sowing was seems to be better. In N scheduling and nano nitrogen, there was not much difference in treatments except control. InSPL-3 PGR and FYM application seems to be better. In SPL-5, there was not much visibility in different Zn treatments. Over all, the experiments were good and layout was proper.
Ludhiana	SPL 1 to5 and SPL 7	All trials were very good. In date of sowing trial early sowing was seems to be better. In N scheduling and nano nitrogen, there was not much difference in treatments except control. InSPL-3 PGR and FYM application seems to be better. In SPL-5, there was visible differences Zn treatments. Overall, the experiments were good and layout was proper.

Report on Pathological Nurseries:

Centre	Trial	Remarks
Hisar	NBDSN (119), EBDSN (43)	All the nurseries were sown and the infectordisease was up to 60S
Ludhiana	NBDSN (119), EBDSN (43), IBDSN (396)	All the nurseries weresown and the infector disease was up to 60S

Special comments, if any (2-3 bullet points only)

There was layout issue at Sriganganagar, So when dispatching trial, a simple and proper layout should be given and packets should be labelled replication, plot number/ entry number wise as the case may be.

Sd/- Signature(s)

Zonal Monitoring Report 2021-22 Zone: NHZ

Period of visit: 15-16 April, 2022

Name of team members:	Centres Visited:
Dr Chuni Lal, ICAR-IIWBR, Karnal	Majhera and Almora

Summary of breeding trials allocated & monitored:

Centre	Trial(s) Allotted	Trials Not Conducted / Rejected	Reason/Remark*
Majhera	IVT-RF-TS-NHZ	Nil	Very Good
Almora	IVT-RF-TS-NHZ	Nil	Excellent

*****_Evaluate trials as very good, good, average and poor based on conduction_

Entries showing promising performance in breeding trials across centres:

Trial	Entry	Remarks
IVT-RF-TS-NHZ	E6, E14, E18, E21, E22,	Over all good appearance

Entries recommended for purification:

Trial	Entry	Remarks
IVT-RF-TS-NHZ	E11	Variations in spike colour and orientation

Entries recommended to be dropped from further testing: Nil

Trial	Entry	Remarks

Entries exhibiting higher diseases incidence / insect infestation: The crop had dried up at the time of monitoring, so this observation could not be made.

Centre	Entry	Remarks

Report on Agronomical Trials: Not allotted

Centre	Trial	Remarks

Report on Pathological Nurseries:

Centre	Nurseries	Remarks
Almora	NBDSN (119), EBDSN (43), IBDSN (396)	All the nurseries were sown. The crop had already dried up. However, the disease incidence was already recorded by the pathologist. As per his records the infector had as high as 80S score for yellow rust and test entries varied from almost no incidence to 65S.

Special comments, if any (2-3 bullet points only)

- At both the locations rainfed breeding trials were very good. Sufficient and prolonged winter rains received could be one of the reasons
- At Majhera centre fertility gradient was perceivable from the appearance of the crop
- First cult was made on 70 DAS (on 13.1.2022 and 5.1.2022 at Majhera and Almora respectively) in the 2nd and 4th replication. The cut replications were equally good in appearance compared to the non-cut replications, especially at Almora.

Sd/- Signature(s):

Barley Frontline Demonstrations (2021-2022)

During the *rabi* crop season 2021-22, 250 Barley Frontline Demonstrations (BFLDs) of one acre each were allotted to 32 cooperating centers all over India in eight states/UT namely, Himachal Pradesh, Uttar Pradesh, Jammu & Kashmir, Punjab, Haryana, Rajasthan and Madhya Pradesh. Out of these, 228 BFLDs were conducted by 29 centers, covering 238 acres area of 277 farmers (Table 1). Improved barley varieties with complete package of practices (irrigation management, nutrient management, weed control, seed treatment etc.) were demonstrated.

Table 1: Centre wise distribution of barley FLDs during *rabi* 2021-22 (in acres)

S.No.	Zone and Centre	BFLDs Allotted	BFLDs Conducted	Area sown (acres)	No. of farmers/ locations
Northern Hills Zone (NHZ)					
1.	CSKHPKV, HAREC, Bajaura, Kullu (HP)	7	7	7	29
2.	ICAR-IARI, RS, Amartara Cottage, Shimla (HP)	5	Not conducted	-	-
3.	KVK (YSPUH&F), Lahaul & Spiti -2, Tabo, Kaza, L&S (HP)	5	Not conducted	-	-
North Eastern Plains Zone (NEPZ)					
4.	NDUA&T, Kumarganj, Ayodhya (UP)	10	10	10	10
5.	KVK (IAS-BHU), Barkachha, Mirzapur (UP)	10	10	12*	12
6.	CSAUA&T, Kanpur (UP)	10	10	10	10
7.	BHU, Varanasi (UP)	12	Not conducted	-	-
8.	KVK, Gorakhpur-2, (Guru Gorakshnath Seva Sansthan), Chauk Mafi (Peppeganj), Jangal Kaudiya, Gorakhpur (UP)	10	10	10	10
North Western Plains Zone (NWPZ)					
9.	KVK (SKUAST-Jammu), Rajhani, Kathua (J&K)	8	8	8	21
10.	PAU, Ludhiana (Punjab)	8	8	8	8
11.	KVK (PAU), Khokhar Khurd, Mansa (Punjab)	10	10	10	13
12.	KVK (PAU), Kheri, Patran Road, Sangrur (Punjab)	5	5	6*	6
13.	KVK (PAU), Goneana, Muktsar (Punjab)	5	5	5	5
14.	KVK (PAU), Dabwali Road, Near Kheti Bhawan, Bathinda (Punjab)	5	5	5	5
15.	CCSHAU, Hisar (Haryana)	10	10	10	10
16.	KVK (BB Ashram), Rampura, Rewari (Haryana)	8	8	8	7
17.	KVK (CCSHAU), Bhiwani (Haryana)	10	10	12*	12
18.	ICAR-IIWBR, Karnal (Haryana)	5	5	5	5
19.	RARI (SKNAU), Durgapura, Jaipur (Rajasthan)	10	10	10	10
20.	KVK (Pragati Trust), Chomu, Jaipur (Rajasthan)	5	5	5	5
21.	KVK (AU-Kota), Akorashi, Dhindora, Hindauncity, Karauli (Rajasthan)	8	8	11*	11
22.	KVK, Alwar-1 (SKNAU-Jobner), Navgaon, District-Alwar (Rajasthan)	5	5	5	5
23.	ACES, Amity University Uttar Pradesh, Noida (UP)	10	10	10	10
Central Zone (CZ)					
24.	RCOA (MPUA&T), Udaipur (Rajasthan)	10	10	10	10
25.	KVK (MPUA&T), Dhoinda, Rajasmand (Rajasthan)	10	10	10	10
26.	KVK (JNKVV), Kuthulia Farm, Rewa (MP)	8	8	8	8
27.	KVK (JNKVV), Purushottampur, Panna (MP)	8	8	8	8
28.	KVK (JNKVV), Tikamgarh (MP)	8	8	8	10
29.	KVK (RVSKVV), Biaora, Kothi Bagh, Rajgarh(MP)	5	5	5	5
30.	COA (JNKVV), Ganj Basoda, Vidisha (MP)	10	10	10	10
31.	KVK (BUA&T-Banda), Lalitpur (UP)	5	5	7*	7
32.	KVK (BUA&T-Banda), Bharari, Bhojla, Jhansi (UP)	5	5	5	5
Total		**250**	**228**	**238**	**277**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

Table 2 : State wise distribution of barley FLDs during *rabi* 2021-22 (in acres)

S.N.	State/UT	BFLDs Allotted	BFLDs Conducted	Area Sown (acres)	No. of farmers/ Locations
1.	HP	17	7	7	29
2.	J&K	8	8	8	21
3.	UP	72	60	64	64
4.	Punjab	33	33	34	37
5.	Haryana	33	33	35	34
6.	Rajasthan	48	48	51	51
7.	MP	39	39	39	41
Total		**250**	**228**	**238**	**277**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

Table 3 : Zone wise distribution of barley FLDs during *rabi* 2021-22 (in acres)

S.N.	Zone	BFLDs Allotted	BFLDs Conducted	Area Sown (acres)	No. of Farmers/ Locations
1.	NHZ	17	7	7	29
2.	NEPZ	52	40	42	42
3.	NWPZ	112	112	118	133
4.	CZ	69	69	71	73
Total		**250**	**228**	**238**	**277**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

Table 4 : State wise yield gain during *rabi* 2021-22

State	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (%)
HP	28.83	21.38	34.85***
Eastern UP	34.70	27.95	24.15***
Central UP	38.88	30.35	28.09***
Western UP	56.18	51.10	9.93***
All UP	38.83	32.03	21.23***
J&K	27.50	20.78	32.37***
Punjab	38.80	35.03	10.78***
Haryana	43.93	40.98	7.20**
Rajasthan (NWPZ)	61.45	50.18	22.47***
Rajasthan (CZ)	42.25	35.30	19.69***
All Rajasthan	53.93	44.35	21.59***
MP	37.85	27.93	35.54***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

The highest gain in barley yield was recorded in MP (35.54 %) followed by HP (34.85%), J&K (32.37 %), Central UP (28.09%), Eastern UP (24.15%), Rajasthan NWPZ (22.47%) and All Rajasthan (21.59 %). The lowest gain in yield was reported in Haryana (7.20 %) (Table 4).

Table 5: Zone wise productivity over regional productivity during *rabi* 2021-22

Zone	BFLDs yield (q/ha)	Regional mean yield (q/ha)	Gain (%)
NHZ	28.83	20.70	39.25***
NEPZ	34.70	27.70	25.27***
NWPZ	44.98	38.18	17.81***
CZ	39.28	29.65	32.46***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

The yield gain due to improved varieties over regional mean yield was highest in NHZ (39.25 %) followed by CZ (32.46 %), NEPZ (25.27 %) and NWPZ (17.81 %) (Table 5).

Table 6 : Zone wise productivity over check during *rabi* 2021-22

Zone	BFLDs yield (q/ha)	Check mean yield (q/ha)	Gain (%)
NHZ	28.83	21.38	34.85***
NEPZ	34.70	27.95	24.15***
NWPZ	44.98	39.03	15.25***
CZ	39.28	30.45	28.98***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

The yield gain due to improved varieties over check was highest in NHZ (34.85 %) followed by CZ (28.98 %), NEPZ (24.15 %) and NWPZ (15.25 %) (Table 6). Therefore, efforts should be made to increase barley yield in the NHZ, CZ and NEPZ by promoting recent barley production technologies in collaboration with the state department of agriculture.

The yield gain under barley FLD was highest at center Rewa (89.13%) followed by Tikamgarh (50.80%), Lalitpur (39.57%) in CZ, Gorakhpur (34.97) in NEPZ, Bajaura (34.85%) in NHZ and Kathua (32.37%) in NWPZ. The yield gain was lowest at Bathinda (03.02%) in NWPZ (Table 7).

Table 7 : Centre wise performance of improved barley varieties during *rabi* 2021-22

Zone and Centre	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (%)
NHZ			
Bajaura	28.83	21.38	34.85***
NEPZ			
Ayodhya	35.75	27.75	28.83***
Mirzapur	18.38	17.25	06.52***
Kanpur	43.83	36.25	20.90***
Gorakhpur	44.10	32.68	34.97***
NWPZ			
Kathua	27.50	20.78	32.37***
Ludhiana	40.33	37.20	08.40 NS
Mansa	32.70	28.85	13.34***
Sangrur	45.25	38.25	18.30***
Muktsar	40.28	36.30	10.95**
Bathinda	44.40	43.10	03.02**
Hisar	46.00	44.75	02.79 NS
Rewari	50.38	44.25	13.84***
Bhiwani	38.38	36.50	05.14***
Karnal	46.00	43.60	05.50**
Durgapura, Jaipur	65.50	52.00	25.96***
Chomu, Jaipur	54.15	42.78	26.59***
Karauli	65.75	55.35	18.79***
Alwar-1	51.20	42.50	20.47***
Noida	56.18	51.10	9.93***
CZ			
Udaipur	44.25	37.50	18.00***
Rajasmand	40.23	33.10	21.53***
Rewa	37.60	19.88	89.13***
Panna	29.38	23.60	24.47***
Tikamgarh	32.95	21.85	50.80***
Rajgarh	49.00	38.15	28.44***
Vidisha	42.73	37.00	15.47***
Lalitpur	38.98	27.93	39.57***
Jhansi	38.75	33.75	14.81***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

Table 8 : Variety wise performance of improved barley varieties during *rabi* 2021-22

Zone and Centre	Improved variety	Average yield (q/ha)	Check variety	Average yield (q/ha)	Yield gain over check (%)
NHZ					
Bajaura	BHS 400	31.58	HBL 113(Vimal)	24.58	28.48***
Bajaura	HBL 713	32.33	HBL 113(Vimal)	24.70	30.87***
Bajaura	HBL 804	30.83	Local	23.33	32.15***
Bajaura	VLB 118	28.75	HBL 316 (Gopi)	22.50	27.78^{NS}
NEPZ					
Ayodhya	DWRB 137	34.58	Azad (K 125)	27.08	27.70**
Ayodhya	DWRB 137	36.25	Narendra Jau 2	26.88	34.88*
Ayodhya	RD 2907	36.25	Narendra Jau 2	28.50	27.19***
Mirzapur	RD 2907	18.75	Azad (K 125)	17.13	9.49***
Mirzapur	DWRB 137	18.00	Azad (K 125)	17.38	3.60**
Kanpur	DWRB 137	44.00	K 508	36.00	22.22***
Kanpur	RD 2907	43.63	K 508	36.50	19.52***
Gorakhpur	DWRB 137	43.75	RD 2660	33.05	32.38***
Gorakhpur	RD 2907	44.45	RD 2660	32.30	37.62***
NWPZ					
Kathua	RD 2907	27.50	Local	20.78	32.37***
Ludhiana	DWRB 137	41.08	PL 807	37.50	9.53^{NS}
Ludhiana	DWRB 182	40.00	Non descript	30.00	33.33^{NS}
Mansa	DWRB 137	32.08	Non descript	28.75	11.57***
Mansa	DWRB 182	40.00	Non descript	30.00	33.33^{NS}
Sangrur	DWRB 137	45.25	PL 807	38.25	18.30***
Muktsar	DWRB 137	39.85	PL 426	36.63	8.81^{NS}
Muktsar	DWRB 182	42.00	PL 426	35.00	20.00^{NS}
Bathinda	DWRB 137	44.25	Local	42.88	3.21**
Bathinda	DWRB 182	45.00	Local	44.00	2.27^{NS}
Hisar	DWRB 137	46.00	BH 946	44.75	2.79^{NS}
Rewari	DWRB 137	50.53	BH 393	44.25	14.18***
Rewari	DWRB 182	49.25	BH 393	44.25	11.30^{NS}
Bhiwani	DWRB 137	38.30	BH 393	36.33	5.44***
Bhiwani	DWRB 182	39.50	BH 393	38.75	1.94^{NS}
Karnal	DWRB 137	46.25	BH 393	43.88	5.41**
Karnal	DWRB 182	45.00	BH 393	42.50	5.88^{NS}
Durgapura, Jaipur	DWRB 137	66.43	RD 2552	52.15	27.37***
Durgapura, Jaipur	DWRB 137	63.33	RD 2660	51.68	22.54***
Chomu, Jaipur	DWRB 137	53.10	RD 2660	44.03	20.61***
Chomu, Jaipur	DWRB 137	55.73	RD 2035	40.93	36.16**
Karauli	DWRB 137	65.75	RD 2035	55.35	18.79***
Alwar-1	DWRB 137	51.20	RD 2035	42.50	20.47***
Noida	DWRB 137	56.18	Local	51.10	9.93***
CZ					
Udaipur	DWRB 137	44.25	RD 2035	37.50	18.00***
Rajasmand	DWRB 137	40.23	RD 2660	33.10	21.53***
Rewa	DWRB 137	37.60	JB 58	19.88	89.13***
Panna	DWRB 137	29.38	Mixed seed	23.60	24.47***
Tikamgarh	DWRB 137	32.95	JB 58	21.85	50.80***
Rajgarh	DWRB 137	49.00	Local	38.15	28.44***
Vidisha	DWRB 137	42.73	Local Variety	37.00	15.47***
Lalitpur	DWRB 137	38.98	Munda	27.93	39.57***
Jhansi	DWRB 137	38.75	Munda	33.75	14.81***
Dual-Purpose Barley					
NHZ-Bajaura					
Av. Grain Yield	HBL 804	25.08	Harit (HBL 276)	17.35	44.52***
Av. Green FodderYield	HBL 804	33.48	Harit (HBL 276)	28.18	18.81***

**** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level, NS is Non-significant*

The varieties HBL 713 (32.33 q/ha) at Bajaura centre in NHZ, RD 2907 (44.45 q/ha) at Gorakhpur in NEPZ, DWRB 137 (66.43 q/ha) at Durgapura Jaipur in NWPZ and DWRB 137 (49.00 q/ha) at Rajgarh in CZ were the highest average yielding. The dual-purpose barley variety HBL 804 yielded 25.08 q/ha grain yield and 33.48 q/ha green fodder yield at Bajaura center, in comparison to this, the check variety HBL 276 yielded 17.35 q/ha grain yield and 28.18 q/ha green fodder yield at Bajaura center (Table 8). It is evident from Table 8 that recent varieties out performed old/check varieties at all the locations. The yield gains due to varietal interventions ranged from 3.21% to 89.13%.

Table 9: Yield potential of barley varieties in different zones during *rabi* 2021-22

Zone	Centre	Variety	Yield (q/ha)
NHZ	Bajaura	HBL 713	36.00
NEPZ	Gorakhpur	RD 2907	46.00
NWPZ	Durgapura, Jaipur	DWRB 137	70.00
CZ	Rajgarh	DWRB 137	51.00

It is evident from table 9 that varieties HBL 713 (36.00 q/ha), RD 2907 (46.00 q/ha), DWRB 137 (70.00 q/ha) and DWRB 137 (51.00 q/ha) performed better than other varieties at Bajaura, Gorakhpur, Durgapura Jaipur and Rajgarh centres in the NHZ, NEPZ, NWPZ and CZ, respectively (Table 9).

Table 10: Barley varieties grown in different zones during *rabi* 2021-22

Zone	Improved varieties	Check varieties	Popular varieties in the region
NHZ	VLB 118, BHS 400, HBL 713, HBL 804,	HBL 316 (Gopi), HBL 276 (Harit), HBL 113 (Vimal), Local	Sonu, Dolma, HBL 276, HBL 316, Local
NEPZ	DWRB 137, RD 2907	Narendra Jau-2, K 125 (Azad), K 508, RD 2660	Narendra Jau-2, Narendra Jau-7, Lakhan, Azad, Jyoti, Jagriti, Amber, K 125 (Azad), K508, K1055, RD2660, RD2794, Local
NWPZ	DWRB 137, DWRB182, RD2907	PL807, PL426, BH393, BH946, RD 2035, RD 2552, RD 2660, Local, Non-descript	RD 2907, PL 807, PL 426, DWRUB 52, BH 393, BH 946, RD 2035, RD 2052, RD 2715, RD 2786, RD 2794, Local
CZ	DWRB 137	JB 58, RD 2035, RD 2660, Munda, Local, Mixed seed, Old mix local variety.	RD 2035, RD 2552, RD 2715, RD 2899, RD 2660, RD 2786, JB 58, Karan 201, Munda, Narendra Jau-1, Local

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(29-31 अगस्त, 2022)

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