प्रगति प्रतिवेदन

PROGRESS REPORT 2020-21

जौ सुधार
BARLEY IMPROVEMENT

अखिल भारतीय समन्वित गेहूँ एवं जौ अनुसंधान परियोजना

AICRP on Wheat and Barley

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

ICAR-Indian Institute of Wheat and Barley Research, Karnal

For official use only

All India Coordinated Research Project on Wheat and Barley

PROGRESS REPORT
2020-21

BARLEY IMPROVEMENT

RPS Verma
AS Kharub
Dinesh Kumar
Chuni Lal
Jogendra Singh
Rekha Malik
Lokendra Kumar
SK Bishnoi
Sudheer Kumar
SC Bhardwaj
Poonam Jasrotia
Ajay Verma
Amit Kumar Sharma
Charan Singh
Satyavir Singh
GP Singh

ICAR-Indian Institute of Wheat and Barley Research
P.O. BOX - 158, Agrasain Marg, Karnal -132001

Correct Citation:

ICAR-IIWBR 2021. Progress Report of AICRP on Wheat & Barley 2020-21: Barley Improvement. Eds: RPS Verma, AS Kharub, D Kumar, C Lal, J Singh, R Malik, L Kumar, SK Bishnoi, S Kumar, SC Bhardwaj, P Jasrotia, A Verma, A K Sharma, C Singh, S Singh and GP Singh. ICAR-Indian Institute of Wheat and Barley Research, Karnal, India. P. 244.

Issued on the occasion of 60th All India Wheat & Barley Research Workers' Meet hosted by ICAR-IIWBR, Karnal during August, 23-24, 2021.

ACKNOWLEDGEMENTS

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

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

I record my sincere acknowledgements for the useful help provided by my colleagues Drs. AS Kharub, Dinesh Kumar, Chuni Lal, Lokendra Kumar, Jogendra Singh, Rekha Malik, SK Bishnoi, AK Sharma Charan Singh, Sudheer Kumar, Poonam Jasrotia, R. Sendhil 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.

Dr. Ajay Verma, who helped in analyzing the voluminous data well in time deserve my special thanks. The help extended for reproduction of adequate number of copies and binding of this report by Dr. Ajay Verma and his team consisting of Sh. Bhim Sain and Sh. Ronak Ram, is duly acknowledged.

(RPS Verma)
Principal Investigator
Barley Improvement
ICAR-IIWBR, Karnal

CONTENTS

60th All India Wheat and Barley Workers Meet (23-24 August 2021)

RESEARCH HIGHLIGHTS OF BARLEY IMPROVEMENT

The crop season 2020-21 was good for barley production as the crop experienced nearly 5.6% increase in production over the previous year, despite with only an increase in area by 3.2 % over the previous year as the productivity increased by 2.3% from 29.2 to 29.88 q/ha. According to 3rd advance estimates for Rabi 2020-21, nearly 1818 thousand tons of barley has been produced in 609 thousand ha area with a productivity of 29.9 q/ha. Rajasthan continues to be the largest state having >58% in production and >51% area followed by Uttar Pradesh (Table 1.1). In case of Rajasthan there is an increase of 4.8% in area and 8.2% in production over last year, while Haryana and Punjab have also witnessed little increase in barley area and production. Maharashtra has an increasing trend for barley in recent last three years. The states of U.P., and Uttarakhand have indicated downward 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	2019-20 (Final Estimates)			2020-21 (3rd Estimates)			Change		
	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)	Area (000'ha)	Production (000't)	Yield (kg/ha)
Bihar	**7.4**	**10.2**	**1369**	**10.7**	**17.6**	**1649**	**3.25**	**7.44**	**280**
Chhattisgarh	**1.7**	**1.0**	**609**	**1.4**	**1.2**	**805**	**-0.24**	**0.13**	**196**
Haryana	**12.1**	**46.5**	**3837**	**19.4**	**73.9**	**3803**	**7.30**	**27.35**	**-34**
Himachal Pradesh	**20.4**	**30.8**	**1510**	**20.0**	**36.2**	**1810**	**-0.41**	**5.37**	**300**
Madhya Pradesh	**30.0**	**63.9**	**2131**	**32.0**	**48.5**	**1515**	**2.00**	**-15.45**	**-616**
Maharashtra	**10.7**	**3.8**	**351**	**14.0**	**18.2**	**1302**	**3.31**	**14.49**	**951**
Punjab	**6.2**	**22.6**	**3644**	**8.1**	**32.0**	**3951**	**1.90**	**9.41**	**307**
Rajasthan	**301.2**	**979.3**	**3251**	**312.7**	**1059.3**	**3388**	**11.43**	**79.99**	**137**
Uttar Pradesh	**167.0**	**523.0**	**3132**	**159.0**	**498.0**	**3132**	**-8.00**	**-25.06**	**0**
Uttarakhand	**24.0**	**34.3**	**1431**	**22.0**	**26.5**	**1203**	**-2.00**	**-7.88**	**-228**
West Bengal	**0.3**	**0.6**	**2155**	**0.5**	**1.0**	**2020**	**0.22**	**0.41**	**-135**
Others	**8.5**	**5.7**	**671**	**8.8**	**6.0**	**686**	**0.27**	**0.32**	**15**
INDIA	**590**	**1722**	**2920**	**609**	**1818**	**2988**	**+19**	**+97**	**+67**

Source: DES, MoA & FW, India.

Very often, a concern is usually raised at various platforms for barley area decline under barley 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 as demonstrated in the figure 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 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.

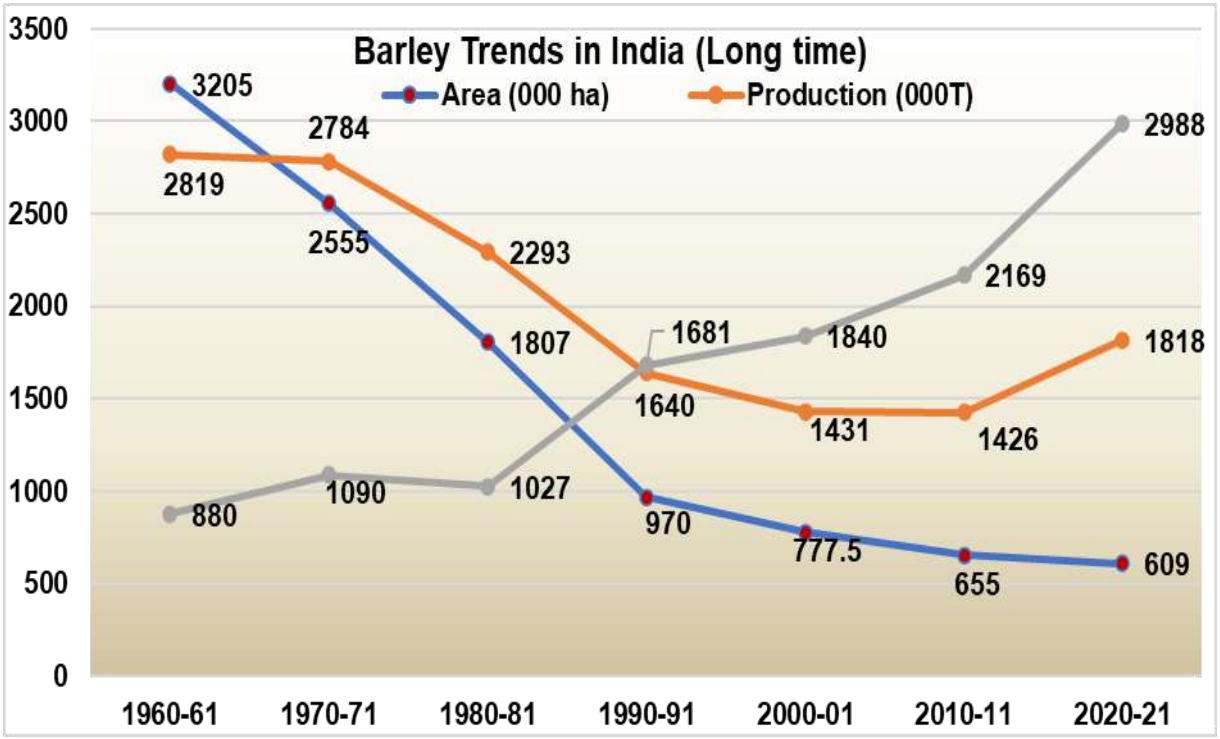


Fig. 1a: Long term trends of barley area, production and productivity in India (Source: DES,MoA&FW, India).

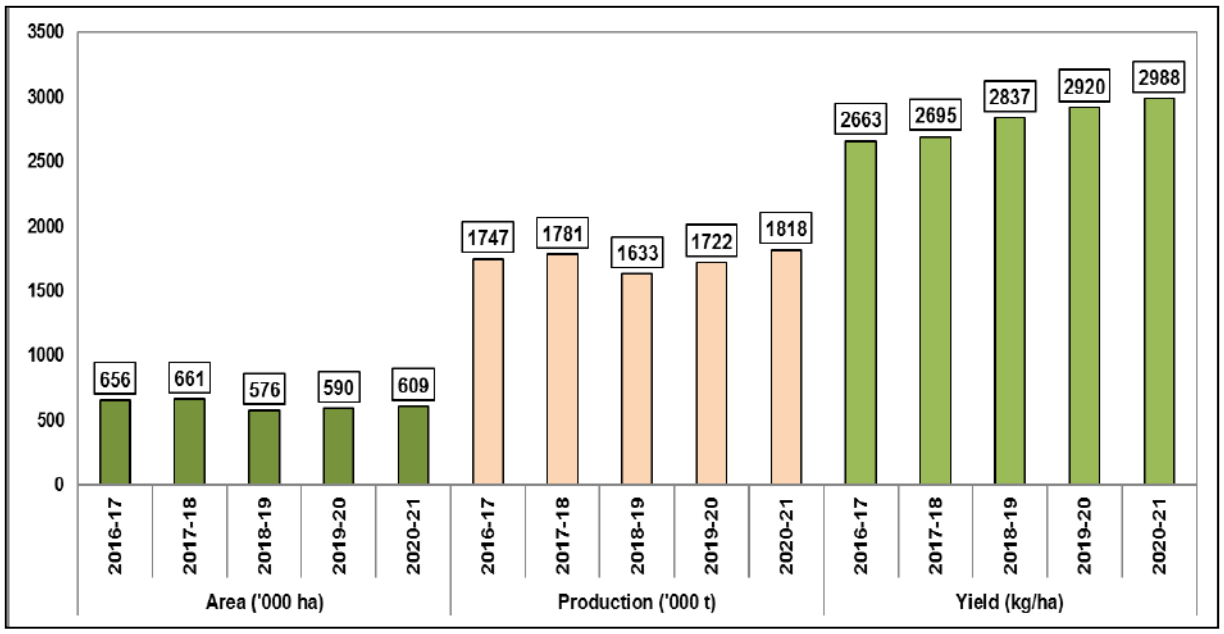


Fig. 1b: Barley area, production and productivity in India in last five years (Source: DES, MoA & FW, India).

Thus, there is a need of 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. Again, there is a 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.

During the year some damage/losses in quantity and quality of the grain due to poor winter rains observed in different areas in timely sown crop. 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 net blotch in some areas because of cool dry situation. The incidence of spot blotch was more in the eastern zone. The smuts (both covered and loose) were common in fields where the seed was not treated by farmers.

Release and Identification of new barley variety

One malt barley variety DWRB182 was released and notified by CVRC for commercial cultivation in North Western Plains Zone (Punjab, Haryana, Western U.P., Rajasthan (except Kota and Udaipur divisions) during 2020-21 (Table 1.2). This variety combines most of the mating and brewing traits required by industry. DWRB182 is the only genotype reported with *very low levels of grain β-glucan content (<5.0%), and wort β-glucan (506 ppm***)** based on three years average performance in AICW&BIP trials. The less β-glucan content in grain and wort is also reflected by *highest filtration rate (263 ml/hr)* amongst all checks. Another trait of current preference is *malt diastatic power, which is highest (86^{0}L) in the proposed genotype***.** These two traits have been lacking so far in the malt barley varieties released in country. The malting and brewing industry is really looking for such genotype, which they can use in place of the imported exotic barleys. DWRB182 *is highly resistant to yellow rust in field as well as in SRT testing to all known pathotypes in country*, while the checks are susceptible to many pathotypes in SRT. Additionally, it has better resistance to the leaf blights over the checks in all the three years of screening in NBDSN.

Another variety of barley KB1425 (Azad Jau 33) have been recommended by the Uttar Pradesh SVRC in its recent meeting in June 2021 for saline-sodic soils areas (pending notification by CVRC).

Table 1.2: Barley varieties released by CVRC/SVRC during 2020-21.

SN	Variety	Parentage	Zone	Developed at	Production condition	Avg. yield	Pot. yield
1.	DWRB182	DWRUB52/ DWRB78	NWPZ	IIWBR, Karnal	Malt barley under Irrigated timely sown,	49.7	74.5
2	KB1425*	K508/NNDB1295	Uttar Pradesh	CSAUA&T Kanpur	Irrigated timely sown, in saline-sodic soils	33.1	47.3

*CVRC notification awaited

Registration of genetic stocks

Seven genetic stocks namely DWRB206, DWRB207, UPB1065, UPB1070, BHS474, BCLA3, and BCLA11-6 (Table 1.3) were registered with ICAR-NBPGR for their unique traits during the year, including two of them for resistance to corn leaf aphid tolerance for the first time in country.

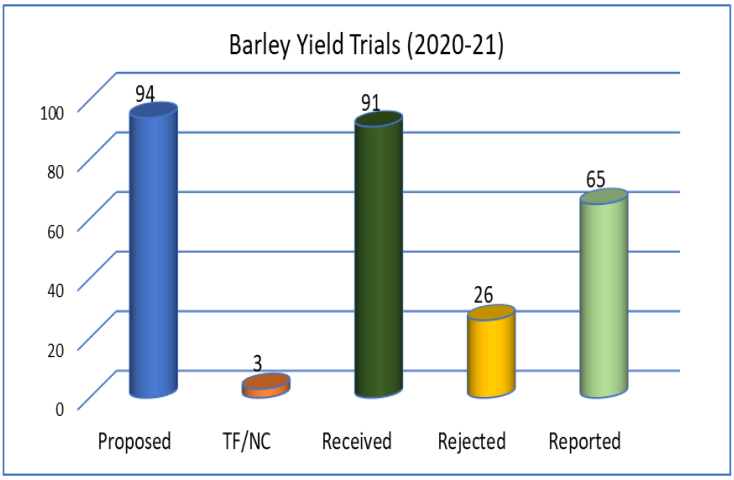
Table 1.3: Genetic stocks registered with NBPGR New Delhi during 2020-21

SN	Name	INGR No.	Year	Parentage	Trait	Institute
1.	DWRB207 (DWRFB19)	INGR20019	2020	CDC Manley/ BCU2881	Highly resistant to stripe rust. High 1000 grain weight (47.5g). Low protein content (9.5).	IIWBR, Karnal
2	BHS 474 (BBM 777)	INGR20018	2020	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.	IARI Regional Station, Shimla,
3	UPB 1065	INGR20083	2020	LIMON/ BICHY2000 //NE167/ CLE176	Low Beta glucan content (<3.5%) and high Filtration rate and Kolbach index.	GBPUA&T, Pantnagar
4	UPB 1070	INGR20020	2020	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	GBPUA&T, Pantnagar
5	DWRB206*	NA*	2021	ZIGZIG/4/ TOCTE//HIGO/ LINO/3/ PETUNIA1	High resistant to stripe rust in huskless back ground	IIWBR, Karnal
6	BCLA 3*	NA*	2021	EB921/ Alfa93	Corn leaf aphid resistance in two-row back ground	IIWBR, Karnal
7	BCLA 11-6*	NA*	2021	BCU390 /alfa93	Corn leaf aphid resistance in six-row back ground	IIWBR, Karnal

*Proceedings awaited

CROP IMPROVEMENT

Coordinated Yield Evaluation Trials



- In all 88 test entries contributed by 11 centres, were evaluated against 23 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 30 additional testing centres (including ICAR, SAUs and State Department of Agriculture) during Rabi 2020-21.

- Out of 94 yield evaluation trials proposed 93 trials were conducted. Two trials failed at Navgaon and Ranchi. The data were received in time for 91 trials. After the analysis, only 65 trials (69.1% of proposed, 71 % of conducted) were found good for reporting. This rejection includes the IVT/AVT huskless barley trial failed at all 15 locations because of extremely poor germination of two entries and one recent check PL891, this made the rejected trials number exceptionally high this year.

Promising entries in AVT/IVTs during 2020-21

Based upon 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 (as applicable), 19 entries were found promising in the different varietal evaluation trials (Table1.2).

Table 1.4: Promising entries in different trials during 2020-21

SN	Trial name	Zone	Entry
1	AVT-IR-FB	NWPZ	RD3012
2	AVT-IR-FB	NEPZ	PL911, PL917
3	AVT-RF	NHZ	UPB1093, BHS484
4	AVT-SST	NWPZ/NEPZ	DWRB224, RD3039
5	IVT-IR-MB	NWPZ	DWRB2019, BH1036, DWRB221, DWRB220, DWRB218
6	IVT-FB	NWPZ	-
7	IVT-FB	NEPZ	NDB1756, UPB1095, RD3034
8	IVT-FB	CZ	K1912, PL927, RD3032,
9	IVT-RF	NEPZ	RD3037

Malt Barley Trials

IVT-MB-TS:

- The IVT-MB-NWPZ was proposed at 10 locations and was conducted at all locations. as per prescribed layout. The data from nine locations were considered for zonal mean analysis as Navgaon was rejected by monitoring team.
- Initially, there were a total of 22 genotypes in this trial including five checks. Due to severe germination problem in the test entry KB1939 over all locations, the improper data of this test entry were not considered for statistical analysis.
- In case of grain yield, the location mean value ranged from 38.71q/ha (Hisar) to 80.57 q/ha (Sriganganagar) with a zonal mean of 49.92 q /ha. Amongst the genotypes, the entry DWRB219 ranked first with 58.55 q/ha and was significantly superior to rest of entries and checks. It was followed by the entries BH1036 (55.02 q/ha), DWRB221 (54.13 q/ha), DWRB220 (53.62 q/ha) and DWRB218 (53.03 q/ha). Amongst checks, DWRB182 (52.87 q/ha) was observed the best check.

Feed Barley Trials

AVT-IR-FB- NWPZ& NEPZ:

- The pooled AVT was proposed at 11 and 7 locations in the NWPZ and NEPZ, respectively. The results were not received from Navgaon centre. After the analysis the data from Chatha in NWPZ, and Kumarganj & Kalyani locations in NEPZ were not included for respective zonal pooled analysis due to LSM. The results from rest 13 centers were included in zonal pooled analysis.
- The trial consisted of six entries and four checks (BH946, BH902, HUB113 and DWRB137).

- The location means for grain yield ranged from 36.43 q/ha (Hisar) to 70.72 q/ha (SG Nagar) with 48.86 q/ha zonal mean across the centres in NWPZ. Entry RD3012 (49.49 q/ha) was numerically higher than the zonal check BH946 (49.12 q/ha).
- The location means for grain yield ranged from 30.41 q/ha (Varanasi) to 39.79 q/ha (Sabour) with 35.50 q/ha zonal mean across the centres in NEPZ. The entry PL917 (41.70 q/ha) ranked first followed by BH902 (37.6 q/ha) and BH946 (36.30 q/ha), PL911 (36.10 q/ha) and the NEPZ check HUB113 (35.70 q/ha).

AVT-IR-FB- Central Zone:

- The trial was proposed at 7 locations in the Central Zone and conducted at all locations except CAU, Jhansi, who returned the trial box back to IIWBR Karnal. The results from all the remaining six locations were considered for zonal pooled analysis.
- The trial consisted of three entries (K1822, RD3013 and UPB1088) and three checks, namely BH959, RD2899 and DWRB137, however the seed of UPB1088 was not supplied by the contributing centre hence the entry was replaced by filler.
- The location means for grain yield ranged from 39.16 q/ha (Vijapur) to 68.57 q/ha (Tikamgarh) with zonal mean 51.92 q/ha. The check BH959 ranked first with 58.00 q/ha mean grain yield and the entry RD3013 ranked second with 57.03 q/ha.

AVT-SST:

- This trial was proposed at 7 locations and was conducted by all centres. After the analysis the data from Fatehpur and IIWBR Hisar centres were not considered for pooled analysis due to LSM and HCV respectively. The trial consisted of 15 genotypes including three checks (NDB1173, RD2794 and RD2907). Entries RD3016 and KB1922 were in AVT-I year (retained last year after first year testing), while rest of the 9 entries were in IVT (first year testing).
- The location means for grain yield ranged from 16.45 q/ha (CSSRI Karnal) to 29.44 q/ha (Bhilwara) with 24.01 q/ha zonal mean across the centres. Entry DWRB224 ranked first with mean grain yield of 30.71 q/ha and entry RD3039 ranked second with grain yield 30.11 q/ha, while the best check RD2794 stood at rank third in the first non-significant group.

IVT-FB-NWPZ/NEPZ/CZ:

- The IVT feed barley was proposed at 18 locations comprising of NWPZ (7), NEPZ (7) and Central Zone (4) in northern plains. The trial was conducted at all locations. The results from all the seven locations were included for zonal compilation in NWPZ. In case of NEPZ, six locations were included in zonal means as the data from Varanasi (low yield levels & high CV) were rejected. Similarly, in central zone data from Morena was rejected and rest three centres were reported. The trial consisted of 19 entries and five checks, namely BH902, BH946, (both NWPZ checks), HUB113, DWRB137 (NEPZ and CZ check), and RD2899 (CZ check). To fit the trial in a 5 x 5 lattice design, one filler was included.
- The location means for grain yield ranged from 31.23 q/ha (Karnal) to 58.74 q/ha at (Durgapura) with 43.1 q/ha zonal mean in NWPZ. In case of NWPZ, entry used as filler ranked first with 52.8 q/ha mean grain yield followed by checks HUB113 (51.7 q/ha) and DWRB137 (51.7 q/ha) in 1st NSG.
- In NEPZ, location means ranged from 32.96 q/ha (Kanpur) to 68.09 q/ha (CAU, Pusa) with location mean 40.4 q/ha. The entry NDB1756 (51.2 q/ha) ranked first and UPB1095 ranked second (48.4 q/ha) whereas, check BH902 (48.3 q/ha) ranked third for mean grain yield in the 1st NSG.
- In case of central zone, the location mean ranged from 36.53 q/ha (Vijapur) to 55.80 q/ha (Gwalior) with 46.5 q/ha zonal mean. The entry KB1912 ranked first with mean grain yield

61.8 q/ha followed by PL927 (58.5 q/ha) and RD3032 (58 q/ha) in the 1st NSG. BH946 was the best check of this zone which ranked fourth with mean grain yield 56.1 q/ha, while DWRB137 was best zonal check with 55.20 q/ha mean grain yield.

AVT /IVT-Hulless-NWPZ/NEPZ/CZ:

- In AVT/IVT hulless barley was proposed at 15 locations comprising of NWPZ (6), NEPZ (3) and Central Zone (6) in northern plains. The trial was conducted at all locations. The results from all the locations were received.
- Three genotypes including the latest check PL891 were having extremely poor germination causing the trial failure at all locations. Hence despite receiving the data from all 15 centres the statistical analysis was not performed.

IVT-RF-NEPZ:

- The trial was proposed at eight locations and was conducted by all centres. However, the trial at Ranchi center failed due to severe drought conditions and after analysis, the data from Varanasi centre was not considered for pooled analysis due to LSM. The results from rest six centers were included in zonal pooled analysis.
- The location means for grain yield ranged from 19.29 q/ha (Kumarganj) to 28.97 q/ha (Chiyanki) with 23.25 q/ha zonal mean across the centres. Entry RD3037 ranked first with mean grain yield of 33.52 q/ha and was significantly superior to rest of entries and checks.

Dual Purpose Barley Trials

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 11 locations across Uttarakhand, Himachal, Jammu and Kashmir and was conducted by all centres. 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.
- Data from Majhera and Ranichauri centres were not considered for zonal mean analysis because of their LSM for normal grain purpose trial. The location means for grain yield ranged from 15.23 q/ha (Almora) to 37.10 q/ha (Katrain) with 26.7 q/ha zonal mean across the centres.
- Entry UPB1093 ranked first with mean grain yield of 30.50 q/ha and entry BHS484 ranked second with grain yield 30.00 q/ha. The check HBL113 (29.80 q/ha) was observed as best check rank third, followed by BHS400 (29.2 q/ha).
- Under the dual-purpose trial, data of six centers were considered for zonal pooled analysis for grain yield in cut treatment after regeneration. The location means for grain yield ranged from 15.48 q/ha (Almora) to 25.64 q/ha (Khudwani) with 19.66 q/ha zonal mean across the centres. Amongst genotypes, the check variety HBL113 ranked first with mean grain yield of 25.21 q/ha.
- The cutting of green fodder was made after the 70 days sowing of the trial. The location means for green fodder yield ranged from 31.05 q/ha (Shimla) to 74.87 q/ha (Berthein) with 53.54 q/ha zonal mean across the centres. Amongst genotypes, the entry HBL870 ranked first with mean green fodder yield of 61.75 q/ha followed by best check variety VLB118 (61.02q/ha).

- Check HBL113 ranks first with 1 and 3 rankings in grain and green fodder yields respectively. Thus, no entry could beat the check variety HBL113 in joint ranking for grain and green fodder.

Molecular diversity analysis of new entries in coordinated trials

In order to develop molecular markers-based amplification profiles for varietal characterization and assess the level of genetic diversity in Indian barley, the coordinated trials entries and checks during 2020-21 were characterized at molecular. Total 100 genotypes were screened with a set of 46 barley specific SSR/STS markers covering seven chromosomes to develop molecular profiles. Total 95 alleles were scored for PCR based amplification profiles for screened genotypes. These genotypes were grouped within similarity coefficient (GS) value around 0.52 to 0.99 and showed sufficient genetic variability at molecular level. All entries except BHS483 and BHS484 are placed at separate nodes in dendrograms thus distinguishing from their check lines, respectively.

Breeder seed production

The breeder seed production of 638.06q of 24 varieties was allocated among 10 BSP centres 644.24q breeder seed indent of 28 varieties from DAC&FW for production during 2020-21. Eight states *viz*., Punjab, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Rajasthan, Uttar Pradesh and Uttarakhand and four public sector agencies *viz*., National Seeds Corporation, IFFDC, NAFED & NDDB 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 (230.00q) followed by NSAI (130.30q), Uttar Pradesh (120.0q) and National Seed Corporation (105.0q). From variety point of view, amongst 24 varieties, ***maximum breeder seed indent was received for the variety DWRB 137 (121.66q)*** followed by RD 2899 (80.0q), BH 393 (53.0q) and RD 2786 (50.0q).

A total of 830.00q of breeder seed of 22 varieties was produced by 10 BSP centres during 2020-21 with a surplus of 186.16q. Among 10 breeder seed production centres, maximum breeder seed was reported from RARI, Durgapura (394.40q) with surplus of 157.20q against allocation followed by IIWBR, Karnal (172.0q) and CCSHAU, Hisar (123.50q). Top ten varieties contribute to the tune of 70.90% in total allocation of breeder seed and finally these varieties contribute 83.94% share in total breeder seed production during 2020-21. Total 39.76q nucleus seed of 24 varieties was also produced against 22.65q allocation in BSP-1 with a surplus of 17.11q seed during 2020-21 at 10 centres.

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 2020-21, two international yield trials and two observation nurseries were supplied from ICARDA which included a total of 272 genotypes for different production conditions (Table 1.5). 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, was organized as one week program due to Covid-19 pandemic.

Table 1.5: International trials and nurseries evaluated during crop season 2020-21

SN	Trial/Nursery	Entries	National Check	# Sets	Locations
1	IBYT-HI-2021	24	DWRB137	4	Durgapura, Hisar, Pantnagar, Karnal
2	8th GSBYT-2021	24	Lakhan	4	Varanasi, Kanpur, Bajaura, Karnal
3	IBON-HI-2021	112 + 3 checks	DWRB137	4	Durgapura, Pantnagar, Hisar, Karnal
4	8th GSBON-2020	112 + 3 checks	Lakhan	4	Kanpur, Varanasi, Bajaura, Karnal

In addition, one set each of EIBGN with 45 entries selected from ICARDA trials/ nurseries of 2019-20 crop season with six released varieties (BH946, BH959, BHS400, RD2715, DWRB101 and DWRB137) as checks was supplied to 10 barley breeding centres for further evaluation /utilization.

A National Barley Genetic Stock Nursery (NBGSN), was constituted during the year consisting of 20 entries as promising sources for important traits from AICW&BIP trials/ nurseries during 2019-20 crop season. The NBGSN was supplied as suggested crossing block for evaluation and utilization at 10-centres (Durgapura, Ludhiana, Karnal, Hisar, Faizabad, Varanasi, Pantnagar, Kanpur, Shimla and Bajaura). During year 2020-21, around 500 barley accessions from the DWR active collection were rejuvenated as a regular maintenance activity of germplasm conservation.

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 1.6). The team in NHZ conducted the virtual monitoring due to Coivid-19 pandemic related restrictions. 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 1.6: Zonal monitoring visits of the barley teams

Zone	Date	Centres visited
CZ	17-19 Feb. & 18-21 Feb., 2021	Vijapur, Agra, Morena, Gwalior, Jhansi and Tikamgarh
NEPZ	1-4 March 2021	Kanpur, Dalipnagar, Kumarganj, Varanasi, Saini,
NWPZ	01-04 March 2021	Bawal, Durgapura, Tabiji, Bhilwara, Kota, Navgaon
	08-11 March 2021	Hisar, Bhatinda, Ludhiana, SG Nagar
	23-24 March2021	Pantnagar, Modipuram

CROP PROTECTION

Survey and surveillance for diseases and pests

The field surveys were 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. The crops were also experiencing force maturity due sudden rising of day temperature in the areas. 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

population was found to be moderate to high in barley fields. Among natural enemies, coccinellid beetles, chrysoperla and syrphid fly were frequently noticed predating on barley aphids.

Pathotypes distribution and seedling resistance tests

There was insignificant incidence of barley rusts in India during 2020-21. Only a few sporadic incidents of barley stripe rust were reported from Northern India and Rajasthan. There was no report of stem and leaf rusts of barley from the farmer's fields.

All the NBDSN and EBDSN lines were screened against different pathotypes of three rusts of barley under precise conditions of temperature and light. Wherever needed, confirmatory and selected testing was also undertaken. These lines were evaluated against seven pathotypes of Puccinia striiformis hordei (24, 57, M, G, Q, 6S0 and 7S0), five pathotypes of P. graminis tritici (11, 21A-2, 40A, 117-6 and 295), 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 Pst, Pt and Pgt. In seedling rust resistance evaluation, out of 108 lines of NBDSN, none of the lines was resistant to all three rusts of barley. Four lines were resistant to both leaf and stripe rust pathotypes/isolates whereas one-line DWRB182 was resistant to stripe and stem rust pathotypes. In addition, 17 lines each was resistant to stripe and leaf rust pathotypes only. Resistance to all the pathotypes of *P. graminis tritici* was observed only in DWRB182. Twenty-three EBDSN lines were evaluated under SRT and resistance to all three rusts was not recorded in any line. However, 2 lines were resistant to leaf and stripe rusts and one was found resistant to all the pathotypes of leaf and stem rust pathogens. Resistance to all the pathotypes/isolates of *Puccinia striiformis hordei* and *P. hordei* rusts was observed in 7 and 4 lines, respectively.

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:

- Total 514 entries consisting 383, 108 and 23 entries in different nurseries IBDSN, NBDSN and EBDSN, respectively, were screened for resistance against various diseases, aphid and CCN at different cooperating centers during the crop season 2020-21.
- Out of 383 entries in IBDSN from different breeding centers, 30 entries were found free from yellow rust (ACI = 0) and 234 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 38 entries were found moderately resistant against leaf blight with an average score of 14-35 and HS < 57 in double digit scoring system.
- A total 108 entries evaluated in NBDSN, 7 entries found free from yellow rust, 89 entries showed resistant reaction having ACI less than 10.
- In case of leaf blight screening, 9 entries showed moderate level of resistance resistant based on average score (double digit) 14-35 and HS < 57, while 11 entries were in this category based on AUDPC (101-500) values calculated this year. Out of them, HBL870, HUB275, PL929, RD3030 and PL891 were common in two scorings indicating the usefulness of AUDPC initiated this year.
- Among 23 EBDSN entries, 3 found free from yellow rust, whereas 19 shown resistant reaction. The 3 entries also showed moderate level of resistance against leaf blight with an average score 14-35 and HS < 57.

- Among five different fungicidal treatments, two sprays of Tebuconazole 50% + Trifloxystrobin 25% WG @ of 0.06% was found most effective in management of yellow rust.
- A total of 108 barley NBDSN entries including checks were screened against foliar aphid, on the basis of average score of five location entries viz.,16 entries BH1029, BH1039, DWRB219, DWRB220, NDB1752, PL911, PL917, PL927, RD3031, RD3032, RD3041, RD3042, BH902(C), BH946 (C), DWRB137(C) and HUB113(C) were scored below 4.0 scale.
- A total of eight chemical were tested for their efficacy against foliar aphid in barley. Treatment of Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon)@ 400 ml/ha was found the best treatment followed by Sulfoxaflor 12 % SC @250 ml/ha in managing aphid population in barley.
- A total 108 entries of NBDSN and 23 of EBDSN were screened against the Cereal Cyst Nematode (CCN) at three locations viz. Durgapura, Ludhiana 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. Resource management group (barley) conducted six special trials at different locations and in total conducted 48 trials, out of which 45 were reported, while three trials (Two at Agra and one at Kanpur) were rejected by the monitoring team due to faulty layout or poor germination. The experiment wise significant findings are as follows.

- **SPL 1: Productivity enhancement through adjusting sowing dates in barley**
  There was no significant difference in three sowing dates (first November to 25th November) but significantly superior to December sowing in NWPZ. In NEPZ, the yield was highest in 11-15 November sowing and thereafter yield decreased significantly. In NHZ, the yield increased as the sowing delays till 11-15 November and thereafter it decreased significantly.
- **SPL 2: Productivity and quality enhancement of barley through Nitrogen and Zinc scheduling**
  In NWPZ with N and Zn applications, the productivity was at par among treatments when three splits of nitrogen and urea and Zn was applied as foliar spray. Although there was no significant difference in protein content in different treatments though highest protein was obtained with three splits of nitrogen i.e. 1/3 at basal+1/3 at tillering (35-40 DAS) +1/3 at flag leaf stage.
- **SPL 3: Yield maximization of barley through integrated nutrient supply and PGRs application**
  In NWPZ, the highest but statistically at par yield was obtained with RDF 125%+10t FYM+PGR followed by RDF+10t FYM+PGR and superior to other combinations. In NEPZ, both RDF 125%+10t FYM+PGR; RDF 150%+PGR and RDF + 10t FYM treatments were at par and better than rest. In NHZ, similar treatments RDF 125%+10t FYM+PGR and RDF 150%+PGR were superior to others. In all the zones, the yield increased with the increase in level of fertilizer and also with the addition of FYM and PGRs.
- **SPL4: Enhancing nutrient use efficiency through nano fertilizer in barley**
  The experiment was conducted at six locations, five in NWPZ and one at Udaipur (CZ) and different combinations of nano fertilizer were used to optimize the dose for barley. The productivity of barley

increased with increase in the level of nitrogen up to recommended level, though it was not statistically significant. Nano nitrogen affected the barley productivity significantly only at low level of nitrogen.

- **SPL 5: Effect of Zn application on quality and productivity of barley**
  Zinc treatments soil application, foliar application (0.5% zinc sulphate) and in combinations were used in two varieties in each zone. In NWPZ, soil application with zinc sulphate @ 25 kg/ha was found superior compared to all soil and foliar applications. It produced 9.2 percent more yield compared to no zinc application. In NEPZ, 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. It produced 9.78 percent more yield compared to no zinc application. In NHZ, (Bajaura and Malan locations), soil application with zinc sulphate @ 25 kg/ha followed by foliar application at heading and early milk stage were at par and superior to other treatments. It obtained 10.5 percent more yield compared to no zinc application.
- **SPL 6: Enhancing productivity and quality of barley using Silicon in low moisture areas.**
  The trial was conducted in dry areas of NWPZ (Agra, Durgapura and Hisar) and Udaipur in split plot design having 3 irrigation levels and 4 Silicon doses (levels). Pooled results of NWPZ revealed that 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 which is significantly superior to all other treatment combinations. At Udaipur, two irrigations with 200 kg silicon and three irrigations with 150 kg silicon per ha were at par and superior to other treatment combinations.

QUALITY EVALUATION

MALT BARLEY TRIAL

The malt is one the major industrial use of barley and to make higher quality malt the raw material should have certain minimum quality traits. This year a total 168 samples of malt barley received from eight locations of North Western Plain Zone were analyzed in the quality laboratory of Barley Improvement programme. The samples consisted of 16 genotypes of Initial Varietal Trial (IVT) and five checks. The material having desirable traits for different traits has been presented in the table 1.7.

Table 1.7: Promising entries for individual malting quality traits

Trait	Promising entries
Hectoliter weight	DWRB 221, PL 930
Bold Grains	RD 3028, BH 1036, DWRB 218
Protein content	PL 930, RD 3028, UPB 1097, DWRB 218, PL 931, BH 1036, BH 1034, BH1035, RD 3029
Husk Content	DWRB 221
Hot water extract	DWRB 220, UPB 1098, PL 930
Filtration Rate	PL 930, RD 3027
Diastatic Power	RD 3029, RD 3030, PL 930, BH 1034, RD 3027
FAN Content	RD 3030, UPB 1098, RD 3028, PL 930, RD 3027, RD 3029, DWRB 218
Kolbach Index	RD 3027, DWRB 220, RD 3028
Over all MQ	DWRB 221

**Better or at par to the best check*

BARLEY QUALITY SCREENING NURSERY

This year nursery had two components *i.e.* for better malting quality traits and hulless barley with better quality traits. In hulless trial 32 genotypes and the malting quality 48 genotypes including checks was grown at Karnal, Hisar, Ludhiana, Pant Nagar, Durgapura and Kanpur. The promising genotypes of these are listed in tables 1.8 and 1.9.

Table 1.8: Promising sources of hulless barley for different traits

Traits	Promising entries
Thousand grain weight	DWRFB 58
Bold grains	DWRFB 40, DWRNB 14, DWRFB 58
Protein content	BCU 8028, BCU 8032, BCU8041, BCU 8038
Starch content	DWRNB 25, DWRB 204, DWRB 217

Table 1.9: Promising sources of malt barley for different traits

Trait	Promising entries
Hectoliter weight	BCU 4966
Thousand grain weight (40-46 g)	ICARDA 12, ICARDA 18, ICARDA 9, BK 306, ICARDA 28, ICARDA 1, ICARDA 19
Protein content (12-13% db)	BCU 4966, DWRB 211, ICARDA 26, ICARDA5, PL912, ICARDA9, ICARDA 18, RD 3025, BK 316, ICARDA 17, ICARDA 11, ICARDA 28, K 647
Starch content	ICARDA 1
Beta glucan content (low)	ICARDA 5, ICARDA 9

FEED BARLEY

The feed grain samples from various trials grown at different locations in four zones were analyzed for 1000 gw, starch and protein contents. A total of around 367 samples were received encompassing different trials grown in different zones and the following promising entries identified.

Table 1.10: Promising sources of malt barley for different traits

No.	Trial	1000gw	Protein content (% db)	Starch content (% db)
1	AVT (RF) NHZ	VLB174,UPB1093, BHS484, HBL870	HBL871, VLB171, VLB170, VLB173, BHS485, BHS483, UPB1091	BHS352 ©, BHS485
2	IVT (IR) NWPZ	BH 902 ©	KB1946, HUB277	NDB1756, KB1912, PL929, RD3034
3	IVT (IR) NEPZ	HUB277, RD3033	KB1946, KB1916	PL927, HUB277, PL932, KB1912, DWRB222
4	IVT (IR) CZ	RD3032, RD3031, HUB277	RD3033, HUB279, PL932, NDB1756, BH1038, RD3034	PL927, KB1946, RD3031
5	IVT (RF) NEPZ	RD3037, RD3035, RD3036, HUB276	HUB276, RD3037	K603©
6	AVT (SST) All Zones	KB1911, RD3040, RD3016, KB1822	RD2907©	RD3039, BH1039, RD3041

FRONTLINE DEMONSTRATIONS

During the rabi crop season 2020-21, 250 Barley Frontline Demonstrations (BFLDs) of one acre each were allotted to 31 cooperating centers all over India in eight states namely, HP, UP, J&K, Punjab, Haryana, Rajasthan, MP and Karnataka. Out of these, all 250 BFLDs were conducted by 31 centers, covering 262.38 acres area of 315 farmers. Improved barley varieties with complete package of practices (irrigation management, nutrient management, weed control, seed treatment etc.) were demonstrated.

State wise distribution of barley FLDs and yield gains during rabi 2020-21 (in acres)

State	BFLDs Allotted	BFLDs Conducted	Number of farmers	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (%)
HP	22	22	62	24.63	18.25	34.93***
J&K	8	8	19	34.55	-	-
UP	62	62	68	36.70	25.18	45.78***
Punjab	33	33	36	37.68	34.80	08.26*
Haryana	33	33	35	44.68	42.28	05.68*
Rajasthan	43	43	46	53.38	44.70	19.41***
MP	39	39	39	38.60	29.00	33.10***
Karnataka	10	10	10	23.75	-	-
Total	**250**	**250**	**315**			

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

Zone wise distribution of barley FLDs and yield gains during *rabi* 2020-21 (in acres)

Zone	BFLDs Allotted	BFLDs Conducted	Number of farmers	BFLDs yield (q/ha)	Zonal mean yield (q/ha)	Gain (%)
NHZ	22	22	62	24.63	17.75	38.73***
NEPZ	52	52	56	36.05	23.10	56.06***
NWPZ	97	97	116	44.58	38.33	16.31***
CZ	69	69	71	40.43	30.33	33.31***
PZ	10	10	10	23.75	-	-
Total	**250**	**250**	**315**			

**** 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 UP (45.78 %) followed by HP (34.93%), MP (33.10 %), Rajasthan (19.41%) and Punjab (08.26 %). The lowest gain in yield was reported in Haryana (5.68 %). The yield gain due to improved varieties over regional mean yield was highest in NEPZ (56.06 %) followed by NHZ (38.73 %), CZ (33.31 %) and NWPZ (16.31 %). The yield gain due to improved varieties over check mean yield was highest in NEPZ (52.59 %) followed by NHZ (34.93 %), CZ (26.33 %) and NWPZ (06.32 %). Therefore, efforts should be made to increase barley yield in the NEPZ and CZ by promoting recent barley production technologies in collaboration with the state department of agriculture.

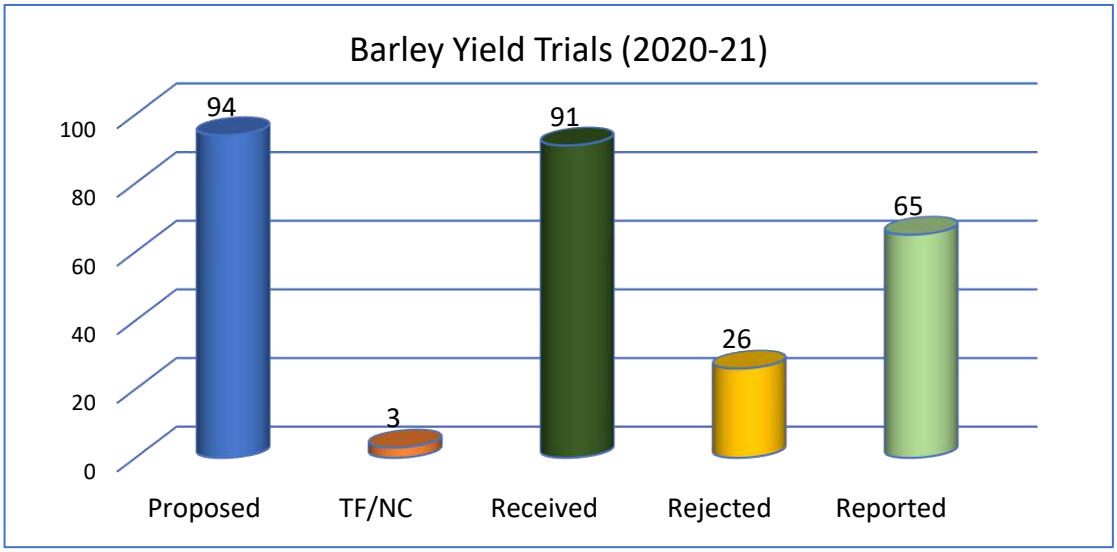
The yield gain under barley FLD was highest at Mirzapur (132.12%) centre and lowest at Hisar (03.81%) center. The varieties HBL 713 (25.63 q/ha) at Bajaura centre in NHZ, RD 2907 (48.88 q/ha) at Mirzapur in NEPZ, RD 2907 (66.25 q/ha) at Durgapura Jaipur in NWPZ, RD 2899 (50.50 q/ha) at Vidisha in CZ and DWRB 137 (23.75 q/ha) at Dharwad in PZ were the highest average yielding. The huskless barley variety PL 891 yielded 31.50 q/ha at Ludhiana center. The demonstrated new barley varieties were introduced for first time at Dharwad and Kathua centers.

BREAK UP OF BARLEY IMPROVEMENT YIELD TRIALS

(RABI 2020-21)

S. No.	Trial Name	No. of centers				
		Proposed	Not Conducted / Failed/ Not Received	Data Received	Data Rejected	Data Reported
1.	AVT-RF-NHZ (Grain)	11	-	11	2 (Ranichauri, Majhera) LSM)	9
2.	AVT-RF-NHZ (Dual Purpose)	11*	2* (Katrain, Bajaura)	9*	Grain= 3 (Kangra, Majhera and Ranichauri) LSM	6*
				9*	Forage= 4 (Almora, Kangra, Majhera and Ranichauri) LSM	5*
3.	AVT-IR-FB-NWPZ	11	1 (Navgaon)	10	1 (Chatha)	9
4.	AVT-IR-FB-NEPZ	7	-	7	2 (Kumarganj & Kalyani) both LSM	5
5.	AVT-IR-FB- Cen Z	7	1 (CAU Jhansi)	6	-	6
6.	AVT-SST-NWPZ/NEPZ	7	-	7	2 = Fatehpur (LSM) and IIWBR Hisar (HCV)	5
7.	IVT-IR-FB-NWPZ/NEPZ/CZ	18	-	18	2 (Varanasi-LSM & HCV and Morena-HCV)	16
8.	IVT/AVT-IR-HLS (NWPZ/NEPZ/CZ)	15	-	15	15*	0
9.	IVT-IR-MB-NWPZ	10	-	10	1 (Navgaon)- RM	9
10.	IVT-RF-NEPZ	8	1 (Ranchi)	7	1 (Varanasi- LSM)	6
	TOTAL	**94**	**3**	**91**	**11**	**65**
				96.8%	**12.1 %**	**69.1 % (P) 71.4 % (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 2020-21

(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	IVT-IR-MB-NWPZ, IVT/AVT-Hulless, IVT-IR-FB, AVT-IR-FB	4	-	-	-
4.	Kumarganj	5	AVT-SST, IVT-RF-NEPZ, IVT-IR-FB, IVT/AVT-Hulless, AVT-FB-NEPZ	5	1	AVT-IR-FB	LSM
5	Hisar	5	AVT-IR-FB-NWPZ, IVT-IR-MB-NWPZ, IVT/AVT-Hulless, IVT-IR-FB, AVT-SST	5	-	-	-
6.	Kanpur	4	AVT-IR-FB, IVT-RF-NEPZ, IVT-IR-FB, IVT/AVT-Hulless	4	-	-	-
7.	Karnal	4	IVT-IR-MB-NWPZ, IVT/AVT-Hulless, IVT-IR-FB, AVT-IR-FB,	4	-	-	-
8.	Ludhiana	4	IVT-IR-MB-NWPZ, IVT/AVT-Hulless, IVT-IR-FB, AVT-IR-FB	4	-	-	-
9.	Shimla	1	AVT-RF-NHZ	1	-	-	-
10.	Varanasi	4	AVT-IR-FB, IVT-RF-NEPZ, IVT-IR-FB, IVT/AVT-Hulless	4	2	IVT-FB IVT-RF-FB	LSM, HCV
11.	Pantnagar	4	IVT-IR-MB-NWPZ, AVT-Hulless, IVT-IR-FB, AVT-IR-FB	4	-	-	-
	Total (A)	**37**		**37**	**3**	**-**	**-**

Contd….

Performance of test sites during Rabi 2020-21

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

No.	Centres	No. of Trials			Trials Rejected		
		Allotted	Name	Conducted	No.	Name	Reason
1	Bawal	1	IVT-IR-MB-NWPZ,	1	-	-	-
2	Bathinda	2	IVT-IR-MB-NWPZ, AVT-IR-FB-NWPZ	2	-	-	
3	Berthein	1	AVT-RF-NHZ	1	-	-	-
4	Chatha	1	AVT-IR-FB	1	-	-	-
5	Chiyanki	1	IVT-RF-NEPZ	1	-	-	-
6	Dalipnagar	1	AVT-SST	1	-	-	-
7	Fatehpur	1	AVT-SST	1	1	AVT-SST	LSM
8	Gwalior	3	AVT-IR-FB, IVT-IR-FB, AVT-Hulless	3	-	-	-
9	Hisar (IIWBR)	1	AVT-SST	1	1	AVT-SST	HCV
10	Jhansi (CAU)	2	AVT-IR-CZ, IVT-AVT-IR-HLS	**1**	-	-	-
11	Kalyani	2	AVT-IR-FB, IVT-IR-FB,	2	1	AVT-IR-FB	LSM
12	Kangra	1	AVT-RF-NHZ	1	-	-	-
13	Katrain	1	AVT-RF-NHZ	1	-	-	-
14	Khudwani	1	AVT-RF-NHZ	1	-	-	-
15	Majhera	1	AVT-RF-NHZ	1	1	AVT-RF-NHZ	LSM
16	Malan	1	AVT-RF-NHZ	1	-	-	-
17	Morena	3	AVT-IR-FB, IVT-IR-FB, AVT-Hulless	3	1	IVT-IR-FB	HCV
18	Modipuram	4	IVT-IR-MB-NWPZ, IVT-IR-FB, AVT-IR-HLS, AVT-IR-FB	4	-	-	-
19	Navgaon	2	AVT-IR-FB, IVT-IR-MB	2	2	AVT-IR-FB, IVT-IR-MB	TF, RM
20	Pusa, CAU	3	AVT-IR-FB, IVT-IR-FB, IVT-RF	3	-	-	-
21	Rajauri	1	AVT-RF-NHZ	1	-	-	-
22	Ranchi	3	AVT-IR-FB, IVT-IR-FB, IVT-RF-NEPZ	3	1	IVT-RF-NEPZ	TF
23	Ranichauri	1	AVT-RF-NHZ	1	1	AVT-FB-NHZ	LSM
24	Sabour	3	AVT-IR-FB, IVT-IR-FB, IVT-RF	3	-	-	-
25	Saini	1	IVT-RF-NEPZ	1	-	-	-
26	Sriganganagar	2	IVT-IR-MB, AVT-IR-FB	2	-	-	-
27	Tabiji	2	IVT-IR-FB, AVT-IR-FB	2	-	-	-
28	Tikamgarh	2	AVT-Hulless, IVT-IR-FB, AVT-IR-FB	2	-	-	-
29	Udaipur	3	IVT-IR-FB, AVT-Hulless, AVT-IR-FB	3	-	-	-
30	Vijapur	3	IVT-IR-FB, AVT-IR-FB, AVT-Hulless	3	-	-	-
	Total (B)	**54**		**53**			

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

Trial wise locations during Rabi 2020-21

SN	Trial Name	Locations	Total
1	AVT-RF-NHZ	Bajaura, Berthein, Kangra, Katrain, Malan, Shimla, Almora, Ranichauri, Majhera, Rajouri, Khudwani	11
2	AVT/IVT-IR-HLS-NWPZ /NEPZ/CZ	Hisar, Karnal, Ludhiana, Durgapura, Pantnagar, Modipuram, Kanpur, Varanasi, Kumarganj, Tikamgarh, Morena, Gwalior, Jhansi (CAU), Udaipur, Vijapur,	15
3	AVT-IR-FB-NWPZ	Hisar, Karnal, Ludhiana, Bathinda, Durgapura, Navgaon, Tabiji, SG Nagar , Modipuram, Pantnagar, Chatha	11
4	AVT-IR-FB-NEPZ	Kanpur, Varanasi, Kumarganj, Pusa (CAU), Sabour, Ranchi, Kalyani	7
5	AVT-IR-FB-CZ	Tikamgarh, Morena, Gwalior, Jhansi (CAU), Udaipur, Kota, Vijapur,	7
6	AVT-SST-NWPZ/NEPZ	CSSRI Karnal, CCSHAU Hisar, IIWBR Hisar, Bhilwara, Fatehpur Dalipnagar, Kumarganj,	7
7	IVT-IR-MB-NWPZ	Bawal, Hisar, Karnal, Ludhiana, Bathinda, Durgapura, Navgaon, SG Nagar, Pantnagar, Modipuram	10
8	IVT-IR-FB-NWPZ/ NEPZ/CZ	Hisar, Karnal, Ludhiana, Durgapura, Tabiji, Modipuram, Pantnagar, Kanpur, Varanasi, Kumarganj, Kalyani, Pusa (CAU), Sabour, Ranchi, Morena, Gwalior, Udaipur, Vijapur,	18
9	IVT-RF-NEPZ	Kanpur, Varanasi, Kumarganj, Saini, Pusa (CAU), Sabour, Ranchi, Chiyanki	8
	Total		94

PARENTAGE OF BARLEY STRAINS UNDER COORDINATED EVALUATION DURING RABI 2020-21

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	3
5	HISAR, C.C.S.H.A.U.	BH	7
6	KANPUR, C.S.A.U.&T.	KB	11
7	KARNAL, ICAR-I.I.W.B.R.	DWRB	7
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	7
	Total		88

SN	Entries	Parentage
	ICAR-IARI, RS, Shimla	
1.	BHS483	BHS352/BHS366
2.	BHS484	BHS352/BHS 169
3.	BHS485	HBL276/BHS369
4.	BHS486	HBL276/BHS365
5.	BHS487	BBM593/ BHS169
	GBPUA&T, Pantnagar	
6.	UPB 1091	RD2828/RD2552
7.	UPB 1092	RD2828/K551
8.	UPB 1093	RD2784/RD2035
9.	UPB 1088	RD2552/P.STO/3/LBIRAN/UNA80//LIGNEEG40/4/BLLU/5…//RD2035
10.	UPB 1097	6th GSBYT Plot 4 2018-19
11.	UPB 1098	UPB1021/DWRB107
12.	UPB 1095	DWRB102/ IBYT-LRA-M-11
13.	UPB 1096	RD2828/RD2552
14.	UPB 1086	MSEL//LIMON/BICHY2000
15.	UPB 1094	CEV96054/DEFRACBSS07Y00554S-OAP-OAP (IBYT-HI-2016-2)
	ICAR-VPKAS, Almora	
16.	VLB 170	VB 1709 INBYT-HI (2016)-12 (CHAMICO/TOCTE//CONGONA/3/PETUNIA 2/4/PENCO/CHEVRON-BAR)
17.	VLB 171	BISON 110.3//CANELA/ZHEDAR#2 (IBON-HI-18-36)
18.	VLB 172	ZIGZIG/3/PENCO/CHEVRON-BAR//PETUNIA 1 (INBYT-HI-15-16-20)
19.	VLB 173	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/ PETUNIA1/6/GLORIA-BAR/COPAL (IBON-HI-18-91)
20.	VLB 174	LIMON/BICHY2000//DEFRA/DESCONOCIDA-BAR (IBON-HI-18-83)
	CSKHPKV, RRS, Bajaura	
21.	HBL 869	DWR 81 x BH 936
22.	HBL 870	VLB 118 x HBL 712
23.	HBL 871	TRADITION/6/VMorales/7/LEGACY//PENCO/CHEVRON-BAR (IBON 16-17-Ent72 or EIBGN 2017-18, Ent-49)
24.	HBL 872	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/6/P.STO/3/LBIRAN/ UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1 (6th GSBON-2018-19 -Ent 86)
25.	HBL 873	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/6/P.STO/3/LBIRAN /UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1 (6th GSBON-2018-19-Ent 87)

	CCSHAU, Hisar	
26.	BH1029	RD 2833 / RD 2870
27.	BH1039	RD 2784 / BHS 415
28.	BH 1034	HBL 712/BH 885
29.	BH 1035	BH 976/BH946
30.	BH 1036	VLB 130/BH 902
31.	BH 1037	RD 2833/HUB 113
32.	BH 1038	UPB1031/BH 902
	BHU, Varanasi	
33.	HUB 272	BH 550 / IBON-39-1
34.	HUB 280	14^{th} HBSN-05-146 x RD 2508-1
35.	HUB277	MOROC-9-75 x RD 2552
36.	HUB278	RD 2552 x KARAN 92
37.	HUB279	MOROC-9-75 x RD 2552
38.	HUB275	25^{th} IBYT-45-1 x K 727
39.	HUB276	14^{th} HBSN-05-146 x RD 2508
	SKNAU, RARI, Durgapura	
40.	RD3012	RD 2660 / NDB1173
41.	RD3013	RD 2552 / PL 419 // RD 2508
42.	RD 3016	RD 2715 / RD 2552
43.	RD 2039	PL 860/RD 2809
44.	RD 2040	RD 2830/RD 2715
45.	RD 2041	DWR 103/DWR 46//RD 2552
46.	RD 2042	RD 2786/IBYT-LRC-5
47.	RD3027	DWR 73 /IBYT-LRA-5
48.	RD3028	NBGSN-11/RD 2668
49.	RD3029	NBGSN-20/RD 2668
50.	RD3030	IBYT-LRA-8/IBYT -LRA-19
51.	RD3031	RD 2828//RD 2634/NDB 1020//RD 2660
52.	RD3032	RD 2828/RD 2035
53.	RD3033	BH 933/RD 2503
54.	RD3034	RD 2035/RD 2660
55.	RD3035	BH 933/RD 2508
56.	RD3036	BH 946/RD 2035
57.	RD3037	RD 2035/RD 2660
58.	RD3038	DWR 105/DWR 46/RD 2552
	PAU, Ludhiana	
59.	PL911	DWR83/RD2798
60.	PL917	STANDER-BAR/CABUYA/6/ROBUR-BAR/142-B//ASTRIX/SUTTER334.3/3/ SUMBARD400/5/CI10622/CI5824//PAICO/3/GLORIA-BAR/COPAL/4/BBSC (*IBON-2013-14-E83*)
61.	PL926	BK9816/DWRUB52
62.	PL930	PL807/*Hordeum Spontaneum* Acc.361
63.	PL931	PL807/*Hordeum Spontaneum* Acc.361
64.	PL927	PL172/*Hordeum Spontaneum* Acc.347
65.	PL928	DWR83/RD2798
66.	PL929	LIGNEE527/GERBEL/3/BOY-B*2/SURB//CI12225.2D/4/M104/6/LEGACY /4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI/5/ESMERALDA
67.	PL932	DWRUB73//BL3/PL426
	CSAUA&T, Kanpur	
68.	KB 1822	K 996/K 508
69.	KB1909	K 1155/RD 2811
70.	KB1911	BH 920/AZAD
71.	KB 1939	CANELA//LIMON/BICHY 2000
72.	KB 1912	KB 1105/Dolma
73.	KB 1916	PL 841/KB 1054
74.	KB 1946	JAGRATI/RD 2785

75.	KB 1926	DD-2 /MUNDAH*2
76.	KB 1940	STANDER-BAR//CALI92/ROBUST/3/DONA JOSEFA
77.	KB 1944	K 560/JB216
78.	KB 1947	K1149/BH 943
	NDUA&T, Faizabad	
79.	NDB1757	EIBGN (18-19) -55 (RD 2715)
80.	NDB 1756	BISON 110.3/3/SVANHALS-BAR/MSEL//AZAF/GOB24DH (IBYT-18-4)
81.	NDB 1754	EIBGN (18-19) -38 (RD 2715)
	ICAR-IIWBR, Karnal	
82.	DWRB224	CDC MANLEY/RD2592
83.	DWRB 218	DWRUB52/DWRB68
84.	DWRB219	BETZS/DWRB88
85.	DWRB220	DWRB73/BK1127
86.	DWRB221	DWRUB52/RD2508
87.	DWRB222	BCU6899/DL88
88.	DWRB223	PENCO/CHEVRON-BAR/3/LEGACY//PENCO/CHEVRON-BAR
	Checks	
89.	BH902	BH495/RD2552
90.	BH946	BHMS22A/BH549//RD2552
91.	BH959	BH393/BH331
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.	DWRB160	DWRB62/DWRB73
98.	DWRB182	DWRUB52/DWRB78
99.	HBL113	SELECTION FROM ZYPHYZE
100.	HUB113	KARAN280/C138
101.	K603	K257/C138
102.	Karan16	AZAM (DWARF)1/EB7576
103.	Lakhan	K12/IB226
104.	NDB943	K 1178/Karan 748
105.	NDB1173	BYTLRA 3-(1994-95)/NDB217
106.	PL891	IBON 343/12th HSBN-176
107.	RD2794	RD2035/RD2683
108.	RD2849	DWRUB52/PL705
109.	RD2899	RD2592/RD2035//RD2715
110.	RD2907	RD103/RD2518//RD2592
111.	VLB118	14th EMBSN-9313

ADVANCE VARIETAL TRIAL (IRRIGATED) FEED BARLEY
(NWPZ and NEPZ pooled)

The pooled AVT was proposed at 11 and 7 locations in the NWPZ and NEPZ, respectively. The results were not received from Navgaon centre. After the analysis the data from Chatha in NWPZ, and Kumarganj & Kalyani locations in NEPZ were not included for respective zonal pooled analysis due to LSM. The results from rest of the centers were included in zonal pooled analysis.

The trial consisted of six entries and four checks (BH946, BH902, HUB113 and DWRB137). All the entries were in the first year of testing. The zonal monitoring teams visited the trials at Hisar, Bathinda, Ludhiana, SG Nagar, Durgapura, Tabiji, Modipuram and Pantnagar in NWPZ and Kanpur, Kumarganj and Varanasi in NEPZ. In entries PL911, HUB272 and PL917 off-types were observed which need purification.

No serous incidence of diseases and insects-pests was reported from any of the locations visited by the monitoring team. However, very high level of powdery mildew was reported at Karnal in the entry PL917.

The location means for grain yield ranged from 36.43 q/ha (Hisar) to 70.72 q/ha (SG Nagar) with 48.86 q/ha zonal mean across the centres in NWPZ. The check DWRB137 ranked first with 52.94 q/ha mean grain yield followed by other check HUB113 (52.66 q/ha), both in the first non-significant group, however both these checks are for NEPZ. Entry RD3012 (49.49 q/ha) was numerically higher than the zonal check BH946 (49.12 q/ha).

The location means for grain yield ranged from 30.41 q/ha (Varanasi) to 39.79 q/ha (Sabour) with 35.50 q/ha zonal mean across the centres in NEPZ. The entry PL917 (41.70 q/ha) ranked first followed by BH902 (37.6 q/ha) and BH946 (36.30 q/ha), PL911 (36.10 q/ha) and the NEPZ checks HUB113 (35.70 q/ha). The checks BH902 and BH946 are for NWPZ, hence entries PL917 and PL911 are candidates for retention.

Grain Yield Data (q/ha) 2020-21

AVT-IR-FB 2020-21 **Zone: NWP Zone**

Varieties	Codes	Bathinda			Hisar			Durgapura			Karnal			Ludhiana		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH1029	AVT-IRFB-7	49.9	6	0	35.89	5	0	55.92	5	0	34.98	9	0	28.19	10	0
HUB272	AVT-IRFB-5	51.68	4	0	34.52	7	0	57.73	4	0	41.09	7	0	30.84	9	0
K1822	AVT-IRFB-6	51.72	3	0	35.41	6	0	53.38	8	0	42.05	6	0	41.56	2	1
PL911	AVT-IRFB-1	47.2	10	0	34.08	8	0	63.04	2	0	43.18	5	0	31.8	8	0
PL917	AVT-IRFB-9	49.78	7	0	38.26	4	0	54.83	6	0	53.5	2	1	43.25	1	1
RD3012	AVT-IRFB-10	53.91	2	1	32.71	9	0	58.57	3	0	31.91	10	0	38.07	6	0
BH902 ©	AVT-IRFB-2	55.09	1	1	28.99	10	0	47.34	9	0	38.56	8	0	33.61	7	0
BH946 ©	AVT-IRFB-4	48.04	9	0	42.13	2	1	53.62	7	0	48.48	4	0	38.31	5	0
DWRB137 ©	AVT-IRFB-3	49.63	8	0	43.31	1	1	74.28	1	1	55.57	1	1	40.48	3	1
HUB113 ©	AVT-IRFB-8	50.81	5	0	39.01	3	0	46.62	10	0	49.68	3	0	39.39	4	1
G.M.		**50.78**			**36.43**			**56.53**			**43.90**			**36.55**		
S.E.(M)		1.23			1.26			1.19			0.87			1.48		
C.D.		2.96			3.03			2.87			2.09			3.56		
C.V.		4.84			6.91			4.21			3.94			10.77		
DOS		19.11.20			10.11.2020			11.11.2020			25.11.2020			11.11.2020		

AVT-IR-FB 2020-21 Contd… **Zone: NWP Zone**

Varieties	Codes	Modipuram			Pantnagar			SG Nagar			Tabiji			NWPZ*		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH1029	AVT-IRFB-7	48.08	10	0	55.74	3	0	82.85	2	0	43.67	9	0	**47.58**	8	0
HUB272	AVT-IRFB-5	49.43	9	0	50.49	7	0	78.26	3	0	54.88	2	1	**49.03**	5	0
K1822	AVT-IRFB-6	56.98	2	1	38.52	10	0	60.39	10	0	36.23	10	0	**45.1**	10	0
PL911	AVT-IRFB-1	51.44	6	0	53.59	5	0	66.43	5	0	51.3	6	0	**48.24**	7	0
PL917	AVT-IRFB-9	50.1	7	0	46.13	8	0	61.11	9	0	53.62	4	0	**48.87**	6	0
RD3012	AVT-IRFB-10	49.5	8	0	59.71	1	1	74.15	4	0	56.33	1	1	**49.49**	3	0
BH902 ©	AVT-IRFB-2	56.3	3	1	43.4	9	0	63.04	8	0	52.17	5	0	**45.57**	9	0
BH946 ©	AVT-IRFB-4	57.26	1	1	51.16	6	0	63.29	7	0	49.28	7	0	**49.12**	4	0
DWRB137 ©	AVT-IRFB-3	53.5	5	0	55.56	4	0	65.7	6	0	48.45	8	0	**52.94**	1	1
HUB113 ©	AVT-IRFB-8	55.81	4	1	56.04	2	0	92.03	1	1	54.3	3	1	**52.66**	2	1
G.M.		**52.84**			**51.03**			**70.72**			**50.02**			**48.86**		
S.E.(M)		0.64			0.90			2.27			0.94			**0.43**		
C.D.		1.55			2.17			5.47			2.25			**0.99**		
C.V.		2.44			3.53			6.42			3.74					
DOS		18.11.2020			12.11.2020			14.11.2020			17.11.2020					

** The data from Chatha (Jammu) were not considered for zonal pooled analysis due to LSM.*

Summary of ancillary and disease data (2020-21)

AVT –IR-FB 2020-21 **Zone: NWP Zone**

Sr. No.	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		Leaf Blight (LS)
												YR	BR	
1	BH1029	AVT-FB-E7	89 (70-103)	127 (113-136)	106 (73-175)	84 (70-101)	8 (7-10)	6	LY	40 (33-52)	H	5MS	0	24(35)
2	HUB272	AVT-FB-E5	86 (68-101)	129 (117-138)	78 (65-115)	86 (60-113)	9 (8-10)	6	LY	38 (34-46)	H	0	0	13(23)
3	K1822	AVT-FB-E6	89 (73-103)	127 (115-134)	86 (65-115)	78 (55-100)	8 (7-10)	6	LY	40 (35-46)	H	0	0	24(35)
4	PL911	AVT-FB-E1	91 (68-105)	128 (114-137)	102 (89-125)	81 (68-96)	7 (7-9)	6	LY	37 (30-45)	H	0	0	12(13)
5	PL917	AVT-FB-E9	88 (68-103)	131 (120-138)	93 (54-135)	86 (65-100)	7 (6-9)	6	LY	38 (32-49)	H	TMS	0	13(14)
6	RD 3012	AVT-FB-E10	88 (68-103)	127 (117-134)	101 (73-145)	85 (71-99)	7 (7-8)	6	LY	37 (33-45)	H	0	0	13(14)
7	BH902(C)	AVT-FB-E2	90 (73-103)	130 (117-142)	91 (65-120)	92 (79-110)	8 (7-10)	6	LY	40 (34-46)	H	5MS	0	24(35)
8	BH946(C)	AVT-FB-E4	88 (69-103)	127 (116-136)	94 (75-135)	84 (69-102)	8 (7-9)	6	LY	38 (33-48)	H	TMS	0	24(35)
9	DWRB137(C)	AVT-FB-E3	83 (62-96)	124 (114-132)	87 (67-102)	65 (48-92)	8 (7-8)	6	LY	44 (34-54)	H	0	0	23(35)
10	HUB113(C)	AVT-FB-E8	91 (73-104)	130 (120-140)	90 (74-105)	85 (71-106)	8 (6-9)	6	LY	40 (34-47)	H	0	0	24(35)

*High incidence of powdery mildew (score 5) was observed at Karnal on the scale 0-9

Grain Yield Data (q/ha) 2020-21

AVT-IR-FB 2020-21 **Zone: NEP Zone**

Varieties	Code	CAU, Pusa			Sabour			Kanpur			Ranchi			Varanasi			NEPZ*		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH1029	AVT-IRFB-7	32.43	10	0	34.06	9	0	34.06	7	0	32.25	5	0	23.55	10	0	**31.3**	10	0
HUB272	AVT-IRFB-5	35.51	8	0	33.94	10	0	33.51	8	0	31.52	7	0	26.57	8	0	**32.2**	9	0
K1822	AVT-IRFB-6	43.3	3	0	38.04	6	0	36.23	5	0	21.01	10	0	26.45	9	0	**33.0**	8	0
PL911	AVT-IRFB-1	43.48	2	0	39.86	5	0	28.44	10	0	31.52	8	0	37.2	2	1	**36.1**	4	0
PL917	AVT-IRFB-9	48.01	1	1	45.05	2	1	34.96	6	0	42.75	1	1	37.68	1	1	**41.7**	1	1
RD3012	AVT-IRFB-10	33.33	9	0	37.80	7	0	38.68	3	0	34.42	4	0	33.09	3	0	**35.5**	6	0
BH902 ©	AVT-IRFB-2	36.41	6	0	37.80	7	0	44.66	1	1	36.41	3	0	32.85	4	0	**37.6**	2	0
BH946 ©	AVT-IRFB-4	36.23	7	0	40.34	4	1	39.86	2	0	36.78	2	0	28.38	7	0	**36.3**	3	0
DWRB137 ©	AVT-IRFB-3	40.04	4	0	45.05	2	1	29.89	9	0	31.88	6	0	28.99	6	0	**35.2**	7	0
HUB113 ©	AVT-IRFB-8	38.22	5	0	46.01	1	1	37.5	4	0	27.17	9	0	29.35	5	0	**35.7**	5	0
G.M.		**38.70**			**39.79**			**35.78**			**32.57**			**30.41**			**35.5**		
S.E.(M)		1.68			2.44			1.24			2.29			1.85			0.871		
C.D.		4.04			5.89			2.99			5.51			4.45			2.0		
C.V.		8.66			12.29			6.94			14.03			12.15					
DOS		25.11.2020			11.11.2020			21.11.2020			11.11.2020			25.11.2020					

** The data from Kumarganj (Ayodhya) and Kalyani were not considered for zonal pooled analysis due to LSM.*

Summary of ancillary and disease data (2020-21)

AVT –IR-FB 2020-21 **Zone: NEP Zone**

Sr. No.	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-gw (g)	H/N	SMUT		Leaf Blight Avg. (HS)
												L (%)	C (%)	
1	BH1029	AVT-FB-E7	78 (71-86)	114 (101-126)	112 (91-140)	102 (72-122)	8 (7-9)	6	LY	40 (27-50)	LY	0.1	0	45(78)
2	HUB272	AVT-FB-E5	79 (72-86)	113 (89-137)	117 (83-173)	103 (73-123)	8 (6-9)	6	LY	40 (28-47)	LY	0	0	34(79)
3	K1822	AVT-FB-E6	80 (75-85)	110 (90-128)	103 (89-150)	98 (72-116)	8 (7-9)	6	LY	41 (32-47)	LY	0	0	45(79)
4	PL911	AVT-FB-E1	77 (70-87)	113 (93-128)	132 (73-217)	97 (73-119)	7 (6-9)	6	LY	40 (33-46)	LY	0.1	0.1	44(78)
5	PL917	AVT-FB-E9	76 (68-85)	111 (87-131)	113 (93-142)	101 (80-117)	7 (6-9)	6	LY	45 (36-50)	LY	0.1	0	34(78)
6	RD 3012	AVT-FB-E10	77 (66-86)	109 (89-129)	108 (70-167)	98 (78-113)	8 (7-9)	6	LY	39 (33-43)	LY	0	0	55(87)
7	BH902(C)	AVT-FB-E2	80 (72-88)	112 (95-130)	118 (79-225)	106 (76-123)	8 (7-10)	6	LY	44 (30-54)	LY	0.1	0	45(68)
8	BH946(C)	AVT-FB-E4	77 (68-87)	112 (91-132)	112 (74-168)	100 (85-120)	8 (7-9)	6	LY	44 (33-51)	LY	0	0	56(87)
9	DWRB137©	AVT-FB-E3	75 (70-79)	112 (92-129)	117 (76-201)	89 (64-120)	8 (7-9)	6	LY	44 (29-52)	LY	0	0	44(87)
10	HUB113(C)	AVT-FB-E8	79 (74-87)	110 (88-128)	108 (89-170)	100 (72-116)	7 (7-8)	6	LY	43 (31-48)	LY		0.1	34(68)

ADVANCE VARIETAL TRIAL (IRRIGATED) FEED BARLEY (Central Zone)

The trial was proposed at 7 locations in the Central Zone. It was conducted at all locations except CAU, Jhansi, who returned the trial box back to IIWBR Karnal. The results from all the remaining six locations were considered for zonal pooled analysis.

The trial consisted of three entries (K1822, RD3013 and UPB1088) and three checks, namely BH959, RD2899 and DWRB137, however the seed of UPB1088 was not supplied by the contributing centre hence the entry was replaced by filler. The monitoring team visited Morena, Gwalior, Tikamgarh and Vijapur locations. In entry K1822 poor germination was reported, while entry RD3013 was reported with off types for purification.

No incidence of diseases and insects-pests was reported from any centre, though traces of covered smuts were observed.

The location means for grain yield ranged from 39.16 q/ha (Vijapur) to 68.57 q/ha (Tikamgarh) with zonal mean 51.92 q/ha. The check BH959 ranked first with 58.00 q/ha mean grain yield and the entry RD3013 ranked second with 57.03 q/ha.

Grain Yield Data (q/ha) 2020-21

AVT-IR-FB 2020-21 **Zone: CEN Zone**

Varieties	Code	Gwalior			Kota			Tikamgarh			Morena			Udaipur			Vijapur			CEN Zone		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
FILLER	AVT-IRFB-1	46.62	2	0	56.88	2	1	77.68	4	0	64.98	3	1	30.89	5	0	35.19	4	0	**52.04**	4	0
K1822	AVT-IRFB-3	36.24	5	0	48.19	5	0	9.23	6	0	70.65	1	1	-	-	-	-	-	-	**41.08**	6	0
RD3013	AVT-IRFB-5	42.28	3	0	43.48	6	0	83.69	2	1	68.6	2	1	58.15	1	1	45.95	1	1	**57.03**	2	1
BH959 ©	AVT-IRFB-4	55.56	1	1	60.27	1	1	85.05	1	1	62.8	4	1	49.44	3	0	34.88	5	0	**58**	1	1
DWRB137©	AVT-IRFB-2	42.27	4	0	55.68	3	1	81.41	3	1	52.66	5	0	49.35	4	0	42.8	2	1	**54.03**	3	0
RD2899 ©	AVT-IRFB-6	28.99	6	0	49.76	4	0	74.33	5	0	49.28	6	0	51.79	2	1	36.99	3	0	**48.52**	5	0
G.M.		**41.99**			**52.38**			**68.57**			**61.49**			**47.93**			**39.16**			**51.92**		
S.E.(M)		1.53			2.27			2.65			3.91			2.42			1.22			**1.02**		
C.D.		3.78			5.63			6.56			9.70			7.46			3.76			**2.38**		
C.V.		7.27			8.67			7.72			12.73			10.11			6.24					
DOS		23.11.20			8.11.20			16.11.20			24.11.20			25.11.20			10.11.20					

Summary of ancillary and disease data (2020-21)

AVT –IR-FB 2020-21 **Zone: CEN Zone**

Sr. No.	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		Leaf Blight (LS)
												BR	BL	
1	FILLER	AVT-IRFB-E1	69 (61-75)	110 (67-132)	102 (71-128)	92 (57-135)	7 (7-8)	6	LY	45 (40-49)	H	0	10MS	
2	K1822	AVT-IRFB-E3	74 (67-79)	111 (67-132)	80 (20-125)	99 (80-140)	9 (7-12)	6	LY	49 (42-67)	H	NG	NG	
3	RD3013	AVT-IRFB-E5	70 (55-79)	109 (72-128)	103 (75-139)	91 (59-140)	7 (6-8)	6	LY	45 (40-58)	H	0	TMS	
4	BH959 (C)	AVT-IRFB-E4	69 (57-80)	108 (71-129)	101 (68-130)	89 (51-139)	7 (6-8)	6	LY	45 (38-54)	H	0	TMS	
5	DWRB137 (C)	AVT-IRFB-E2	70 (60-76)	109 (71-131)	99 (69-119)	88 (54-138)	7 (6-8)	6	LY	46 (40-57)	H	0	TR	
6	RD2899 (C)	AVT-IRFB-E6	71 (63-80)	110 (70-130)	103 (74-126)	93 (60-137)	7 (7-9)	6	LY	48 (44-59)	H	0	TR	

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

This trial was proposed at 18 locations scattered in NWPZ (7), NEPZ (7) and central zone (4) in northern plains. The results from all the proposed locations were received. The data from all the seven locations were included for zonal pooled analysis in NWPZ, while data from Varanasi location were not included for pooled analysis due to LSM and HCV in NEPZ. In case of CZ the results from Morena were not in accordance for zonal pooling due to HCV.

The trial consisted of 19 entries and five checks, namely BH902, BH946, (both NWPZ checks), HUB113, DWRB137 (NEPZ and CZ check), and RD2899 (CZ check). To fit the trial in a 5 x 5 lattice design, one filler was included.

The monitoring teams visited Hisar, Bathinda, Ludhiana, Durgapura, Tabiji, Modipuram and Pantnagar in NWPZ; Kanpur, Kumarganj and Varanasi in NEPZ and Gwalior, Morena, Vijapur in central zone. Entries ***KB1912 and BH1038 were reported segregating /mixture beyond purification.*** In entries PL929 and KB1916 off types were reported across the zones. Similarly, in KB1916 and KB1946 very poor germination was observed.

In case of diseases and insect/pest high levels of incidence were observed for leaf blight (RD3031, RD3033 and RD3032), in NWPZ. In NEPZ also leaf blight of very high levels (99 score) were recorded at Varanasi in most of the entries (in 15 out of 25 entries). In case of CZ the black rust incidence was observed in few entries with maximum incidence of 20S.

The location means for grain yield ranged from 31.23 q/ha (Karnal) to 58.74 q/ha at (Durgapura) with 43.1 q/ha zonal mean in NWPZ. In case of NWPZ, entry used as filler ranked first with 52.8 q/ha mean grain yield followed by checks HUB113 (51.7 q/ha) and DWRB137 (51.7 q/ha) in 1st NSG.

In NEPZ, location means ranged from 32.96 q/ha (Kanpur) to 68.09 q/ha (CAU, Pusa) with location mean 40.4 q/ha. The entry NDB1756 (51.2 q/ha) ranked first and UPB1095 ranked second (48.4 q/ha) whereas, check BH902 (48.3 q/ha) ranked third for mean grain yield in the 1st NSG.

In case of central zone, the location mean ranged from 36.53 q/ha (Vijapur) to 55.80 q/ha (Gwalior) with 46.5 q/ha zonal mean. The entry KB1912 ranked first with mean grain yield 61.8 q/ha followed by PL927 (58.5 q/ha) and RD3032 (58 q/ha) in the 1st NSG. BH946 was the best check of this zone which ranked fourth with mean grain yield 56.1 q/ha, while DWRB137 was best zonal check with 55.20 q/ha mean grain yield.

Grain Yield Data (q/ha) 2020-21

IVT-IR-FB 2020-21 **Zone: NWP Zone**

Entry	Codes	Durgapura			Hisar			Karnal			Ludhiana			Modipuram			Pantnagar			Tabiji			NWPZ		
		Yield	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**	**Yield**	**RK**	**G**
BH1037	IVT-IRFB-2	65.22	6	0	50.94	1	1	41.39	3	0	48.55	1	1	43.01	10	0	35.42	20	0	47.12	20	0	**47.4**	6	0
BH1038	IVT-IRFB-23	60.39	12	0	34.03	19	0	34.72	10	0	36.59	8	0	42.76	12	0	51.84	6	0	46.14	21	0	**43.8**	12	0
DWRB222	IVT-IRFB-19	61.59	9	0	19.6	23	0	32.08	13	0	32.97	13	0	45.39	7	0	51.86	5	0	54.6	13	0	**42.6**	17	0
Filler	IVT-IRFB-11	64.01	8	0	45.78	6	1	52.96	1	1	34.78	12	0	51.32	2	1	64.05	2	1	57	11	0	**52.8**	1	1
HUB277	IVT-IRFB-20	61.59	9	0	34.69	18	0	22.55	19	0	32.61	14	0	39.63	17	0	30.54	24	0	44.44	23	0	**38**	21	0
HUB279	IVT-IRFB-25	65.22	6	0	39.78	12	0	16	25	0	26.52	22	0	41.99	14	0	40.99	17	0	59.18	7	1	**41.4**	20	0
KB1912	IVT-IRFB-6	77.29	2	1	35.9	15	0	34.83	9	0	29.71	16	0	37.42	21	0	35.71	19	0	58.7	8	1	**44.2**	11	0
KB1916	IVT-IRFB-13	51.93	19	0	16.29	24	0	22.1	20	0	27.54	19	0	30.39	24	0	46.69	13	0	35.74	24	0	**33**	23	0
KB1946	IVT-IRFB-16	39.86	24	0	13.26	25	0	17.02	23	0	24.64	24	0	27.59	25	0	28.05	25	0	34.31	25	0	**26.4**	25	0
NDB1756	IVT-IRFB-9	55.56	15	0	35.2	16	0	34.31	11	0	47.1	3	1	36.1	22	0	47.22	12	0	62.8	5	1	**45.5**	8	0
PL927	IVT-IRFB-5	53.14	18	0	36.51	14	0	31.7	15	0	44.93	4	1	38.89	19	0	32.39	22	0	54.12	15	0	**41.7**	19	0
PL928	IVT-IRFB-12	55.56	15	0	25.12	20	0	32.08	13	0	27.54	19	0	43.09	9	0	51.41	7	0	63.53	4	1	**42.6**	16	0
PL929	IVT-IRFB-1	68.84	5	0	34.84	17	0	22.08	21	0	32.61	14	0	50.21	4	1	48.04	11	0	46.13	22	0	**43.2**	14	0
PL932	IVT-IRFB-21	48.31	21	0	45.8	5	1	25.04	18	0	48.55	1	1	42.47	13	0	43.22	16	0	64.73	2	1	**45.4**	9	0
RD3031	IVT-IRFB-17	41.06	23	0	23.29	22	0	19.55	22	0	20.29	25	0	34.03	23	0	32.28	23	0	51.46	17	0	**31.7**	24	0
RD3032	IVT-IRFB-18	60.39	12	0	41.35	8	0	41.04	4	0	26.09	23	0	38.95	18	0	49.06	10	0	66.18	1	1	**46.2**	7	0
RD3033	IVT-IRFB-14	50.72	20	0	24.99	21	0	16.01	24	0	28.26	18	0	40.41	15	0	35.27	21	0	57.24	10	0	**36.1**	22	0
RD3034	IVT-IRFB-24	47.1	22	0	46.84	3	1	27.4	16	0	36.23	9	0	39.78	16	0	43.35	15	0	51.21	18	0	**41.7**	18	0
UPB1095	IVT-IRFB-10	77.29	2	1	46.31	4	1	26.79	17	0	28.99	17	0	37.58	20	0	37.9	18	0	62.8	6	1	**45.4**	10	0
UPB1096	IVT-IRFB-8	54.35	17	0	36.98	13	0	37.39	7	0	27.54	19	0	42.93	11	0	58.35	3	0	47.81	19	0	**43.6**	13	0
BH902 ©	IVT-IRFB-22	37.44	25	0	40.04	11	0	38.3	6	0	36.96	7	0	45.31	8	0	46.5	14	0	57.72	9	1	**43.2**	15	0
BH946 ©	IVT-IRFB-15	71.26	4	0	45	7	1	34.26	12	0	41.3	5	0	52.66	1	1	49.39	9	0	54.1	16	0	**49.7**	4	0
DWRB137©	IVT-IRFB-3	79.71	1	1	40.19	10	0	45.07	2	0	39.86	6	0	50.84	3	1	49.9	8	0	56.05	12	0	**51.7**	3	1
HUB113©	IVT-IRFB-4	59.18	14	0	49.07	2	1	39.19	5	0	35.51	11	0	48.93	5	1	65.52	1	1	64.5	3	1	**51.7**	2	1
RD2899©	IVT-IRFB-7	61.59	9	0	40.73	9	0	36.87	8	0	36.23	9	0	48.77	6	1	55.77	4	0	54.35	14	0	**47.8**	5	0
Mean =		**58.74**			**36.10**			**31.23**			**34.08**			**42.02**			**45.23**			**54.08**			**43.1**		
C.D.		7.82			7.33			5.21			4.38			4.43			4.45			8.62			**2.2**		
C.V. =		7.78			11.63			9.74			7.51			6.04			5.63			9.13					
D.O.S. =		11.11.2020			10.11.2020			25.11.2020			11.12.2020			19.11.2020			12.11.2020			18.11.2020					

Summary of ancillary and disease data (2020-21)

IVT–IR-FB 2020-21 **Zone: NWP Zone**

Sr. No.	Entry	Entry Code	AGRONOMIC CHARACTERS						GRAIN TRAITS			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	SMUT		LB Avg. (HS)
												L (%)	C (%)	
1	BH1037	IVT-IRFB-2	86 (71-96)	128 (117-136)	134 (100-173)	100 (90-116)	8 (7-9)	6	LY	43 (36-50)	H			13 (35)
2	BH1038	IVT-IRFB-23	80 (66-93)	124 (113-134)	128 (104-149)	100 (92-112)	8 (7-9)	6	LY	43 (37-47)	H			34(35)
3	DWRB222	IVT-IRFB-19	81 (66-96)	126 (111-136)	109 (78-140)	89 (75-107)	8 (8-10)	6	LY	39 (34-46)	H			23(34)
4	Filler	IVT-IRFB-11	79 (63-95)	125 (113-137)	91 (57-126)	86 (72-100)	9 (7-12)	6	LY	46 (36-50)	H			24(25)
5	HUB277	IVT-IRFB-20	79 (62-92)	120 (107-131)	114 (86-141)	88 (73-105)	7 (7-9)	6	LY	44 (36-51)	H			34 (57)
6	HUB279	IVT-IRFB-25	81 (66-95)	122 (106-132)	99 (89-128)	100 (87-120)	8 (7-10)	6	LY	45 (38-49)	H			13(23)
7	KB1912	IVT-IRFB-6	84 (71-94)	127 (116-135)	114 (88-133)	103 (88-116)	9 (8-12)	6	LY	43 (31-50)	H			23(45)
8	KB1916	IVT-IRFB-13	90 (77-102)	133 (122-142)	75 (40-100)	95 (85-109)	9 (8-9)	6	LY	45 (38-50)	H			34(57)
9	KB1946	IVT-IRFB-16	90 (79-100)	130 (120-139)	69 (52-108)	92 (84-103)	9 (6-12)	6	LY	42 (37-50)	H			24(35)
10	NDB1756	IVT-IRFB-9	87 (76-99)	131 (118-143)	112 (78-162)	104 (95-116)	8 (7-9)	6	LY	46 (39-51)	H			23(34)
11	PL927	IVT-IRFB-5	91 (72-101)	128 (116-138)	108 (89-138)	97 (86-107)	7 (6-7)	6	LY	45 (36-52)	H			23(56)
12	PL928	IVT-IRFB-12	83 (66-94)	125 (113-134)	89 (67-115)	84 (70-100)	7 (6-8)	6	LY	47 (34-51)	H			35(57)
13	PL929	IVT-IRFB-1	85 (70-95)	125 (115-133)	114 (91-138)	92 (74-104)	8 (7-9)	6	LY	36 (33-38)	H			12 (13)
14	PL932	IVT-IRFB-21	89 (78-96)	128 (120-138)	110 (80-130)	100 (86-109)	9 (7-12)	6	LY	42 (36-46)	H			13(35)
15	RD3031	IVT-IRFB-17	85 (72-101)	126 (114-138)	106 (74-145)	97 (72-111)	10 (7-12)	6	LY	42 (30-49)	H			34(89)
16	RD3032	IVT-IRFB-18	77 (58-91)	126 (113-135)	113 (82-147)	90 (75-104)	8 (7-9)	6	LY	41 (28-49)	H			34 (78)
17	RD3033	IVT-IRFB-14	87 (70-101)	126 (115-138)	104 (83-120)	99 (90-108)	9 (7-12)	6	LY	40 (29-46)	H			45(78)
18	RD3034	IVT-IRFB-24	84 (67-97)	124 (114-133)	130 (79-159)	103 (92-117)	8 (6-9)	6	LY	44 (35-51)	H			13(14)
19	UPB1095	IVT-IRFB-10	86 (77-96)	126 (114-136)	121 (88-181)	95 (80-103)	8 (6-10)	6	LY	38 (26-46)	H			23(35)
20	UPB1096	IVT-IRFB-8	90 (79-96)	126 (116-136)	112 (92-134)	97 (80-104)	8 (6-9)	6	LY	35 (26-40)	H			13(25)
21	BH902 (C)	IVT-IRFB-22	86 (71-92)	128 (118-141)	115 (89-168)	105 (90-124)	9 (7-10)	6	LY	47 (35-56)	H			24(45)
22	BH946 (C)	IVT-IRFB-15	85 (69-95)	126 (115-135)	112 (87-161)	94 (80-107)	8 (6-8)	6	LY	42 (34-51)	H			23(45)
23	DWRB137(C)	IVT-IRFB-3	81 (64-92)	123 (112-134)	90 (68-130)	97 (77-155)	8 (7-10)	6	LY	45 (28-52)	H			24 (45)
24	HUB113 (C)	IVT-IRFB-4	86 (78-95)	129 (117-142)	110 (85-138)	99 (83-110)	7 (6-8)	6	LY	41 (32-46)	H			13 (23)
25	RD2899 (C)	IVT-IRFB-7	85 (74-95)	130 (119-143)	124 (93-165)	97 (78-108)	7 (6-8)	6	LY	43 (36-47)	H			24(35)

Grain Yield Data (q/ha) 2020-21

IVT-IR-FB 2020-21 **Zone: NEP Zone**

Variety	Codes	CAU, Pusa			Kanpur			Ranchi			Sabour			Kumarganj			Kalyani			NEPZ*		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
BH1037	IVT-IRFB-2	84.94	3	0	31.16	14	0	39.35	10	0	39.86	9	0	36.02	8	0	35.87	10	0	44.50	6	0
BH1038	IVT-IRFB-23	76.04	10	0	34.06	11	0	47.10	3	1	38.04	11	0	33.82	14	0	29.35	20	0	43.10	8	0
DWRB222	IVT-IRFB-19	70.26	14	0	31.16	15	0	15.26	25	0	31.16	17	0	32.57	17	0	45.65	4	1	37.70	19	0
Filler	IVT-IRFB-11	65.58	17	0	27.54	21	0	44.62	5	0	32.97	15	0	37.29	6	1	38.04	8	0	41.00	12	0
HUB277	IVT-IRFB-20	49.59	21	0	29.71	18	0	25.63	21	0	31.88	16	0	35.64	9	0	30.43	18	0	33.80	21	0
HUB279	IVT-IRFB-25	68.89	15	0	31.88	13	0	34.21	13	0	48.19	4	1	30.84	21	0	33.70	13	0	41.30	11	0
KB1912	IVT-IRFB-6	68.54	16	0	38.41	6	0	28.85	16	0	37.32	12	0	38.13	4	1	31.52	15	0	40.50	16	0
KB1916	IVT-IRFB-13	26.83	24	0	15.94	25	0	38.32	12	0	12.32	24	0	-	-	-	-	-	-	23.40	24	0
KB1946	IVT-IRFB-16	26.39	25	0	20.83	24	0	23.81	23	0	11.96	25	0	-	-	-	-	-	-	20.70	25	0
NDB1756	IVT-IRFB-9	105.33	2	1	34.42	10	0	40.84	8	0	56.16	1	1	37.99	5	1	32.61	14	0	51.20	1	1
PL927	IVT-IRFB-5	51.16	20	0	38.04	7	0	26.46	19	0	44.93	7	0	36.32	7	0	48.91	2	1	41.00	14	0
PL928	IVT-IRFB-12	76.22	9	0	24.64	22	0	28.68	17	0	29.35	19	0	34.02	12	0	48.91	2	1	40.30	17	0
PL929	IVT-IRFB-1	47.76	22	0	33.33	12	0	23.87	22	0	28.26	21	0	31.53	19	0	34.78	11	0	33.30	22	0
PL932	IVT-IRFB-21	58.91	18	0	23.55	23	0	21.28	24	0	31.16	17	0	31.18	20	0	30.43	18	0	32.80	23	0
RD3031	IVT-IRFB-17	75.74	11	0	43.48	3	0	46.82	4	1	15.58	23	0	34.78	10	0	39.13	7	0	42.60	10	0
RD3032	IVT-IRFB-18	72.82	12	0	36.96	8	0	42.07	7	0	28.62	20	0	33.87	13	0	29.35	20	0	40.60	15	0
RD3033	IVT-IRFB-14	76.52	7	0	31.16	15	0	49.19	1	1	24.76	22	0	30.40	23	0	28.26	22	0	40.00	18	0
RD3034	IVT-IRFB-24	82.68	5	0	39.13	5	0	40.40	9	0	35.87	13	0	32.66	16	0	45.65	4	1	46.10	4	0
UPB1095	IVT-IRFB-10	76.26	8	0	50.72	1	1	39.22	11	0	55.56	2	1	30.44	22	0	38.04	8	0	48.40	2	1
UPB1096	IVT-IRFB-8	44.86	23	0	44.20	2	0	29.71	15	0	44.20	8	0	34.32	11	0	28.26	23	0	37.60	20	0
BH902 ©	IVT-IRFB-22	105.62	1	1	30.43	17	0	33.79	14	0	46.38	5	0	38.64	2	1	34.78	11	0	48.30	3	1
BH946 ©	IVT-IRFB-15	58.31	19	0	36.23	9	0	43.11	6	0	38.41	10	0	38.35	3	1	31.52	16	0	41.00	13	0
DWRB137©	IVT-IRFB-3	83.82	4	0	28.26	20	0	28.30	18	0	33.33	14	0	32.13	18	0	52.17	1	1	43.00	9	0
HUB113©	IVT-IRFB-4	71.59	13	0	39.86	4	0	25.73	20	0	45.65	6	0	33.24	15	0	42.39	6	0	43.10	7	0
RD2899©	IVT-IRFB-7	77.55	6	0	28.99	19	0	48.42	2	1	50.36	3	1	39.14	1	1	31.52	16	0	46.00	5	0
Mean =		**68.09**			**32.96**			**34.60**			**35.69**			**34.49**			**36.58**			**40.4**		
C.D.		13.75			4.71			3.91			8.28			2.18			7.74			**3.0**		
C.V. =		11.57			8.36			6.48			13.56			3.63			12.22					
D.O.S. =		24.11.2020			21.11.2020			12.11.2020			25.11.2020			01.12.18			01.12.18					

**The data from Varanasi were not considered for pooled zonal analysis due to HCV and LSM.*

Summary of ancillary and disease data (2020-21)

IVT –IR-FB 2020-21 **Zone: NEP Zone**

Sr. No.	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	SMUT L (%)	SMUT C (%)	LB Avg. (HS)
1	BH1037	IVT-IRFB-2	83 (76-96)	115 (99-129)	102 (72-150)	87 (71-116)	7 (6-8)	6	LY	38 (30-46)	H			56(99)
2	BH1038	IVT-IRFB-23	78 (66-90)	114 (95-127)	106 (85-170)	90 (67-106)	8 (7-9)	6	LY	40 (29-48)	H			56(99)
3	DWRB222	IVT-IRFB-19	79 (73-99)	115 (96-132)	93 (41-139)	82 (64-100)	7 (6-8)	6	LY	39 (26-44)	H			57(99)
4	Filler	IVT-IRFB-11	77 (70-89)	112 (96-128)	87 (52-120)	63 (52-81)	7 (6-8)	6	LY	42 (33-52)	H			57(99)
5	HUB277	IVT-IRFB-20	81 (74-98)	117 (100-128)	89 (48-140)	81 (60-100)	8 (7-9)	6	LY	38 (28-47)	H			46(78)
6	HUB279	IVT-IRFB-25	80 (73-91)	117 (100-130)	91 (65-120)	87 (65-100)	8 (7-9)	6	LY	42 (38-48)	H			67(99)
7	KB1912	IVT-IRFB-6	82 (75-93)	116 (96-128)	94 (50-150)	89 (72-101)	8 (7-9)	6	LY	36 (22-46)	H			57(99)
8	KB1916	IVT-IRFB-13	73 (0-95)	104 (0-131)	48 (0-89)	75 (0-99)	8 (7-10)	6	LY	41 (38-44)	H			56(99)
9	KB1946	IVT-IRFB-16	72 (0-96)	102 (0-130)	62 (0-130)	66 (0-103)	8 (6-10)	6	LY	40 (33-48)	H			57(78)
10	NDB1756	IVT-IRFB-9	81 (75-93)	116 (96-129)	102 (46-210)	85 (61-108)	8 (7-9)	6	LY	37 (26-46)	H			68(99)
11	PL927	IVT-IRFB-5	84 (76-93)	119 (100-131)	86 (22-150)	84 (70-106)	8 (6-10)	6	LY	38 (31-43)	H			56(78)
12	PL928	IVT-IRFB-12	81 (75-92)	117 (103-129)	88 (41-120)	83 (58-98)	7 (5-9)	6	LY	39 (33-51)	H			78(99)
13	PL929	IVT-IRFB-1	82 (73-97)	118 (102-133)	96 (34-185)	80 (65-112)	7 (6-8)	6	LY	42 (32-52)	H			35(78)
14	PL932	IVT-IRFB-21	85 (77-90)	110 (39-129)	89 (59-136)	84 (66-100)	9 (7-12)	6	LY	40 (33-47)	H			34(78)
15	RD3031	IVT-IRFB-17	76 (71-89)	112 (93-130)	92 (68-128)	95 (64-117)	9 (8-13)	6	LY	40 (31-49)	H			78(99)
16	RD3032	IVT-IRFB-18	75 (58-96)	115 (96-132)	92 (51-125)	79 (52-98)	7 (7-8)	6	LY	39 (32-53)	H			67(99)
17	RD3033	IVT-IRFB-14	80 (68-97)	115 (100-129)	89 (69-121)	89 (79-99)	9 (6-11)	6	LY	39 (32-48)	H			68(99)
18	RD3034	IVT-IRFB-24	79 (75-89)	113 (98-125)	108 (82-177)	91 (66-115)	8 (7-10)	6	LY	39 (31-48)	H			35(79)
19	UPB1095	IVT-IRFB-10	79 (71-91)	113 (94-127)	110 (36-195)	81 (54-100)	7 (6-7)	6	LY	38 (27-48)	H			67(99)
20	UPB1096	IVT-IRFB-8	85 (78-94)	116 (97-129)	97 (48-155)	84 (64-97)	8 (7-9)	6	LY	39 (32-48)	H			46(79)
21	BH902 (C)	IVT-IRFB-22	82 (73-95)	118 (104-129)	105 (40-201)	90 (65-110)	8 (7-9)	6	LY	38 (28-45)	H			56(78)
22	BH946 (C)	IVT-IRFB-15	80 (73-91)	116 (98-127)	89 (41-140)	86 (65-114)	8 (7-9)	6	LY	39 (32-44)	H			57(99)
23	DWRB137(C)	IVT-IRFB-3	78 (73-89)	113 (100-128)	90 (38-155)	70 (58-91)	7 (6-8)	6	LY	42 (31-51)	H			78(99)
24	HUB113 (C)	IVT-IRFB-4	80 (72-93)	117 (105-131)	100 (65-180)	86 (70-106)	7 (6-7)	6	LY	41 (29-50)	H			47(69)
25	RD2899 (C)	IVT-IRFB-7	81 (75-98)	105 (27-127)	97 (65-130)	80 (53-99)	7 (5-10)	6	LY	48 (30-99)	H			46(78)

Grain Yield Data (q/ha) 2020-21

IVT-IR-FB 2020-21 **Zone: Cen Zone**

Variety	Codes	Gwalior			Udaipur			Vijapur			Cen Zone*		
		Yield	RK	G	Yield	RK	G	Yield	RK	G	Yield	RK	G
BH1037	IVT-IRFB-2	69.81	6	0	41.38	18	0	36.88	12	0	**49.4**	13	0
BH1038	IVT-IRFB-23	62.3	9	0	52.25	8	1	36.59	13	0	**50.4**	12	0
DWRB222	IVT-IRFB-19	43.17	21	0	35.65	20	0	44.19	7	0	**41**	18	0
Filler	IVT-IRFB-11	54.19	11	0	49.71	13	0	47.73	5	0	**50.5**	11	0
HUB277	IVT-IRFB-20	49.75	15	0	40.07	19	0	20.45	20	0	**36.8**	19	0
HUB279	IVT-IRFB-25	45.28	20	0	35.65	21	0	19.92	21	0	**33.6**	25	0
KB1912	IVT-IRFB-6	64.44	8	0	52.8	6	1	68.28	1	1	**61.8**	1	1
KB1916	IVT-IRFB-13	51.24	13	0	-	-	-	-	-	-	**51.2**	9	0
KB1946	IVT-IRFB-16	48.63	17	0	-	-	-	-	-	-	**48.6**	14	0
NDB1756	IVT-IRFB-9	71.61	5	0	51.81	9	1	38.01	11	0	**53.8**	6	0
PL927	IVT-IRFB-5	65	7	0	53.26	5	1	57.17	3	0	**58.5**	2	1
PL928	IVT-IRFB-12	39.15	22	0	31.3	22	0	38.43	9	0	**36.3**	20	0
PL929	IVT-IRFB-1	91.93	1	1	44.71	16	0	21.8	19	0	**52.8**	7	0
PL932	IVT-IRFB-21	38.85	23	0	49.06	14	0	13.09	23	0	**33.7**	24	0
RD3031	IVT-IRFB-17	47.28	18	0	46.74	15	0	14.23	22	0	**36.1**	21	0
RD3032	IVT-IRFB-18	74.94	2	0	51.59	11	1	47.45	6	0	**58**	3	1
RD3033	IVT-IRFB-14	32.17	25	0	52.42	7	1	22.95	18	0	**35.8**	23	0
RD3034	IVT-IRFB-24	49.11	16	0	30.87	23	0	27.6	17	0	**35.9**	22	0
UPB1095	IVT-IRFB-10	54.1	12	0	57.66	2	1	31.03	15	0	**47.6**	15	0
UPB1096	IVT-IRFB-8	50.37	14	0	53.79	3	1	32.58	14	0	**45.6**	16	0
BH902 ©	IVT-IRFB-22	45.56	19	0	53.5	4	1	28.87	16	0	**42.6**	17	0
BH946 ©	IVT-IRFB-15	73.84	3	0	43.41	17	0	50.99	4	0	**56.1**	4	0
DWRB137 ©	IVT-IRFB-3	72.98	4	0	49.93	12	0	42.68	8	0	**55.2**	5	0
HUB113 ©	IVT-IRFB-4	61.99	10	0	51.81	9	1	38.2	10	0	**50.7**	10	0
RD2899 ©	IVT-IRFB-7	37.27	24	0	59.08	1	1	60.99	2	0	**52.4**	8	0
Mean =		**55.80**			**47.32**			**36.53**			**46.5**		
C.D. = (10%)		8.57			8.06			6.94			**4.4**		
C.V. =		8.98			9.99			10.69					
D.O.S. =		10.11.2020			24.11.20			10.11.20					

**The data from Morena were not considered for pooled zonal analysis due to HCV.*

Summary of ancillary and disease data (2020-21)

IVT –IR-FB 2020-21 **Zone: CEN Zone**

SN	Entry	Code	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			DISEASE REACTION*		
			Days to Heading (75%)	Days to Maturity (75%)	Tillers per meter	Plant height (cm)	Spike length (cm)	Two/ Six Row	Colour	1000-grain weight (g)	H/N	Rusts		Leaf Blight (LS)
												BR	BL	
1	BH1037	IVT-IRFB-2	70 (66-75)	114 (112-120)	129 (78-169)	83 (69-93)	7 (6-7)	6	LY	43 (35-52)	H	TR	10MS	
2	BH1038	IVT-IRFB-23	65 (56-73)	114 (104-123)	117 (62-196)	87 (74-102)	8 (7-9)	6	LY	44 (37-50)	H	0	20MS	
3	DWRB222	IVT-IRFB-19	66 (60-70)	113 (101-122)	82 (66-101)	83 (62-101)	9 (8-9)	6	LY	39 (29-44)	H	TR	5MS	
4	Filler	IVT-IRFB-11	69 (58-79)	115 (103-121)	113 (71-152)	72 (53-90)	7 (6-7)	6	LY	48 (41-58)	H	0	TMS	
5	HUB277	IVT-IRFB-20	67 (56-79)	111 (97-121)	107 (70-148)	85 (55-109)	10 (7-14)	6	LY	48 (41-62)	H	0	TMS	
6	HUB279	IVT-IRFB-25	68 (58-78)	109 (97-115)	95 (70-111)	83 (66-97)	8 (7-8)	6	LY	46 (37-60)	H	0	TMS	
7	KB1912	IVT-IRFB-6	69 (62-76)	112 (106-120)	110 (58-156)	82 (69-95)	9 (8-9)	6	LY	48 (36-59)	H	TMS	10S	
8	KB1916	IVT-IRFB-13	63 (60-67)	114 (113-116)	116 (113-119)	85 (72-97)	8 (8-8)	6	LY	44 (34-53)	H	-	-	
9	KB1946	IVT-IRFB-16	70 (68-71)	116 (111-122)	120 (114-126)	67 (61-73)	9 (8-9)	6	LY	45 (34-56)	H	-	-	
10	NDB1756	IVT-IRFB-9	68 (60-76)	117 (111-122)	126 (80-169)	88 (66-105)	8 (8-8)	6	LY	56 (43-95)	H	0	TR	
11	PL927	IVT-IRFB-5	70 (66-76)	113 (107-116)	128 (80-228)	82 (62-91)	7 (6-8)	6	LY	44 (35-50)	H	0	TMS	
12	PL928	IVT-IRFB-12	66 (61-76)	113 (105-120)	113 (68-152)	73 (53-84)	7 (7-8)	6	LY	46 (39-56)	H	0	5MS	
13	PL929	IVT-IRFB-1	67 (61-73)	113 (103-119)	116 (63-150)	81 (57-104)	7 (6-7)	6	LY	42 (35-47)	H	0	TR	
14	PL932	IVT-IRFB-21	74 (70-79)	117 (112-123)	103 (66-124)	80 (52-99)	9 (7-11)	6	LY	43 (38-54)	H	0	0	
15	RD3031	IVT-IRFB-17	71 (64-75)	115 (109-121)	122 (93-145)	94 (72-114)	9 (6-10)	6	LY	46 (36-52)	H	0	0	
16	RD3032	IVT-IRFB-18	65 (53-71)	116 (111-119)	124 (69-177)	83 (66-102)	8 (6-9)	6	LY	49 (37-60)	H	0	TR	
17	RD3033	IVT-IRFB-14	68 (64-75)	112 (108-116)	108 (78-155)	94 (86-101)	11 (11-11)	6	LY	42 (39-45)	H	0	0	
18	RD3034	IVT-IRFB-24	66 (59-72)	114 (105-119)	109 (76-127)	90 (78-99)	8 (7-9)	6	LY	44 (38-49)	H	0	0	
19	UPB1095	IVT-IRFB-10	70 (63-75)	114 (109-119)	122 (74-182)	83 (63-96)	8 (7-8)	6	LY	47 (43-53)	H	0	TMS	
20	UPB1096	IVT-IRFB-8	73 (65-79)	114 (111-120)	123 (76-158)	84 (62-96)	7 (6-8)	6	LY	40 (33-53)	H	0	TR	
21	BH902 (C)	IVT-IRFB-22	72 (70-76)	115 (112-117)	113 (83-152)	90 (71-114)	8 (6-8)	6	LY	48 (43-56)	H	0	5MS	
22	BH946 (C)	IVT-IRFB-15	66 (61-73)	113 (105-122)	121 (82-161)	82 (72-91)	8 (7-8)	6	LY	45 (37-50)	H	0	TMS	
23	DWRB137(C)	IVT-IRFB-3	66 (57-73)	114 (103-121)	117 (86-159)	76 (53-89)	7 (5-8)	6	LY	46 (38-51)	H	0	TMS	
24	HUB113 (C)	IVT-IRFB-4	71 (66-76)	119 (114-122)	113 (71-156)	89 (69-103)	7 (6-7)	6	LY	46 (36-54)	H	0	TR	
25	RD2899 (C)	IVT-IRFB-7	70 (64-78)	117 (111-125)	129 (77-161)	83 (55-103)	8 (6-10)	6	LY	44 (39-49)	H	TMS	10MS	

ADVANCE VARIETAL TRIAL (IRRIGATED) HUSKLESS BARLEY
(NWPZ, NEPZ and CZ pooled)

The pooled AVT/ IVT Huskless barley trial originally consisted of eight genotypes (five entries and three checks), however, Pantnagar centre failed to supply the seed of its two entries. Thus, the trial was constituted with six genotypes (three entries and three checks). The trial for was proposed at 15 centres across three zones (6, 3 and 6 locations in the NWPZ, NEPZ, and Central zone respectively). The results were received from all the 15 centres.

The zonal monitoring teams visited the trials at Hisar, Bathinda, Ludhiana, SG Nagar, Durgapura, Tabiji, Modipuram and Pantnagar in NWPZ; Kanpur, Kumarganj and Varanasi in NEPZ and Morena, Gwalior, CAU Jhansi and Tikamgarh in central zone.

At all the locations it was observed that three genotypes including the latest check PL891 were having extremely poor germination causing the trial failure at all locations. Hence despite receiving the data from all 15 centres the statistical analysis was not performed and it was decided to repeat the trial for next season with the entries of this year and few more if contributed by the centres.

The issue however will also be taken up while finalizing the technical programme for Rabi 2021-22 in the annual AICRP meeting.

INITIAL VARIETAL TRIAL-MALT BARLEY-NWPZ

The Initial Varietal Trial of Malt Barley (IVT-MB-NWPZ) was proposed at 10 locations in North Western Plains Zone of the country. The trial was conducted at all locations as per prescribed layout. Due to salinity patches and some other reasons the expression of the trial at Navgaon centre was not proper. Hence, the monitoring team recommended the rejection of this trial at this centre. Finally, the data from remaining nine locations were considered for zonal mean analysis.

Initially, there were a total of 22 genotypes in this trial and out of which 17 genotypes were the test entries while rest five genotypes (DWRUB52, DWRB160, DWRB182, BH946 and RD2849) were used as the checks. Among total 17 test entries, four entries (RD3027, RD3028, RD3029 and RD3030) were contributed from Durgapura centre, another four entries (DWRB218, DWRB219, DWRB220 and DWRB221) from ICAR-IIWBR Karnal, three entries (BH1034, BH1035, and BH1036) from CCSHAU Hisar, three entries (PL926, PL930, PL931) from PAU Ludhiana, two entries (UPB1097, UPB1098) from Pantnagar and one entry (KB1939) was contributed from Kanpur centre.

Due to severe germination problem in the test entry KB1939 over all locations, the improper data of this test entry were not considered for statistical analysis. Finally, the data of remaining 21 genotypes were utilized for location wise and zonal pooled analysis.

The monitoring of the trial was made at all centres during the cropping season. Upon monitoring, the team was not satisfied with the genetic purity of two entries namely UPB1097 (IVT-MB-TS-6) and BH1036 (IVT-MB-TS-14) as these entries were observed with segregation/ mixture across all locations. In case of disease/pest incidence, no major problem was reported at the any location except a mild incidence of spot blotch at Karnal and Pantnagar centre. Overall, the status of the crop was very good at all centres.

In case of grain yield, the location mean value ranged from 38.71q/ha (Hisar) to 80.57 q/ha (Sriganganagar) with a zonal mean of 49.92 q /ha. Amongst the genotypes, the entry DWRB219 ranked first with 58.55 q/ha and was significantly superior to rest of entries and checks. It was followed by the entries BH1036 (55.02 q/ha), DWRB221 (54.13 q/ha), DWRB220 (53.62 q/ha) and DWRB218 (53.03 q/ha). Amongst checks, DWRB182 (52.87 q/ha) was observed the best check.

Grain Yield Data (q/ha) 2020-21

IVT-MB-TS 2020-21 **Zone: NWPZ****

Varieties*	Entry code	Bathinda			Bawal			Durgapura			Hisar			Karnal		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH1034	IVT-MB-TS-9	44.99	18	0	36.73	19	0	28.94	19	0	43.52	4	1	43.97	17	0
BH1035	IVT-MB-TS-15	47.6	12	0	46.76	12	0	55.56	6	0	42.82	5	0	32.39	21	0
BH1036	IVT-MB-TS-14	55.12	4	0	55.09	1	1	52.47	10	0	41.44	6	0	48.41	13	0
DWRB218	IVT-MB-TS-11	42.57	19	0	51.77	4	1	51.31	12	0	37.65	16	0	58.17	3	1
DWRB219	IVT-MB-TS-19	60.94	2	1	49.23	8	0	62.5	2	1	41.2	8	0	58.29	2	1
DWRB220	IVT-MB-TS-20	51.9	7	0	39.43	18	0	53.24	9	0	39.12	12	0	55.36	4	1
DWRB221	IVT-MB-TS-17	62.27	1	1	48.77	9	0	57.48	4	0	38.73	13	0	49.53	11	0
PL926	IVT-MB-TS-7	45.83	17	0	48.38	10	0	49.38	14	0	33.95	19	0	52.19	7	0
PL930	IVT-MB-TS-2	52.53	5	0	33.18	20	0	49.38	14	0	28.16	20	0	39.48	18	0
PL931	IVT-MB-TS-12	51.94	6	0	53.09	3	1	50.15	13	0	36.88	17	0	48.95	12	0
RD3027	IVT-MB-TS-16	46.69	16	0	53.4	2	1	28.94	19	0	34.65	18	0	39.32	19	0
RD3028	IVT-MB-TS-8	47.23	14	0	30.86	21	0	57.48	4	0	38.66	14	0	45.75	15	0
RD3029	IVT-MB-TS-10	40.78	21	0	51.31	5	1	28.94	19	0	39.74	10	0	49.60	10	0
RD3030	IVT-MB-TS-1	47.08	15	0	43.83	16	0	38.58	18	0	37.89	15	0	51.70	8	0
UPB1097	IVT-MB-TS-6	41.87	20	0	44.29	15	0	52.47	10	0	17.98	21	0	37.19	20	0
UPB1098	IVT-MB-TS-22	47.54	13	0	50.08	7	0	47.84	17	0	45.83	2	1	47.43	14	0
BH946©	IVT-MB-TS-13	48.29	10	0	44.68	14	0	48.61	16	0	47.84	1	1	59.22	1	1
DWRUB52©	IVT-MB-TS-18	49.35	9	0	46.3	13	0	67.9	1	1	39.51	11	0	52.36	6	0
DWRB160©	IVT-MB-TS-5	47.62	11	0	42.98	17	0	54.01	8	0	45.52	3	1	53.83	5	0
DWRB182©	IVT-MB-TS-4	55.17	3	0	51.31	5	1	60.19	3	0	41.28	7	0	44.84	16	0
RD2849©	IVT-MB-TS-21	50.2	8	0	47.99	11	0	54.78	7	0	40.43	9	0	51.29	9	0
	G.M.	**49.4**			**46.16**			**50.01**			**38.71**			**48.54**		
	S.E.(M)	2.5			2.05			2.57			1.87			1.84		
	C.D.	5.91			4.84			6.08			4.43			4.35		
	C.V.	10.12			8.87			10.3			9.68			7.58		
	DOS	17-11-2020			25-11-2020			11-11-2020			11-11-2020			25.11.20		

**Entry KB1939 (IVT-MB-TS-3) did not germinate at all locations hence excluded from analysis **The trial at Navgaon centre was rejected by monitoring team*

Grain Yield Data (q/ha) 2020-21

IVT-MB-TS 2020-21 Contd… **Zone: NWPZ****

Varieties*	Entry code	Ludhiana			Modipuram			Pantnagar			SG Nagar			NWPZ		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH1034	IVT-MB-TS-9	37.04	17	0	41.49	19	0	30.53	19	0	73.07	16	0	**42.25**	20	0
BH1035	IVT-MB-TS-15	44.91	13	0	40.97	20	0	46.92	10	0	94.2	2	1	**50.24**	10	0
BH1036	IVT-MB-TS-14	54.17	1	1	51.94	6	0	50.84	5	0	85.75	6	1	**55.02**	2	0
DWRB218	IVT-MB-TS-11	51.85	5	1	54.62	2	0	49.58	6	0	79.71	14	0	**53.03**	5	0
DWRB219	IVT-MB-TS-19	53.24	2	1	51.94	6	0	57.24	1	1	92.39	3	1	**58.55**	1	1
DWRB220	IVT-MB-TS-20	51.85	5	1	54.31	3	0	48	9	0	89.37	4	1	**53.62**	4	0
DWRB221	IVT-MB-TS-17	48.15	10	0	42.99	16	0	54.75	2	1	84.54	9	1	**54.13**	3	0
PL926	IVT-MB-TS-7	44.44	14	0	48.26	8	0	37.28	15	0	83.94	12	1	**49.30**	12	0
PL930	IVT-MB-TS-2	37.04	17	0	43.54	15	0	35.52	16	0	57.37	21	0	**41.80**	21	0
PL931	IVT-MB-TS-12	49.54	7	0	43.68	14	0	26.72	21	0	82.13	13	1	**49.23**	13	0
RD3027	IVT-MB-TS-16	35.65	20	0	45.21	11	0	40.57	13	0	70.65	17	0	**43.90**	19	0
RD3028	IVT-MB-TS-8	42.59	15	0	42.64	17	0	32.03	18	0	88.77	5	1	**47.34**	17	0
RD3029	IVT-MB-TS-10	35.19	21	0	46.18	9	0	48.62	8	0	95.41	1	1	**48.42**	16	0
RD3030	IVT-MB-TS-1	53.24	3	1	44.62	13	0	35.42	17	0	85.75	6	1	**48.68**	15	0
UPB1097	IVT-MB-TS-6	37.04	17	0	39.31	21	0	52.23	4	0	85.14	8	1	**45.28**	18	0
UPB1098	IVT-MB-TS-22	48.15	9	0	42.57	18	0	48.88	7	0	63.41	19	0	**49.08**	14	0
BH946©	IVT-MB-TS-13	52.78	4	1	45.35	10	0	29.41	20	0	69.44	18	0	**49.51**	11	0
DWRUB52©	IVT-MB-TS-18	45.37	12	0	44.76	12	0	45.24	11	0	84.54	10	1	**52.81**	7	0
DWRB160©	IVT-MB-TS-5	49.07	8	0	53.23	4	0	52.42	3	0	62.2	20	0	**51.21**	9	0
DWRB182©	IVT-MB-TS-4	47.69	11	0	53.19	5	0	37.65	14	0	84.54	11	1	**52.87**	6	0
RD2849©	IVT-MB-TS-21	42.13	16	0	57.85	1	1	43.28	12	0	79.71	14	0	**51.96**	8	0
	G.M.	**45.77**			**47.08**			**43.01**			**80.57**			**49.92**		
	S.E.(M)	1.24			1.28			1.73			5.75			**0.88**		
	C.D.	2.93			3.03			4.10			13.60			**2.06**		
	C.V.	5.43			5.45			8.06			14.28					
	DOS	**12-11-20**			**19.11.20**			**12.11.20**			**14-11-20**					

**Entry KB1939 (IVT-MB-TS-3) did not germinate at all locations hence excluded from analysis **The trial at Navgaon centre was rejected by monitoring team*

Summary of ancillary and disease data (2020-21)

IVT –IR-MB 2020-21 **Zone: NWP Zone**

Entry	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS				Net blotch
	Final Stand (%)	Days to heading	Days to maturity	Tillers/ meter	Plant height (cm)	Spike length (cm)	TGW (g)	2/6 Row	H/N	Colour	
BH1034	91 (80-99)	93 (78-103)	131 (116-145)	102 (88-116)	101 (75-120)	8.7 (8.0-10.0)	54 (41-62)	2R	H	LY	13
BH1035	95 (92-99)	94 (79-104)	133 (118-148)	136 (81-208)	98 (82-119)	8.4 (7.4-8.9)	43 (39-47)	2R	H	LY	13
BH1036	90 (83-99)	88 (71-100)	128 (114-140)	99 (90-112)	98 (65-117)	8.2 (7.0-9.3)	53 (39-60)	2R	H	LY	24
DWRB218	93(88-99)	87(62-101)	131(113-143)	120(93-170)	92(74-108)	8.5(7.8-9.0)	54(40-62)	2R	H	LY	13
DWRB219	91(85-99)	90(70-102)	131(116-148)	122(90-160)	92(82-105)	8.7(8.1-9.5)	50(39-56)	2R	H	LY	23
DWRB220	94(84-99)	923-103)	131(117-148)	126(89-176)	88(73-102)	7.3(6.0-8.2)	52(39-58)	2R	H	LY	34
DWRB221	90(80-99)	86(68-95)	132(116-148)	120(89-168)	90(74-105)	8.4(7.7-9.0)	49(39-56)	2R	H	LY	35
PL926	91(78-99)	93(79-104)	133(118-143)	113(80-127)	90(74-103)	7.5(7.0-8.0)	54(45-61)	2R	H	LY	13
PL930	85(70-99)	92(79-104)	132(119-147)	144(89-194)	91(78-103)	8.9(7.6-9.9)	43(34-49)	2R	H	LY	23
PL931	84(70-99)	91(72-103)	131(117-141)	116(89-178)	92(72-110)	8.9(8.0-9.9)	48(39-52)	2R	H	LY	13
RD3027	92(86-99)	88(64-100)	130(115-142)	117(80-166)	94(74-115)	8.6(7.5-9.8)	54(40-62)	2R	H	LY	34
RD3028	93(83-99)	85(66-94)	128(114-145)	115(91-166)	98(90-112)	8.1(7.6-8.6)	5640-64)	2R	H	LY	36
RD3029	93(88-99)	88(65-103)	131(114-147)	113(86-158)	92(76-110)	8.6(7.8-9.2)	52(36-58)	2R	H	LY	34
RD3030	95(88-99)	85(64-96)	128(114-147)	120(98-173)	98(87-118)	7.6(7.0-8.7)	51(36-58)	2R	H	LY	25
UPB1097	91(76-99)	88(70-97)	129(115-144)	122(66-181)	100(82-115)	8.4(7.8-8.7)	50(38-54)	2R	H	LY	25
UPB1098	91(85-99)	90(70-99)	131(116-147)	103(66-150)	98(76-124)	8.1(7.0-9.3)	56(37-67)	2R	H	LY	24
BH946©	93(83-99)	87(69-100)	131(116-149)	125(76-196)	94(86-103)	8.3(7.7-9.0)	49(39-56)	2R	H	LY	23
DWRUB52©	95(88-99)	90(75-100)	130(116-139)	112(83-143)	96(72-111)	9.3(8.9-10.0)	54(33-67)	2R	H	LY	57
DWRB160©	91(77-99)	87(66-98)	130(115-143)	142(85-224)	90(73-104)	7.1(6.8-7.5)	44(38-48)	2R	H	LY	14
DWRB182©	91(85-99)	90(70-103)	130(117-144)	94(80-115)	97(74-122)	8.3(6.0-10.0)	44(37-49)	6R	H	LY	35
RD2849©	92 (88-99)	87 (67-100)	128(115-145)	111(88-150)	91(78-102)	7.7(6.0-8.4)	48(40-52)	2R	H	LY	13

INITIAL VARIETAL TRIAL (RAINFED) TIMELY SOWN - NEPZ

This trial was proposed at eight locations and was conducted by all centres. However, the trial at Ranchi center failed due to severe drought conditions and data were not reported from the center. After analysis, the data from Varanasi centre was not considered for pooled analysis due to LSM. The results from rest six centers were included in zonal pooled analysis.

There was a total of 12 genotypes in this trial and out of which 10 genotypes were the test entries and two genotypes (K603 and Lakhan) were the check varieties. Among 10 test entries, four entries (RD3035, RD3036, RD3037 and RD3038) were contributed by Durgapura centre and three entries (KB1940, KB1944 and KB1947) by Kanpur. Similarly, two entries (HUB275 and HUB276) by Varanasi and one entry (NDB1754) were contributed from Kumarganj centre.

The zonal monitoring team visited the trials at Kanpur, Kumarganj, Varanasi and Saini centres during the appropriate stage of the crop. Except a minor problem of germination in few entries, the overall performance of the trial was satisfactory at all locations. In case of disease-pest incidence, low to severe incidence of spot blotch has been reported. The maximum severity of spot blotch was reported at the Varanasi centre. In addition, traces of loose and covered smuts were also observed in some entries.

The location means for grain yield ranged from 19.29 q/ha (Kumarganj) to 28.97 q/ha (Chiyanki) with 23.25 q/ha zonal mean across the centres. Entry RD3037 ranked first with mean grain yield of 33.52 q/ha and was significantly superior to rest of entries and checks.

Grain Yield Data (q/ha) 2020-21

IVT-RF-TS 2020-21 **Zone: NEPZ**

Varieties	Code	Kumarganj			Pusa CAU			Kanpur			Saini			Chiyanki			Sabour			NEPZ*		
		Yield	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**
HUB275	IVT-RF-6	25.00	4	0	30.19	5	0	32.25	1	1	25.91	6	0	10.22	8	0	21.74	5	0	**24.22**	6	0
HUB276	IVT-RF-3	10.08	11	0	7.49	11	0	11.96	12	0	15.04	11	0	-	-	-	25.06	4	0	**13.93**	12	0
KB1940	IVT-RF-11	28.62	1	1	10.87	9	0	16.12	9	0	18.12	9	0	-	-	-	13.89	8	0	**17.52**	10	0
KB1944	IVT-RF-10	26.51	3	0	10.87	9	0	13.59	10	0	13.95	12	0	-	-	-	4.83	11	0	**13.95**	11	0
KB1947	IVT-RF-7	19.50	7	0	21.32	7	0	12.14	11	0	15.94	10	0	31.70	4	0	7.52	10	0	**18.02**	9	0
NDB1754	IVT-RF-4	11.59	9	0	20.23	8	0	26.63	5	0	24.46	7	0	-	-	-	15.70	7	0	**19.72**	7	0
RD3035	IVT-RF-2	21.62	5	0	27.78	6	0	23.91	8	0	30.25	2	0	25.88	6	0	21.74	5	0	**25.20**	5	0
RD3036	IVT-RF-9	19.50	7	0	38.65	4	0	25.54	6	0	27.72	5	0	26.35	5	0	28.68	3	0	**27.74**	4	0
RD3037	IVT-RF-12	20.68	6	0	47.40	1	1	27.90	3	0	28.80	4	0	42.80	1	1		-	-	**33.52**	1	1
RD3038	IVT-RF-1	9.60	12	0	6.22	12	0	24.46	7	0	18.66	8	0	37.62	2	0	12.74	9	0	**18.22**	8	0
K603©	IVT-RF-5	27.11	2	0	40.46	2	0	30.07	2	1	33.51	1	1	23.50	7	0	32.91	2	1	**31.26**	2	0
LAKHAN©	IVT-RF-8	11.59	9	0	40.46	2	0	27.90	3	0	29.35	3	0	33.69	3	0	33.82	1	1	**29.47**	3	0
	G.M.	**19.29**			**25.16**			**22.71**			**23.48**			**28.97**			**19.88**			**23.25**		
	S.E.(M)	0.49			1.71			1.03			1.10			1.50			1.47			**0.52**		
	C.D.@10%	1.16			4.10			2.46			2.63			3.66			3.52			**1.22**		
	C.V.	5.04			13.60			9.07			9.35			10.39			14.76					
	DOS	08.11.20			08.11.20			28.10.20			03.11.20			05.11.20			09.11.20					

**The data from Varanasi (LSM) was not considered for pooled zonal analysis*

Summary of ancillary and disease data (2020-21)

IVT –RF-FB 2020-21 **Zone: NEP Zone**

Entry	Code No	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS				DISEASE REACTION*
		Final Stand (%)	Days to heading	Days to maturity	Tillers/ meter	Plant height (cm)	Spike length (cm)	TGW (g)	2/6 Row	H/N	Colour	Spot blotch
HUB275	IVT-RF-6	75 (25-100)	81 70-92)	122 (108-133)	77 (52-110)	80 (50-90)	8.0 (6.0-10.5)	43 (36-49)	6	H	Y	45 (65)
HUB276	IVT-RF-3	54 (15-100)	83 (79-92)	124 (120-132)	37 (21-55)	81 (65-95)	7.9 (6.0-9.0)	38 (34-43)	6	H	Y	46 (87)
KB1940	IVT-RF-11	53 (25-82)	84 (77-90)	125 (111-137)	45 (30-65)	75 (49-85)	7.8 (6.8-9.0)	40 (32-46)	6	H	Y	56(76)
KB1944	IVT-RF-10	50 (20-100)	84 (74-94)	122 (107-136)	43 (21-60)	63 (44-82)	8.0 (6.0-10.0)	41 (34-47)	6	H	Y	56(87)
KB1947	IVT-RF-7	71 (35-100)	83 (76-97)	124 (118-131)	65 (37-118)	69 (50-83)	7.8 (6.0-10.0)	40 (34-48)	6	H	Y	34(76)
NDB1754	IVT-RF-4	68 (10-100)	82 (70-96)	124 (117-133)	68 (32-119)	67 (53-79)	8.1 (5.0-10.0)	42 (30-55)	6	H	Y	56 (65)
RD3035	IVT-RF-2	86 (65-100)	75 (60-89)	123 (115-133)	69 (40-110)	79 (70-86)	7.8 (5.9-9.1)	41 (34-50)	6	H	Y	67(99)
RD3036	IVT-RF-9	87 (70-100)	75 (62-94)	116 (85-134)	71 (55-115)	77 (55-93)	7.3 (5.0-9.0)	44 (34-53)	6	H	Y	56(76)
RD3037	IVT-RF-12	87 (70-100)	79 (67-88)	125 (115-133)	73 (53-110)	80 (63-92)	8.3 (7.8-9.1)	44 (36-54)	6	H	Y	44(87)
RD3038	IVT-RF-1	72 (10-100)	72 (55-85)	122 (105-135)	57 (15-87)	66 (43-83)	8.0 (5.1-9.8)	39 (32-46)	6	H	Y	56 (87)
K603©	IVT-RF-5	89 (75-100)	78 (71-91)	124 (119-135)	82 (60-118)	90 (71-105)	8.8 (5.0-11.0)	44 (38-50)	6	H	Y	44 (76)
LAKHAN©	IVT-RF-8	88 (70-100)	80 (70-92)	125 (119-135)	75 (48-116)	78 (53-97)	7.5 (5.0-10.0)	42 (34-50)	6	H	Y	45(87)

ADVANCED VARIETAL TRIAL OF RAINFED NORTH HILLS ZONES

The advanced varietal trial (Rainfed) for North Hills Zone was proposed with some modifications as per the decisions of the last annual workshop having the 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. In dual purpose replications, the green fodder cutting was to be made 70 days after sowing of the trial. The trial was proposed at 11 locations across Uttarakhand, Himachal, Jammu and Kashmir and was conducted by all centres. 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.

The zonal monitoring of the trials was done ***online*** during the crop season and observed no problem of genetic purity in any genotypes at any centre. Over all the performance of the trial was very good at the monitored centres. In case of disease & pest incidence, no major problem was reported from any centre except some traces of covered smuts in few entries as indicated in ancillary data table.

A. Performance in Uncut Replications (Normal)

After location wise analysis, the data from Majhera and Ranichauri centres were not considered for zonal mean analysis because of their LSM. The results from rest nine centers were in accordance and included in zonal pooled analysis. The location means for grain yield ranged from 15.23 q/ha (Almora) to 37.10 q/ha (Katrain) with 26.7 q/ha zonal mean across the centres. Entry UPB1093 ranked first with mean grain yield of 30.50 q/ha and entry BHS484 ranked second with grain yield 30.00 q/ha. The check HBL113 (29.80 q/ha) was observed as best check rank third, followed by BHS400 (29.2 q/ha). The above two entries and two checks were in the first non-significant group.

(B) Performance in Cut Replications (Dual purpose)

Grain yield performance: Though the trial was proposed at 11 locations but due to some reasons the conduction of dual-purpose replications could be not be implemented at Katrain

and Bajaura, while after analysis, the data from Kanga, Majhera and Ranichauri centres were also excluded for zonal mean analysis because of the LSM. In this way, the data of remaining six centers were considered for zonal pooled analysis for grain yield in cut treatment after regeneration. The relevant data of accessory traits in cut replications are given in ancillary table. The location means for grain yield ranged from 15.48 q/ha (Almora) to 25.64 q/ha (Khudwani) with 19.66 q/ha zonal mean across the centres. Amongst genotypes, the check variety HBL113 ranked first with mean grain yield of 25.21 q/ha. Hence, no test entries could out yield the best check variety.

Green fodder yield performance:

The cutting of green fodder was made after the 70 days sowing of the trial. The data of Almora and Majhera centre were not included in zonal pool analysis on account of their LSM.

The location means for green fodder yield ranged from 31.05 q/ha (Shimla) to 74.87 q/ha (Berthein) with 53.54 q/ha zonal mean across the centres. Amongst genotypes, the entry HBL870 ranked first with mean green fodder yield of 61.75 q/ha followed by best check variety VLB118 (61.02q/ha).

Combined performance of grain yield and green fodder yield:

Taking in view of the overall performance for dual purpose, both yield together (grain yield and fodder yield), a joint ranking of all genotypes was developed and on the basis of this criteria the check variety HBL113 ranks first with 1 and 3 rankings in grain and green fodder yields respectively. Thus, no entry could beat the check variety HBL113 in joint ranking for grain and green fodder.

Grain Yield (q/ha) 2020-21 in No Cut Trial

AVT-RF-NHZ 2020-21 **Zone: NHZ**

Varieties	Codes	Almora			Berthein			Kangra			Katrain			Khudwani		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS483	AVT-NHZ-4	12.44	20	0	27.07	5	1	30.29	1	1	25.34	22	0	42.44	1	1
BHS484	AVT-NHZ-16	12.32	22	0	29.5	2	1	24.02	7	0	41.47	6	0	30.43	18	0
BHS485	AVT-NHZ-15	13.04	17	0	19.1	21	0	17.07	23	0	29.17	18	0	40.37	6	1
BHS486	AVT-NHZ-9	18.24	4	0	27.23	4	1	22.68	9	0	33.42	15	0	40.84	3	1
BHS487	AVT-NHZ-7	13.04	17	0	27.74	3	1	18.39	17	0	24.6	23	0	30.02	19	0
HBL869	AVT-NHZ-12	18.12	5	0	24.28	12	0	23.85	8	0	28.42	21	0	37.78	8	1
HBL870	AVT-NHZ-2	12.44	20	0	24.33	10	0	17.86	18	0	30.14	17	0	40.01	7	1
HBL871	AVT-NHZ-20	16.18	8	0	22.15	16	0	17.39	21	0	38.09	13	0	30.64	16	0
HBL872	AVT-NHZ-17	14.86	14	0	20.08	20	0	25.91	5	0	28.7	20	0	36.08	9	0
HBL873	AVT-NHZ-1	21.5	1	1	26.04	8	1	24.97	6	0	37.39	14	0	34.16	11	0
UPB1091	AVT-NHZ-23	15.4	11	0	24.12	13	0	18.41	16	0	38.16	12	0	29.5	20	0
UPB1092	AVT-NHZ-18	18.84	3	1	22.98	15	0	26.61	2	0	29.04	19	0	32.19	13	0
UPB1093	AVT-NHZ-5	9.3	23	0	30.12	1	1	26.39	3	0	41.09	8	0	40.73	5	1
VLB170	AVT-NHZ-3	14.25	15	0	24.43	9	0	19.28	15	0	45.02	4	0	30.59	17	0
VLB171	AVT-NHZ-19	16.43	6	0	23.5	14	0	20.92	12	0	41.47	6	0	34.06	12	0
VLB172	AVT-NHZ-13	15.94	9	0	21.33	18	0	17.49	20	0	58.01	1	1	27.85	21	0
VLB173	AVT-NHZ-10	15.22	12	0	26.97	6	1	26.36	4	0	45.39	3	0	30.9	15	0
VLB174	AVT-NHZ-22	13.16	16	0	26.4	7	1	17.35	22	0	39.11	10	0	31.88	14	0
BHS352 ©	AVT-NHZ-11	16.3	7	0	13.3	23	0	17.54	19	0	31.53	16	0	40.79	4	1
BHS380 ©	AVT-NHZ-21	12.68	19	0	17.86	22	0	22.16	11	0	41.91	5	0	27.12	23	0
BHS400 ©	AVT-NHZ-8	15.58	10	0	21.17	19	0	22.63	10	0	46.73	2	0	35.46	10	0
HBL113 ©	AVT-NHZ-14	19.93	2	1	21.43	17	0	20.67	13	0	40.3	9	0	42.03	2	1
VLB118 ©	AVT-NHZ-6	14.98	13	0	24.33	10	0	20.45	14	0	38.91	11	0	27.74	22	0
	G.M.	**15.23**			**23.72**			**21.68**			**37.10**			**34.51**		
	S.E.(M)	1.14			2.26			0.27			2.52			2.23		
	C.D.	2.77			5.49			0.66			6.13			5.41		
	C.V.	10.59			13.49			1.77			9.62			9.14		
	DOS	20.10.20			31.10.20			07.11.20			07.11.20			09.11.20		

Grain Yield (q/ha) 2020-21 in No Cut Trial

AVT-RF-NHZ 2020-21 Contd…. **Zone: NHZ**

Varieties	Codes	Malan			Rajauri			Shimla			Bajaura			NHZ		
		Yield	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**	**Yield**	**Rk**	**G**
BHS483	AVT-NHZ-4	26.25	18	0	28.26	13	0	15.45	22	0	19.39	22	0	**25.20**	**17**	**0**
BHS484	AVT-NHZ-16	37.3	5	0	35.87	5	0	21.43	1	1	37.41	5	1	**30.00**	**2**	**1**
BHS485	AVT-NHZ-15	25.14	20	0	21.58	16	0	16.07	15	0	29.92	16	0	**23.50**	**22**	**0**
BHS486	AVT-NHZ-9	27.24	16	0	39.91	1	1	18.32	8	0	32.06	15	0	**28.90**	**5**	**0**
BHS487	AVT-NHZ-7	28.08	15	0	35.87	5	0	15.68	19	0	35.61	7	0	**25.40**	**16**	**0**
HBL869	AVT-NHZ-12	37.62	4	1	22.83	14	0	18.01	9	0	34.4	12	0	**27.30**	**10**	**0**
HBL870	AVT-NHZ-2	32.93	7	0	33.54	9	0	16.46	12	0	40.37	2	1	**27.60**	**9**	**0**
HBL871	AVT-NHZ-20	30.81	12	0	29.35	12	0	16.07	15	0	35.85	6	0	**26.30**	**14**	**0**
HBL872	AVT-NHZ-17	24.03	22	0	14.44	20	0	16.23	13	0	21.6	21	0	**22.40**	**23**	**0**
HBL873	AVT-NHZ-1	27.07	17	0	38.35	3	1	20.96	3	1	28.34	17	0	**28.80**	**6**	**0**
UPB1091	AVT-NHZ-23	28.37	14	0	13.82	23	0	16.93	11	0	32.3	14	0	**24.10**	**20**	**0**
UPB1092	AVT-NHZ-18	32.43	9	0	35.71	7	0	15.68	20	0	37.89	4	1	**27.90**	**8**	**0**
UPB1093	AVT-NHZ-5	37.8	3	1	36.02	4	0	18.4	7	0	35.06	11	0	**30.50**	**1**	**1**
VLB170	AVT-NHZ-3	24.49	21	0	33.07	10	0	15.45	22	0	23.57	20	0	**25.60**	**15**	**0**
VLB171	AVT-NHZ-19	31.9	10	0	30.43	11	0	18.01	9	0	27.61	19	0	**27.10**	**11**	**0**
VLB172	AVT-NHZ-13	29.78	13	0	35.56	8	0	15.92	18	0	35.33	8	0	**28.60**	**7**	**0**
VLB173	AVT-NHZ-10	23.43	23	0	14.44	20	0	20.26	5	0	18.16	23	0	**24.60**	**18**	**0**
VLB174	AVT-NHZ-22	32.69	8	0	20.81	17	0	21.43	1	1	39.3	3	1	**26.90**	**12**	**0**
BHS352 ©	AVT-NHZ-11	25.78	19	0	20.5	19	0	20.5	4	1	27.88	18	0	**23.80**	**21**	**0**
BHS380 ©	AVT-NHZ-21	33.21	6	0	13.98	22	0	16.15	14	0	35.09	10	0	**24.50**	**19**	**0**
BHS400 ©	AVT-NHZ-8	43.08	1	1	20.65	18	0	16.07	15	0	41.34	1	1	**29.20**	**4**	**1**
HBL113 ©	AVT-NHZ-14	31.64	11	0	39.29	2	1	19.38	6	0	33.61	13	0	**29.80**	**3**	**1**
VLB118 ©	AVT-NHZ-6	40.41	2	1	22.05	15	0	15.53	21	0	35.13	9	0	**26.60**	**13**	**0**
	G.M.	**30.93**			**27.67**			**17.58**			**32.05**			**26.7**		
	S.E.(M)	2.30			1.33			0.21			1.76			**0.588**		
	C.D.	5.57			3.22			0.51			5.02			**1.4**		
	C.V.	10.50			6.78			1.69			9.52					
	DOS	05.11.20			17.11.20			10.11.20			06.11.20					

The results from Majhera and Ranichauri were not included in zonal means because of LSM.

Grain Yield (q/ha) 2020-21 in Cut Trial

AVT-RF-NHZ 2020-21 **Zone: NHZ**

Varieties	Codes	Almora			Berthein			Khudwani			Malan			Rajauri			Shimla			NHZ		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS483	AVT-NHZ-4	12.8	19	0	25.88	7	1	26.6	11	0	20.53	3	0	21.58	13	0	15.06	16	0	**20.41**	**10**	**0**
BHS484	AVT-NHZ-16	10.51	20	0	19.88	19	0	31.16	3	1	15.17	12	0	28.42	7	0	19.95	1	1	**20.85**	**8**	**0**
BHS485	AVT-NHZ-15	13.04	17	0	22.83	14	0	26.92	9	0	15.09	13	0	15.22	19	0	14.91	17	0	**18.00**	**20**	**0**
BHS486	AVT-NHZ-9	18.00	5	0	25.57	8	1	29.4	8	0	15.06	14	0	28.57	6	0	15.68	8	0	**22.05**	**2**	**0**
BHS487	AVT-NHZ-7	13.04	17	0	21.43	17	0	19.36	21	0	16.54	9	0	29.19	3	0	13.98	23	0	**18.92**	**15**	**0**
HBL869	AVT-NHZ-12	17.27	6	0	29.09	2	1	32.04	2	1	13.03	18	0	18.32	15	0	17.16	5	0	**21.15**	**6**	**0**
HBL870	AVT-NHZ-2	10.02	22	0	26.76	5	1	30.64	5	0	11.15	20	0	29.66	2	0	14.29	22	0	**20.42**	**9**	**0**
HBL871	AVT-NHZ-20	19.32	4	0	19.15	20	0	24.22	14	0	16.15	10	0	24.22	12	0	15.14	13	0	**19.70**	**13**	**0**
HBL872	AVT-NHZ-17	16.06	10	0	21.64	16	0	18.84	22	0	10.68	21	0	11.34	20	0	15.53	9	0	**15.68**	**22**	**0**
HBL873	AVT-NHZ-1	21.01	2	1	26.6	6	1	21.01	18	0	15.31	11	0	28.88	5	0	16.93	6	0	**21.63**	**5**	**0**
UPB1091	AVT-NHZ-23	15.70	12	0	34.16	1	1	18.12	23	0	18.05	7	0	9.01	23	0	15.53	9	0	**18.43**	**16**	**0**
UPB1092	AVT-NHZ-18	20.41	3	1	23.29	12	0	29.4	7	0	14.98	15	0	27.02	10	0	15.53	9	0	**21.77**	**3**	**0**
UPB1093	AVT-NHZ-5	10.21	21	0	27.74	4	1	30.02	6	0	18.41	6	0	28.42	7	0	15.14	13	0	**21.66**	**4**	**0**
VLB170	AVT-NHZ-3	15.82	11	0	28.47	3	1	21.01	18	0	14.48	16	0	27.48	9	0	14.44	20	0	**20.29**	**11**	**0**
VLB171	AVT-NHZ-19	13.65	16	0	15.22	22	0	31.06	4	1	14.34	17	0	25.78	11	0	15.22	12	0	**19.21**	**14**	**0**
VLB172	AVT-NHZ-13	17.03	9	0	23.91	10	0	22.46	16	0	17.89	8	0	29.04	4	0	14.91	17	0	**20.87**	**7**	**0**
VLB173	AVT-NHZ-10	14.13	15	0	23.45	11	0	24.53	13	0	10.22	22	0	11.18	21	0	15.76	7	0	**16.55**	**21**	**0**
VLB174	AVT-NHZ-22	17.15	8	0	23.24	13	0	22.26	17	0	12.44	19	0	16.46	16	0	18.79	3	1	**18.39**	**18**	**0**
BHS352 ©	AVT-NHZ-11	17.27	6	0	20.29	18	0	26.09	12	0	8.87	23	0	15.99	17	0	19.57	2	1	**18.01**	**19**	**0**
BHS380 ©	AVT-NHZ-21	9.18	23	0	11.49	23	0	23.29	15	0	18.62	5	0	11.02	22	0	15.14	13	0	**14.79**	**23**	**0**
BHS400 ©	AVT-NHZ-8	15.58	13	0	16.98	21	0	19.46	20	0	28.06	1	1	15.53	18	0	14.83	19	0	**18.41**	**17**	**0**
HBL113 ©	AVT-NHZ-14	23.19	1	1	24.84	9	1	35.09	1	1	19.09	4	0	31.52	1	1	17.53	4	0	**25.21**	**1**	**1**
VLB118 ©	AVT-NHZ-6	15.58	14	0	22.26	15	0	26.71	10	0	20.81	2	0	18.63	14	0	14.36	21	0	**19.72**	**12**	**0**
G.M.		**15.48**			**23.22**			**25.64**			**15.87**			**21.85**			**15.89**			**19.66**		
S.E.(M)		1.28			2.01			1.76			1.26			0.62			0.50			**0.55**		
C.D.		3.10			4.88			4.27			3.05			1.49			1.22			**1.28**		
C.V.		11.65			12.24			9.70			11.20			3.98			4.48					
DOS		20.10.20			31.10.20			09.11.20			05.11.20			17.11.20			10.11.20					

The results from Kangra, Majhera and Ranichauri were not included in zonal means because of LSM.

Green Forage Yield (q/ha) 2020-21 in Cut Trial

AVT-RF-NHZ 2020-21 **Zone: NHZ**

Varieties	Codes	Berthein			Khudwani			Malan			Rajauri			Shimla			NHZ		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BHS483	AVT-NHZ-4	63.46	19	1	74.53	2	1	31.16	16	0	60.87	13	0	27.17	22	0	**51.44**	**15**	**1**
BHS484	AVT-NHZ-16	51.04	23	0	67.29	9	0	42.44	6	0	75.62	5	1	36.8	1	1	**54.64**	**11**	**1**
BHS485	AVT-NHZ-15	75.31	12	1	66.25	12	0	29.3	19	0	43.94	19	0	32.61	8	1	**49.48**	**19**	**0**
BHS486	AVT-NHZ-9	89.03	4	1	64.18	14	0	37.58	11	0	61.02	12	0	29.19	15	0	**56.2**	**9**	**1**
BHS487	AVT-NHZ-7	81.26	7	1	63.15	15	0	40.17	8	0	80.43	3	1	28.26	17	0	**58.65**	**5**	**1**
HBL869	AVT-NHZ-12	104.87	1	1	72.46	4	1	34.47	13	0	46.12	17	0	28.57	16	0	**57.3**	**8**	**1**
HBL870	AVT-NHZ-2	77.23	10	1	73.5	3	1	42.96	5	0	79.97	4	1	35.09	3	1	**61.75**	**1**	**1**
HBL871	AVT-NHZ-20	58.85	20	1	60.04	21	0	29.5	18	0	71.89	9	0	29.19	14	0	**49.9**	**18**	**0**
HBL872	AVT-NHZ-17	66.2	17	1	61.08	20	0	38.3	9	0	28.26	22	0	32.61	8	1	**45.29**	**21**	**0**
HBL873	AVT-NHZ-1	88.2	5	1	68.32	7	0	30.33	17	0	71.12	10	0	34.78	4	1	**58.55**	**6**	**1**
UPB1091	AVT-NHZ-23	54.09	21	1	59.01	23	0	31.68	14	0	22.2	23	0	34.78	4	1	**40.35**	**23**	**0**
UPB1092	AVT-NHZ-18	79.45	8	1	66.25	12	0	31.68	14	0	73.91	6	0	35.25	2	1	**57.31**	**7**	**1**
UPB1093	AVT-NHZ-5	70.55	14	1	70.39	5	1	40.58	7	0	69.72	11	0	29.5	13	0	**56.15**	**10**	**1**
VLB170	AVT-NHZ-3	67.03	16	1	68.32	7	0	28.99	20	0	73.14	7	0	27.02	23	0	**52.9**	**13**	**1**
VLB171	AVT-NHZ-19	53.05	22	1	69.36	6	1	43.37	4	0	72.05	8	0	33.85	7	1	**54.34**	**12**	**1**
VLB172	AVT-NHZ-13	100.78	2	1	60.04	21	0	28.78	22	0	84.01	2	1	28.11	18	0	**60.34**	**4**	**1**
VLB173	AVT-NHZ-10	77.12	11	1	63.15	15	0	37.16	12	0	29.35	20	0	32.3	10	1	**47.82**	**20**	**0**
VLB174	AVT-NHZ-22	63.66	18	1	67.29	9	0	44.04	2	0	51.4	15	0	27.64	20	0	**50.81**	**17**	**0**
BHS352 ©	AVT-NHZ-11	72.46	13	1	63.15	15	0	43.48	3	0	48.76	16	0	34.01	6	1	**52.37**	**14**	**1**
BHS380 ©	AVT-NHZ-21	69.51	15	1	62.11	19	0	25.9	23	0	28.57	21	0	27.64	20	0	**42.75**	**22**	**0**
BHS400 ©	AVT-NHZ-8	79.14	9	1	63.15	15	0	38.1	10	0	45.96	18	0	29.81	12	0	**51.23**	**16**	**1**
HBL113 ©	AVT-NHZ-14	84.83	6	1	75.57	1	1	28.99	20	0	86.49	1	1	27.8	19	0	**60.73**	**3**	**1**
VLB118 ©	AVT-NHZ-6	94.98	3	1	67.29	9	0	54.04	1	1	56.68	14	0	32.14	11	1	**61.02**	**2**	**1**
	G.M.	74.87			66.34			36.22			59.20			31.05			**53.54**		
	S.E.(M)	22.11			2.67			0.84			5.11			1.46			**4.58**		
	C.D.	53.68			6.47			2.03			12.41			3.53			**10.66**		
	C.V.	41.75			5.68			3.27			12.21			6.63					
	DOS	31.10.20			09.11.20			05.11.20			17.11.20			10.11.20					

The results from Almora and Majhera were not included in zonal means because of LSM.

Summary of ancillary and disease data (2020-21) No Cut Trial

IVT –RF-NHZ 2020-21 **Zone: NH Zone**

Entry	Code No	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS				Disease (CS)
		Final Stand (%)	Days to heading	Days to maturity	Tillers/ meter	Plant height (cm)	Spike length (cm)	TGW (g)	2/6 Row	H/N	Colour	
BHS483	AVT-RF-NHZ-4	84(70-98)	126(107-172)	170(138-207)	96(59-172)	85(47-122)	8(6-13)	40(28-50)	6	N	A	0.8
BHS484	AVT-RF-NHZ-16	80(65-97)	124(103-170)	171(134-205)	96(53-190)	86(44-112)	7(6-9)	43(26-52)	6	H	Y	0.0
BHS485	AVT-RF-NHZ-15	81(68-97)	126(108-169)	170(139-202)	103(54-278)	87(38-124)	7(5-8)	38(32-43)	6	N	A	4.0
BHS486	AVT-RF-NHZ-9	83(70-98)	125(97-172)	169(137-206)	94(48-193)	85(67-116)	8(7-9)	42(36-48)	6	H	Y	1.3
Bhs487	AVT-RF-NHZ-7	83(70-98)	127(102-172)	171(133-207)	84(47-171)	81(63-105)	7(5-9)	40(29-48)	6	H	Y	2.0
HBL869	AVT-RF-NHZ-12	84(75-98)	124(101-168)	170(141-202)	92(54-238)	87(51-120)	7(5-10)	41(33-45)	6	H	Y	3.8
HBL870	AVT-RF-NHZ-2	86(73-98)	126(103-171)	171(136-205)	108(57-361)	89(61-106)	8(7-9)	41(30-49)	6	H	Y	0.0
HBL871	AVT-RF-NHZ-20	79(60-97)	126(101-171)	170(137-202)	89(42-211)	77(42-115)	7(5-9)	41(27-50)	6	H	Y	1.8
HBL872	AVT-RF-NHZ-17	79(65-97)	127(103-171)	171(143-204)	98(57-263)	78(61-116)	7(5-9)	40(28-45)	6	H	Y	0.0
HBL873	AVT-RF-NHZ-1	86(75-98)	126(107-170)	171(138-203)	97(57-223)	83(58-113)	8(7-9)	40(31-46)	6	H	Y	0.3
UPB1091	AVT-RF-NHZ-23	78(55-97)	125(99-171)	170(134-202)	85(50-200)	78(53-116)	7(5-9)	41(25-50)	6	H	Y	0.0
UPB1092	AVT-RF-NHZ-18	76(40-97)	126(105-170)	171(143-205)	107(57-252)	75(45-118)	6(5-8)	40(29-50)	6	H	Y	0.0
UPB1093	AVT-RF-NHZ-5	84(75-97)	125(97-171)	172(141-205)	94(60-187)	83(55-132)	8(6-13)	43(28-53)	6	H	Y	0.8
VLB170	AVT-RF-NHZ-3	82(70-96)	126(94-170)	170(135-204)	94(50-216)	84(60-105)	8(6-9)	41(28-48)	6	Mix	A	0.0
VLB171	AVT-RF-NHZ-19	81(65-98)	124(102-168)	171(143-201)	79(62-125)	83(54-121)	6(6-7)	42(32-50)	6	H	Y	0.0
VLB172	AVT-RF-NHZ-13	81(70-97)	127(106-170)	171(137-206)	104(50-259)	87(53-121)	8(5-10)	42(32-45)	6	Mix	A	2.0
VLB173	AVT-RF-NHZ-10	83(70-98)	128(107-171)	172(141-206)	96(36-258)	80(54-118)	7(5-8)	40(33-45)	6	H	Y	0.0
VLB174	AVT-RF-NHZ-22	84(58-98)	128(103-173)	170(134-205)	100(56-235)	77(44-116)	7(5-8)	43(31-55)	2	H	Y	0.0
BHS352©	AVT-RF-NHZ-11	77(45-98)	121(101-169)	167(133-203)	95(52-238)	91(44-127)	7(5-8)	40(27-49)	6	N	A	0.0
BHS380©	AVT-RF-NHZ-21	78(55-96)	127(97-171)	170(135-203)	88(44-257)	81(52-113)	7(5-9)	41(31-49)	6	H	Y	0.0
BHS400©	AVT-RF-NHZ-8	85(70-97)	126(100-172)	170(138-205)	101(60-187)	78(51-106)	7(5-9)	42(29-51)	6	H	Y	0.0
HBL113©	AVT-RF-NHZ-14	81(67-98)	129(104-170)	173(141-206)	107(52-155)	83(41-128)	8(5-10)	40(28-45)	2	H	Y	0.0
VLB118©	AVT-RF-NHZ-6	86(80-97)	124(106-169)	171(138-201)	94(57-200)	79(57-96)	7(6-8)	42(32-50)	6	H	Y	0.0

Summary of ancillary and disease data (2020-21) Cut Trial

IVT –RF-NHZ 2020-21 **Zone: NH Zone**

Entry	Final Stand (%)	Days to heading	Days to maturity	Tillers/m	Plant height (cm)	Spike length (cm)	TGW (g)
BHS483	81(55-98)	132(113-170)	177(158-208)	91(40-248)	70(47-130)	8.0(6.2-11.7)	39.5(35.0-44.0)
BHS484	83(56-97)	133(115-171)	178(159-209)	93(33-187)	66(47-85)	7.1(5.6-8.3)	41.2(29.1-50.0)
BHS485	78(55-96)	134(111-170)	178(157-207)	88(30-221)	68(45-101)	7.1(4.8-9.0)	39.5(32.7-45.0)
BHS486	79(55-98)	134(113-171)	176(157-210)	88(39-206)	66(37-101)	6.9(5.0-9.2)	37.2(29.7-45.0)
Bhs487	80(50-97)	132(111-170)	175(157-208)	80(35-198)	66(42-122)	7.9(6.2-11.3)	42.2(29.4-52.0)
HBL869	76(55-97)	133(112-169)	176(158-206)	94(41-275)	61(45-81)	6.9(6.0-8.7)	40.1(26.5-47.5)
HBL870	76(50-98)	134(115-170)	178(159-208)	84(32-273)	65(42-87)	7.0(5.2-8.3)	39.5(32.5-45.2)
HBL871	76(50-97)	132(112-171)	176(157-210)	93(38-233)	65(48-81)	6.9(6.1-7.7)	40.2(31.8-50.0)
HBL872	78(50-98)	132(115-169)	175(158-206)	94(38-178)	65(39-88)	6.9(5.8-8.2)	39.4(35.0-42.1)
HBL873	79(45-97)	133(113-168)	176(158-207)	86(39-167)	69(49-95)	7.6(6.2-10.0)	37.7(29.9-42.7)
UPB1091	76(42-97)	133(111-169)	178(157-208)	94(34-302)	70(47-106)	8.4(7.0-10.7)	39.6(30.2-47.0)
UPB1092	79(42-97)	133(113-172)	177(159-209)	99(40-254)	65(44-100)	7.4(4.6-10.0)	40.3(34.2-43.1)
UPB1093	80(55-97)	133(114-172)	177(158-209)	89(38-200)	69(48-99)	8.0(6.2-10.0)	38.5(32.3-41.4)
VLB170	81(56-97)	135(120-171)	178(158-209)	89(39-177)	67(50-98)	7.8(5.7-9.7)	38.1(31.9-42.0)
VLB171	79(50-97)	134(111-169)	177(156-206)	87(35-218)	68(49-89)	7.7(7.4-8.0)	37.2(24.3-45.0)
VLB172	84(70-97)	133(111-170)	178(157-206)	96(35-304)	68(44-114)	6.4(4.2-8.7)	42.2(35.1-49.1)
VLB173	79(55-97)	132(114-171)	176(159-209)	84(36-194)	68(48-104)	7.0(6.2-9.0)	40.6(34.3-55.0)
VLB174	82(62-95)	132(112-170)	176(157-208)	94(41-193)	61(47-79)	6.3(4.8-7.0)	41.9(36.6-50.0)
BHS352©	80(55-97)	133(108-173)	178(157-210)	105(40-278)	69(45-117)	7.3(5.8-10.0)	41.1(35.0-48.0)
BHS380©	80(65-97)	134(108-171)	178(156-209)	92(37-267)	69(53-105)	8.0 (6.3-10.3)	39.3(24.1-45.0)
BHS400©	76(45-96)	134(113-170)	177(155-208)	82(36-191)	70(50-105)	7.0(5.8-8.7)	40.5(34.5-46.0)
HBL113©	81(65-96)	134(113-169)	175(156-206)	92(37-236)	66(45-102)	7.9(6.5-10.3)	40.2(28.4-51.0)
VLB118©	83(60-97)	132(113-169)	176(158-207)	101(41-277)	68(52-102)	6.9(5.2-9.7)	40.0(34.8-49.0)

SOIL SALINITY TOLERANCE YIELD TRIAL

This trial was proposed at 7 locations and was conducted by all centres. After the analysis the data from Fatehpur and IIWBR Hisar centres were not considered for pooled analysis due to LSM and HCV respectively. The results from rest five centers were included in zonal pooled analysis. The trial consisted of 15 genotypes including three checks (NDB1173, RD2794 and RD2907). Entries RD3016 and KB1922 were in AVT-I year (retained last year after first year testing), while rest of the 9 entries were in IVT (first year testing).

The zonal monitoring teams visited the trials at Dalipnagar and Kumarganj in NEPZ and Bhilwara in CZ, CCSHAU, Hisar and IIWBR Hisar in NWPZ during the crop season. Entries number 2 (NDB1173©) and 5 (BH1039) were reported as segregating, while entry 6 (RD2907©) was indicated with off types. In case of disease pest incidence, low to moderate incidence of spot blotch has been reported, with traces of loose and covered smuts in some entries as indicated in ancillary data table.

The location means for grain yield ranged from 16.45 q/ha (CSSRI Karnal) to 29.44 q/ha (Bhilwara) with 24.01 q/ha zonal mean across the centres. Entry DWRB224 ranked first with mean grain yield of 30.71 q/ha and entry RD3039 ranked second with grain yield 30.11 q/ha, while the check RD2794 was observed as best check and stood at rank third in the first non-significant group.

Grain Yield Data (q/ha) 2020-21

AVT-SST 2020-21 **Zone: NWPZ & NEPZ**

Entry Name	Entry code	Kumarganj			Dalipnagar			CSSRI, Karnal			HAU, Hisar			Bhilwara			Overall		
		Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
BH1039	AVT-SST-5	26.85	4	0	31.16	4	0	16.76	8	0	38.59	2	1	27.78	9	0	28.23	5	0
DWRB224	AVT-SST-4	29.74	2	1	27.17	7	0	19.15	5	0	34.78	3	0	42.72	2	0	30.71	1	1
HUB280	AVT-SST-7	5.86	14	0	19.93	10	0	20.97	4	0	29.77	10	0	25.69	12	0	20.44	12	0
KB1822	AVT-SST-13	22.34	9	0	13.77	13	0	6.49	14	0	17.51	13	0	12.29	14	0	14.48	14	0
KB1909	AVT-SST-15	20.11	11	0	11.59	15	0	3.26	15	0	8.03	15	0	10.87	15	0	10.77	15	0
KB1911	AVT-SST-10	23.61	6	0	13.77	13	0	10.17	13	0	12.8	14	0	12.35	13	0	14.54	13	0
NDB1757	AVT-SST-9	4.53	15	0	31.88	2	0	16.91	7	0	34.36	4	0	35.87	4	0	24.71	10	0
RD3016	AVT-SST-11	26.63	5	0	17.39	11	0	14.41	10	0	33.15	6	0	38.04	3	0	25.93	8	0
RD3039	AVT-SST-8	19.93	12	0	31.52	3	0	12.84	12	0	33.09	7	0	53.14	1	1	30.11	2	1
RD3040	AVT-SST-1	23.4	7	0	28.26	6	0	31.82	1	1	28.2	12	0	30.8	8	0	28.5	4	0
RD3041	AVT-SST-12	22.34	10	0	31.16	4	0	18.11	6	0	33.82	5	0	33.82	5	0	27.85	6	0
RD3042	AVT-SST-14	9.42	13	0	17.39	12	0	13.42	11	0	40.94	1	1	26.06	11	0	21.45	11	0
NDB1173©	AVT-SST-2	29.14	3	0	22.46	9	0	15.44	9	0	29.17	11	0	33	6	0	25.84	9	0
RD2794©	AVT-SST-3	31.49	1	1	36.96	1	1	22.45	3	0	30.31	9	0	26.63	10	0	29.57	3	1
RD2907©	AVT-SST-6	22.49	8	0	23.19	8	0	24.51	2	0	32.37	8	0	32.61	7	0	27.03	7	0
G.M.		**21.19**			**23.84**			**16.45**			**29.13**			**29.44**			**24.01**		
S.E. (M)		0.82			1.39			1.94			2.36			1.54			**0.76**		
C.D.		1.96			3.31			4.61			5.62			3.67			**1.76**		
C.V.		7.76			11.68			23.55			16.23			10.47					
DOS		18.11.2020			30.11.2020			14.11.2020			11.11.2020			22.11.2020					

The results from Fatehpur (LSM) and IIWBR Hisar (HCV) are not considered in zonal means.

Summary of ancillary and disease data

AVT-SST 2020-21 **Zone: NWPZ & NEPZ**

Entry Name	AGRONOMIC CHARACTERS						GRAIN CHARACTERISTICS			Disease Reaction							
	H days Mean & Range	M. days Mean & Range	Height Mean & Range (cm)	Tillering per meter Mean & Range	Spike Length Mean & Range (cm)	Two/ Six row	Colour	1000g.w Mean & Range	H/N	Rust			Leaf blight		Other disease (Loose smut)	Aphid	CNN
										YL	BR	BL	Spot	Net			
BH1039	86 (74-111)	119 (108-141)	71.9 (60.8-93.3)	82 (51-120)	8.3 (7.1-9.1)	6	LY	38.8 (32.0-44.4)	H				12		0.1%		
DWRB224	84 (75-105)	120 (105-141)	68.7 (55.4-96.3)	81 (39-132)	8.4 (8.0-8.6)	6	LY	41.6 (37.4-47.9)	H				57		0		
HUB280	87 (77-111)	119 (109-141)	71.9 (51.2-110)	83 (15-154)	8.8 (8.6-9.3)	6	LY	40.9 (38.0-45.9)	H				36		0		
KB1822	86 (75-109)	117 (105-135)	65.6 (52.0-88.0)	57 (41-83)	9.3 (8.5-10.8)	6	LY	38.9 (32.0-44.8)	H				13		0		
KB1909	90 (79-119)	122 (110-145)	62.8 (55.0-71.2)	52 (41-80)	9.2 (7.9-11.2)	6	LY	38.0 (27.0-49.2)	H				13		0		
KB1911	91 (82-113)	125 (115-143)	63.7 (48.5-81.7)	62 (31-127)	8.6 (7.9-9.2)	6	LY	39.1 (34.0-47.2)	H				13		0		
NDB1757	87 (75-112)	121 (105-143)	71.7 (65.3-82)	79 (17-113)	9.6 (8.9-9.9)	6	LY	35.9 (30.0-41.9)	H				24		0		
RD3016	81 (64-106)	117 (100-136)	61.0 (51.5-88.0)	70 (22-109)	9.6 (8.9-10.9)	6	LY	42.0 (38.0-47.6)	H				47		0		
RD3039	80 (61-101	117 (102-134)	69.1 (55-87.2)	79 (38-110)	8.1 (7.7-8.5)	6	LY	38.0 (28.0-44.1)	H				47		0		
RD3040	83 (75-99)	122 (111-144)	76.3 (59.6-102.7)	99 (67-170)	8.3 (7.0-9.7)	6	LY	44.3 (34.0-54.9)	H				47		0		
RD3041	81 ((65-103)	117 (101-135)	62.6 (48.0-78.0)	86 (45-141)	8.6 (7.8-9.5)	6	LY	40.7 (36.0-46.9)	H				36		0		
RD3042	86 (77-106)	119 (109-137)	58.6 (51.1-62.0)	89 (70-104)	8.4 (7.5-8.9)	6	LY	42.5 (40.0-45.3)	H				47		0		
NDB1173©	88 (74-110)	122 (115-135)	69.1 (51.6-108.7)	75 (38-117)	8.8 (7.5-10.2)	6	LY	37.5 (32.5-46.6)	H				47		0		
RD2794©	86 (74-110)	120 (107-139)	68.4 (55-98.7)	108 (74-158)	8.2 (7.7-9.0)	6	LY	38.8 (32.8-45.6)	H				12		0.1%		
RD2907©	86 (76-110)	120 (109-143)	66.2 (39.9-97.3)	94 (46-166)	8.2 (7.5-8.8)	6	LY	41.8 (36.0-47.0)	H				2		0		

Trials Rejected and their reasons

Rejected Trials- AVT-IR-FB-NWP/NEP Zone

Varieties	Ayodhya (NEPZ)			Kalyani (NEPZ)			Chatha (NWPZ)		
	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
AVT-IRFB-1	32.46	3	0	28.91	2	0	25.08	8	0
AVT-IRFB-2	8.48	10	0	33.48	1	1	25.13	6	0
AVT-IRFB-3	19.42	9	0	27.83	4	0	31.36	2	0
AVT-IRFB-4	31.06	4	0	24.57	9	0	25.12	7	0
AVT-IRFB-5	26.16	6	0	28.48	3	0	19.80	10	0
AVT-IRFB-6	26.16	6	0	24.57	9	0	30.03	4	0
AVT-IRFB-7	37.27	1	1	27.61	5	0	26.99	5	0
AVT-IRFB-8	36.38	2	0	26.96	7	0	30.84	3	0
AVT-IRFB-9	26.71	5	0	27.39	6	0	35.99	1	1
AVT-IRFB-10	21.38	8	0	25.65	8	0	21.43	9	0
G.M.	**26.55**			**27.54**			**27.18**		
S.E.(M)	0.34			1.04			0.23		
C.D.	0.83			2.50			0.56		
C.V.	2.59			7.52			1.72		
DOS	12.11.20			23.11.20			24.11.20		
Reason	LSM			LSM			LSM		

Rejected Trials- AVT-SST-NWP/NEP Zone

Varieties	Fatehpur			IIWBR, Hisar		
	Yield	Rk	G	Yield	Rk	G
AVT-SST -1	8.57	5	0	20.31	13	0
AVT-SST -2	7.43	9	0	38.76	5	1
AVT-SST -3	14.31	2	0	8.42	15	0
AVT-SST -4	8.15	7	0	33.09	9	1
AVT-SST -5	9.31	4	0	34.15	8	1
AVT-SST -6	8.39	6	0	35.40	6	1
AVT-SST -7	6.43	11	0	23.70	12	0
AVT-SST -8	8.03	8	0	45.60	3	1
AVT-SST -9	6.52	10	0	27.56	10	1
AVT-SST -10	0.00	13	0	38.79	4	1
AVT-SST -11	17.84	1	1	34.47	7	1
AVT-SST -12	6.19	12	0	26.18	11	1
AVT-SST -13	0.00	13	0	18.94	14	0
AVT-SST -14	11.47	3	0	52.36	2	1
AVT-SST -15	0.00	13	0	55.74	1	1
G.M.	**7.51**			32.90		
S.E.(M)	0.51			13.01		
C.D.	1.21			30.94		
C.V.	13.50			**55.91**		
DOS	10.11.2020			25.11.2020		
Reason	**LSM**			**HCV**		

Rejected Trials- IVT-IR-FB -NWP/NEP/Cen Zones & IVT-RF-NEPZ

IVT-IR-FB							IVT-RF-FB-NEPZ			
Variety	**Varanasi**			**Morena**			**Variety**	**Varanasi**		
	Yield	**RK**	**G**	**Yield**	**RK**	**G**		**Yield**	**Rk**	**G**
IVT-IRFB-1	24.31	8	0	61.48	20	0	IVT-RF-1	4.44	5	0
IVT-IRFB-2	14.21	19	0	64.25	19	0	IVT-RF- 2			
IVT-IRFB-3	25.02	7	0	103.11	1	1	IVT-RF- 3			
IVT-IRFB-4	17.84	15	0	76.97	10	1	IVT-RF- 4	5.94	2	0
IVT-IRFB-5	19.59	12	0	70.58	13	0	IVT-RF- 5	13.11	1	1
IVT-IRFB-6	20.24	11	0	83.90	5	1	IVT-RF -6	2.51	8	0
IVT-IRFB-7	39.87	1	1	88.73	2	1	IVT-RF-7	5.65	3	0
IVT-IRFB-8	25.60	5	0	79.00	9	1	IVT-RF-8	4.28	6	0
IVT-IRFB-9	20.34	10	0	49.17	21	0	IVT-RF-9	4.77	4	0
IVT-IRFB-10	31.15	3	0	73.53	12	0	IVT-RF-10	3.54	7	0
IVT-IRFB-11	17.87	14	0	70.35	14	0	IVT-RF-11			
IVT-IRFB-12	21.82	9	0	45.24	22	0	IVT-RF-12			
IVT-IRFB-13	4.76	23	0	81.50	7	1	G.M.	5.53		
IVT-IRFB-14	2.11	25	0	41.65	25	0	S.E.(M)	0.56		
IVT-IRFB-15	10.59	21	0	75.01	11	0	C.D.	1.36		
IVT-IRFB-16	8.20	22	0	45.18	23	0	C.V.	20.23		
IVT-IRFB-17	2.14	24	0	70.24	15	0	DOS	08.11.20		
IVT-IRFB-18	13.18	20	0	83.26	6	1	Reason	LSM		
IVT-IRFB-19	18.19	13	0	67.82	17	0				
IVT-IRFB-20	17.17	18	0	87.53	3	1				
IVT-IRFB-21	25.81	4	0	81.13	8	1				
IVT-IRFB-22	25.16	6	0	85.30	4	1				
IVT-IRFB-23	17.58	16	0	42.18	24	0				
IVT-IRFB-24	37.02	2	1	65.33	18	0				
IVT-IRFB-25	17.55	17	0	69.39	16	0				
GM	**19.09**			70.47						
S.E.m =	3.24			11.34						
C.D. =	7.83			28.01						
C.V. =	**23.97**			**22.76**						
D.O.S. =	18.11.20			24.11.20						
Reason	LSM & HCV			HCV						

Rejected Trials- AVT-RF-NHZ

Varieties	Grain yield (No Cut)						Forage yield						Grain yield (Cut)								
	Majhera			Ranichauri			Almora			Majhera			Kangra			Majhera			Ranichauri		
	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G	Yield	Rk	G
AVT-NHZ-1	7.75	16	0	10.62	20	0	4.11	13	0	13.20	12	0	11.30	3	0	7.08	8	0	8.21	12	0
AVT-NHZ-2	13.33	5	1	16.35	11	1	3.62	20	0	5.90	22	0	10.66	7	0	4.63	22	0	7.13	17	0
AVT-NHZ-3	14.29	3	1	16.67	10	1	1.75	23	0	20.19	5	0	10.86	6	0	5.47	19	0	8.45	10	0
AVT-NHZ-4	14.05	4	1	11.30	17	0	3.93	16	0	10.87	16	0	11.20	4	0	5.71	14	0	8.42	11	0
AVT-NHZ-5	12.53	7	1	13.33	15	0	2.29	22	0	20.19	5	0	10.19	9	0	5.51	17	0	8.15	13	0
AVT-NHZ-6	12.90	6	1	18.27	3	1	6.28	8	1	22.52	3	0	7.53	21	0	10.84	1	1	10.39	7	0
AVT-NHZ-7	4.63	21	0	13.51	14	0	3.74	19	0	13.98	11	0	11.73	2	0	5.56	15	0	11.71	4	1
AVT-NHZ-8	5.30	20	0	17.98	7	1	2.66	21	0	14.75	9	0	9.14	16	0	6.02	11	0	7.13	17	0
AVT-NHZ-9	9.45	14	0	18.32	2	1	3.93	17	0	8.54	19	0	7.58	20	0	8.52	4	0	11.59	5	1
AVT-NHZ-10	15.10	2	1	18.12	4	1	6.64	7	1	12.42	14	0	12.35	1	1	7.69	6	0	13.29	3	1
AVT-NHZ-11	12.20	8	0	18.70	1	1	7.13	6	1	33.39	1	1	10.34	8	0	5.47	18	0	15.10	1	1
AVT-NHZ-12	11.70	9	0	9.82	22	0	8.51	3	1	11.65	15	0	9.49	14	0	9.08	2	0	3.38	23	0
AVT-NHZ-13	6.98	17	0	18.06	6	1	3.99	15	0	6.99	20	0	8.10	18	0	5.75	13	0	14.49	2	1
AVT-NHZ-14	3.53	23	0	13.88	13	0	3.86	18	0	4.66	23	0	6.93	23	0	5.54	16	0	7.15	16	0
AVT-NHZ-15	10.63	12	0	10.07	21	0	4.47	12	0	21.74	4	0	9.61	13	0	4.77	21	0	7.79	15	0
AVT-NHZ-16	3.78	22	0	17.50	8	1	7.31	4	1	10.09	17	0	7.45	22	0	4.41	23	0	10.51	6	0
AVT-NHZ-17	8.56	15	0	10.99	18	0	10.14	1	1	6.37	21	0	10.06	10	0	6.59	10	0	6.70	19	0
AVT-NHZ-18	16.90	1	1	17.37	9	1	5.37	9	0	9.78	18	0	8.52	17	0	5.90	12	0	9.72	9	0
AVT-NHZ-19	6.17	18	0	13.26	16	0	4.05	14	0	13.20	12	0	9.99	11	0	8.06	5	0	5.86	21	0
AVT-NHZ-20	10.61	13	0	18.12	4	1	7.25	5	1	26.09	2	0	9.74	12	0	5.23	20	0	8.03	14	0
AVT-NHZ-21	11.36	11	0	10.83	19	0	4.53	11	0	17.08	7	0	9.32	15	0	7.09	7	0	10.02	8	0
AVT-NHZ-22	11.45	10	0	14.35	12	1	5.01	10	0	16.30	8	0	7.88	19	0	8.77	3	0	6.70	19	0
AVT-NHZ-23	6.08	19	0	8.15	23	0	9.36	2	1	14.60	10	0	11.13	5	0	6.93	9	0	5.56	22	0
G.M.	**9.97**			**14.59**			**5.21**			**14.54**			**9.61**			**6.55**			**8.93**		
S.E.(M)	1.18			1.91			1.04			1.95			0.21			0.59			1.55		
C.D.	2.85			4.64			2.53			4.74			0.52			1.44			3.77		
C.V.	16.68			18.52			**28.21**			19.00			3.12			12.81			24.60		
DOS	22.10.20			09.11.20			20.10.20			22.10.20			07.11.20			22.10.20					
Reason	**LSM**			**LSM**			**LSM &HCV**			**LSM**			**LSM**			**LSM**			**LSM**		

International Trials and Nurseries

During *rabi* 2020-21 season two international trials and two international germplasm nurseries were supplied from ICARDA. Each trial (IBYT and 8th GSBYT) comprised of 24 test entries and one Indian check was included. The nurseries IBON-HI-2021 and 8th GSBON-2020 comprised each of 112 test entries and 3-checks (repeated 7-times) and one Indian check was also included. All the four checks were repeated 7-times. In total 278 genotypes were received from ICARDA. Each of these international trials and nurseries were evaluated at four different selected locations including Karnal. 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 for one week. In addition, one set each of EIBGN (75 entries) and NBGSN (20 entries), was each supplied to 10-different locations.

International trials and nurseries evaluated during crop season 2020-2021

Sr. No.	Trials/Nurseries	Genotypes received from ICARDA	National Check	# Sets	Locations
1	IBYT-HI-2021	24	DWRB137	4	Durgapura, Hisar, Pantnagar, Karnal
2	8th GSBYT-2021	24	Lakhan	4	Varanasi, Kanpur, Bajaura, Karnal
3	IBON-HI-2021	112 + 3 checks	DWRB137	4	Durgapura, Pantnagar, Hisar, Karnal
4	8th GSBON-2020	112 + 3 checks	Lakhan	4	Kanpur, Varanasi, Bajaura, Karnal

International Barley Yield Trial-High Input-2021 (IBYT-HI-2021)

The IBYT-HI comprising of 25 entries including one Indian local check variety DWRB137, was evaluated in an Alpha-Lattice Design with two replications at four locations namely, Durgapura, Hisar, Pantnagar and Karnal of NWPZ under high input conditions. Data from all the locations were included in the national pooled analysis. The entry IBYT-HI-2021-10 ranked first with 47.6 q/ha and the check variety DWRB137 ranked second with 46.6 q/ha grain yield. This entry was at par with the check variety for grain yield.

Grain yield, ranking and grouping of barley IBYT-HI-(2021) genotypes in rabi 2020-2021.

Entry (No.)	Durgapura			Pantnagar			Hisar			Karnal			National Means		
	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G
1	46.0	16	0	26.7	12	0	29.5	17	0	31.8	25	0	33.5	18	0
2	40.5	21	0	46.5	1	1	18.5	25	0	40.5	15	0	36.5	16	0
3	46.2	15	0	27.5	11	0	40.0	8	0	44.0	7	0	39.4	9	0
4	46.6	14	0	36.7	4	0	26.9	21	0	41.0	13	0	37.8	11	0
5	41.1	20	0	22.0	16	0	27.1	20	0	42.7	9	0	33.2	20	0
6	51.2	9	0	33.6	6	0	40.9	6	0	43.7	8	0	42.3	5	0
7	38.4	24	0	16.6	20	0	28.3	19	0	39.6	17	0	30.7	23	0
8	39.0	23	0	12.4	22	0	31.7	16	0	35.5	22	0	29.7	24	0
9	56.9	4	0	22.1	15	0	31.8	15	0	40.6	14	0	37.9	10	0
10	55.9	5	0	43.6	3	1	42.4	4	0	48.5	3	1	47.6	1	1
11	39.1	22	0	29.7	9	0	23.0	23	0	41.4	12	0	33.3	19	0
12	51.4	8	0	26.3	13	0	31.9	14	0	40.2	16	0	37.5	13	0
13	49.8	11	0	24.6	14	0	41.9	5	0	47.1	4	1	40.9	7	0
14	59.8	2	1	20.4	18	0	37.5	10	0	45.3	5	0	40.8	8	0
15	66.8	1	1	18.5	19	0	50.9	1	1	37.0	19	0	43.3	3	0
16	41.9	19	0	29.7	8	0	25.4	22	0	34.6	23	0	32.9	21	0
17	50.9	10	0	21.4	17	0	33.6	11	0	44.8	6	0	37.7	12	0
18	47.9	13	0	28.6	10	0	45.5	3	0	49.3	2	1	42.8	4	0
19	44.1	17	0	12.1	23	0	48.6	2	1	36.0	21	0	35.2	17	0
20	52.0	7	0	9.2	24	0	28.7	18	0	37.0	20	0	31.7	22	0
21	42.0	18	0	32.2	7	0	32.6	13	0	39.5	18	0	36.6	15	0
22	49.4	12	0	35.0	5	0	40.6	7	0	41.6	11	0	41.7	6	0
23 C1	35.1	25	0	8.7	25	0	21.1	24	0	34.5	24	0	24.9	25	0
24 C2	52.4	6	0	14.2	21	0	37.8	9	0	41.8	10	0	36.6	14	0
25(NC)	57.3	3	0	45.3	2	1	33.6	12	0	50.5	1	1	46.6	2	1
GM	**48.1**			**25.7**			**34.0**			**41.1**			**37.2**		
CD5%	8.1			5.9			5.2			5.2			2.9		
C.V.	9.6			13.2			8.7			7.4					
DOS	30.11.20			11.11.20			11.11.20			11.11.20					

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

Mean and Range for ancillary characters of IBYT-HI-(2021) entries in *rabi* 2020-21

Entry Name	Row-type	Days to heading	Days to Maturity	Plant height (cm)	1000-Grain weight (g)	Spike length (cm)
1	2	81 (68-87)	116 (107-126)	88 (78-101)	53 (49-56)	7 (6-8)
2	2	89 (82-94)	122 (115-125)	91 (79-106)	42 (41-44)	9 (8-11)
3	2	85 (74-94)	117 (108-124)	98 (85-118)	44 (41-46)	8 (7-9)
4	2	75 (64-86)	115 (105-129)	94 (80-106)	46 (43-48)	8 (7-9)
5	2	77 (65-86)	114 (105-124)	97 (86-107)	54 (50-58)	9 (8-9)
6	2	84 (73-92)	113 (87-126)	100 (89-111)	49 (48-53)	9 (8-9)
7	2	85 (72-95)	116 (106-124)	94 (76-109)	49 (43-63)	9 (8-9)
8	2	83 (68-90)	116 (108-122)	104 (90-122)	52 (49-53)	8 (8-9)
9	2	76 (60-86)	115 (107-126)	105 (86-116)	54 (43-58)	10 (8-11)
10	2	78 (61-88)	115 (97-124)	94 (81-108)	47 (44-50)	8 (8-10)
11	2	81 (71-86)	115 (107-122)	95 (86-99)	52 (49-55)	9 (8-10)
12	2	82 (70-90)	112 (90-122)	101 (90-113)	51 (50-54)	9 (8-11)
13	6	82 (71-90)	117 (106-124)	97 (86-109)	45 (41-48)	7 (7-8)
14	6	86 (73-95)	117 (110-127)	106 (93-125)	37 (36-39)	9 (8-9)
15	6	81 (71-91)	117 (111-122)	92 (82-107)	38 (35-43)	8 (6-10)
16	6	89 (80-95)	120 (113-126)	105 (95-115)	37 (32-42)	8 (7-8)
17	6	83 (74-90)	116 (109-126)	95 (84-105)	36 (31-41)	9 (9-9)
18	6	79 (71-86)	115 (106-122)	105 (86-123)	45 (39-49)	8 (7-9)
19	6	87 (75-95)	119 (109-127)	102 (95-119)	38 (33-46)	8 (7-9)
20	6	87 (75-93)	112 (85-127)	102 (89-113)	37 (33-43)	9 (8-9)
21	6	84 (74-91)	118 (108-126)	93 (83-103)	38 (34-44)	9 (7-10)
22	6	87 (79-95)	120 (111-128)	98 (85-115)	37 (34-42)	9 (8-10)
23	6	91 (85-97)	120 (113-127)	98 (84-119)	41 (37-46)	5 (5-6)
24	6	86 (74-92)	111 (83-124)	96 (80-110)	36 (28-43)	7 (7-8)
25 NC)	6	78 (64-86)	114 (103-122)	80 (70-91)	48 (46-51)	7 (6-8)

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

8th Global Spring Barley Yield Trail-2021 (8th GSBYT-2021)

The GSBYT comprised of twenty-five entries including local check variety Lakhan and was evaluated at two locations (Varanasi and Kanpur) in NEPZ and one location each in NWPZ (Karnal) and NHZ (Bajaura) under low input production conditions. Data from Varanasi centre were not included for pooled national means analysis due to high HCV observed at this centre for grain yield. Pooled analysis indicated that three test entries, IBT-HI-2021-Nos. 16, 3 and 13 with national ranks 1, 2 and 3 respectively were significantly superior over the check variety DWRB137 for grain yield.

Grain yield, ranking and grouping of 8th GSBYT-(2021) entries in rabi 2020-2021 season

Entries	Varanasi*			Kanpur			Karnal			Bajaura			National Means		
	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G	GY (q/ha)	Rk	G
1	24.4	13	0	42.7	2	1	42.1	3	1	18.2	22	0	34.3	5	1
2	33.3	8	1	25.2	20	0	45.5	1	1	22.1	17	0	30.9	14	0
3	28.9	11	0	30.0	16	0	44.2	2	1	36.8	1	1	37.0	2	1
4	42.2	2	1	25.3	19	0	34.2	16	0	23.9	12	0	27.8	19	0
5	31.1	9	1	30.5	14	0	36.4	12	0	10.0	25	0	25.6	23	0
6	13.3	24	0	37.9	9	1	36.9	10	0	23.1	16	0	32.6	10	0
7	13.3	24	0	23.3	21	0	34.0	19	0	24.4	11	0	27.2	20	0
8	17.8	17	0	36.7	11	1	32.5	23	0	26.6	6	1	31.9	11	0
9	15.6	21	0	42.9	1	1	36.3	13	0	21.4	19	0	33.5	7	1
10	37.8	5	1	30.3	15	0	38.3	8	0	31.4	4	1	33.4	8	1
11	31.1	10	1	41.3	3	1	36.8	11	0	25.4	8	0	34.5	4	1
12	40.0	4	1	18.5	24	0	40.2	6	0	19.6	21	0	26.1	22	0
13	37.8	5	1	38.6	7	1	37.1	9	0	33.6	3	1	36.4	3	1
14	48.9	1	1	38.6	7	1	40.6	5	0	21.6	18	0	33.6	6	1
15	17.8	17	0	22.8	22	0	34.8	14	0	16.4	24	0	24.7	24	0
16	33.3	7	1	37.3	10	1	38.7	7	0	36.0	2	1	37.3	1	1
17	17.8	17	0	25.4	18	0	33.6	21	0	27.9	5	1	29.0	17	0
18	28.9	11	0	32.1	12	0	33.1	22	0	24.8	9	0	30.0	16	0
19	22.2	14	0	25.9	17	0	34.2	17	0	26.3	7	1	28.8	18	0
20	20.0	16	0	17.3	25	0	28.8	25	0	23.4	14	0	23.2	25	0
21	15.6	21	0	41.3	4	1	34.0	18	0	23.8	13	0	33.1	9	1
22	22.2	14	0	21.4	23	0	34.3	15	0	24.5	10	0	26.7	21	0
23C1	17.8	17	0	41.2	5	1	32.4	24	0	19.7	20	0	31.1	13	0
24 C2	15.6	21	0	38.7	6	1	33.7	20	0	23.3	15	0	31.9	12	0
25(NC)	42.2	2	1	31.4	13	0	41.6	4	1	18.1	23	0	30.4	15	0
G.M.	26.8			31.9			36.6			24.1			30.8		
C.D.	16.0			8.1			5.2			9.7			4.4		
C.V.	34.9			14.6			8.3			23.5					
DOS	11.11.2020			11.11.2020			11.11.2020			11.11.2020					

**Centre was not included in the national pooled analysis for HCV, NC= Lakhan C1= Rihane-03, C2= Furat-03*

Mean and range (in parenthesis) for ancillary characters of 8th GSBYT-21 entries in rabi 2020-21

Entry	Row Type	Days to heading	Days to maturity	Plant height (cm)	1000-grain weight (g)	Spike length (cm)
1	6	90 (73-112)	126 (111-158)	84 (62-102)	40 (37-44)	8 (7-9)
2	6	87 (71-111)	124 (108-157)	84 (57-108)	42 (34-50)	8 (7-9)
3	6	90 (75-113)	126 (112-157)	80 (61-100)	37 (35-39)	9 (8-9)
4	6	93 (77-118)	128 (110-164)	74 (52-99)	37 (33-40)	8 (7-9)
5	6	91 (73-115)	128 (113-159)	69 (56-103)	31 (27-35)	6 (5-9)
6	6	99 (92-112)	133 (120-165)	74 (52-104)	42 (42-43)	7 (7-9)
7	6	92 (73-117)	129 (112-162)	74 (50-99)	40 (37-45)	9 (7-11)
8	6	94 (80-115)	128 (112-159)	72 (53-101)	42 (33-50)	7 (5-9)
9	2	98 (79-124)	131 (115-164)	72 (50-109)	45 (44-46)	7 (6-9)
10	2	92 (81-111)	127 (110-160)	78 (61-104)	41 (33-44)	10 (8-11)
11	2	93 (79-114)	127 (109-158)	73 (49-94)	43 (38-45)	7 (4-9)
12	2	92 (74-117)	127 (110-162)	81 (59-103)	46 (41-54)	10 (8-11)
13	2	89 (71-112)	125 (109-156)	87 (74-105)	36 (34-39)	9 (7-10)
14	2	92 (80-116)	126 (108-160)	78 (66-108)	43 (40-47)	8 (7-9)
15	2	97 (81-121)	130 (116-157)	80 (65-100)	36 (35-37)	8 (6-9)
16	2	92 (73-116)	126 (110-160)	84 (73-100)	43 (38-49)	7 (6-8)
17	2	85 (69-111)	123 (108-162)	76 (59-92)	43 (37-46)	8 (7-10)
18	6	89 (73-111)	127 (112-160)	76 (59-96)	37 (32-43)	8 (6-9)
19	6	88 (70-112)	125 (109-159)	80 (66-101)	35 (31-39)	7 (7-7)
20	6	93 (73-117)	129 (112-162)	80 (59-98)	32 (28-34)	9 (7-10)
21	6	92 (78-118)	128 (111-162)	76 (60-92)	34 (31-35)	8 (7-10)
22	6	91 (77-113)	128 (112-162)	77 (61-99)	37 (36-37)	8 (7-10)
23 C1	6	101 (93-120)	133 (120-162)	73 (51-100)	41 (38-46)	8 (7-9)
24 C2	2	92 (76-116)	125 (108-158)	80 (57-99)	42 (39-44)	10 (8-12)
25(NC)	6	87 (71-112)	124 (110-157)	78 (56-96)	41 (34-47)	8 (6-9)

NC= Lakhan NC= Lakhan C1= Rihane-03, C2= Furat-03

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

The IBON-HI comprising of 112 entries and four checks (3 ICARDA checks and one Indian check, DWRB137) each repeated seven times, was conducted at four locations namely, Durgapura, Pantnagar, Hisar, Karnal in *rabi* 2020-2021. The range and means for ancillary characters and grain yields was worked out as kg/ha from plot yield across the test locations. Grain yield in the check variety DWRB137 ranged from 1522 kg to 7222 kg/ha with a mean of 5039 kg/ha. No test entry gave higher yield over this check variety. Among the test entries highest grain yields were recorded in IBON-HI-32 (4902 Kg/ha) followed by IBON-HI-91, IBON-HI-15, IBON-HI-116 and IBON-HI-115.

Mean and range (in parenthesis) for ancillary characters of IBON-HI-(2021) entries in *rabi* 2010-21

Entries	Row Type	Days to heading	Plant height (cm)	Days to maturity	1000-gw (g)	Spike length (cm)	Grain yield (Kg/ha)
1	2	76 (65-83)	88 (77-106)	113 (100-124)	46 (39-51)	8 (7-10)	3546 (2348-4333)
2	2	79 (63-86)	93 (76-116)	114 (103-124)	38 (33-40)	8 (6-10)	3182 (2261-4267)
3	2	86 (78-93)	103 (92-118)	116 (107-120)	43 (41-46)	10 (9-11)	4041 (3667-4650)
4	2	87 (76-94)	93 (88-100)	119 (109-131)	49 (47-51)	9 (8-9)	3674 (2488-4208)
5	2	80 (66-91)	102 (86-115)	121 (104-144)	54 (47-58)	8 (7-9)	3962 (2783-4933)
6	2	86 (75-95)	102 (93-115)	117 (106-130)	48 (46-51)	8 (8-9)	3883 (3617-4333)
7	2	81 (68-93)	101 (85-117)	116 (106-128)	53 (45-60)	9 (7-10)	4085 (3609-4708)
8	2	84 (75-93)	100 (92-116)	116 (109-119)	50 (43-54)	9 (8-11)	3126 (1667-3983)
9	2	79 (68-86)	97 (80-118)	114 (108-118)	50 (37-58)	8 (7-10)	4141 (3217-4767)
10	2	97 (93-102)	92 (75-100)	127 (120-131)	49 (43-55)	10 (9-11)	2623 (2087-3000)
11	2	86 (77-100)	100 (87-115)	116 (108-126)	50 (48-52)	9 (7-11)	3382 (3025-3778)
12	2	78 (63-86)	88 (84-93)	114 (102-122)	39 (36-42)	9 (7-10)	3798 (2261-4667)
13	2	82 (72-90)	93 (78-103)	116 (106-122)	53 (44-59)	8 (6-10)	4027 (3422-4333)
14	2	81 (71-91)	101 (86-119)	117 (107-124)	48 (43-55)	9 (7-11)	3826 (2087-4708)
15	2	78 (68-84)	99 (82-112)	113 (105-118)	55 (46-63)	9 (9-10)	4736 (3565-7044)
16	2	84 (77-91)	89 (75-103)	116 (108-125)	47 (40-62)	8 (6-10)	4669 (2957-7511)
17	2	76 (60-84)	99 (86-114)	115 (108-122)	42 (37-46)	8 (6-10)	4217 (3489-5642)
18	2	85 (77-94)	88 (75-101)	115 (107-123)	42 (35-47)	9 (7-10)	3369 (2733-4000)
19	2	79 (71-86)	102 (87-122)	113 (102-119)	52 (44-55)	9 (7-10)	4660 (4130-5178)
20	2	76 (66-85)	91 (80-102)	113 (108-119)	38 (32-44)	9 (7-10)	3067 (2378-4000)
21	2	80 (69-87)	97 (83-103)	114 (105-120)	48 (40-53)	9 (7-11)	3471 (2609-4000)
22	2	79 (71-86)	100 (85-121)	112 (101-119)	51 (41-56)	9 (7-10)	4471 (3333-5617)
23	2	87 (77-95)	86 (76-94)	115 (109-122)	41 (32-46)	8 (7-10)	2876 (933-4108)
24	2	83 (74-93)	96 (83-111)	115 (107-122)	48 (41-51)	8 (7-10)	3994 (2783-5483)
25	2	82 (72-92)	92 (74-100)	115 (103-127)	50 (40-55)	8 (6-10)	3527 (1478-4667)
26	2	84 (71-94)	102 (87-116)	115 (105-124)	46 (42-50)	8 (6-10)	3972 (3043-5200)
27	2	80 (69-86)	92 (76-113)	115 (105-119)	53 (50-58)	8 (8-9)	3059 (2555-3625)
28	2	81 (72-91)	97 (76-112)	116 (106-124)	47 (40-53)	8 (7-10)	3948 (3304-4467)
29	2	82 (71-93)	100 (87-122)	114 (104-124)	45 (36-53)	9 (9-11)	4198 (3217-4667)
30	2	82 (68-91)	96 (78-112)	115 (107-124)	45 (38-47)	9 (8-10)	3863 (1978-5333)
31	2	82 (72-90)	101 (92-111)	115 (105-122)	54 (53-56)	8 (7-10)	3587 (2022-4600)
32	2	88 (79-94)	92 (75-113)	118 (110-127)	49 (44-50)	9 (6-11)	4902 (3565-6066)

Entries	Row Type	Days to heading	Plant height (cm)	Days to maturity	1000-gw (g)	Spike length (cm)	Grain yield (Kg/ha)
33	2	81 (75-86)	96 (82-105)	116 (109-122)	49 (45-51)	9 (8-12)	3541 (2955-4333)
34	2	78 (69-86)	98 (85-113)	116 (110-120)	48 (39-54)	9 (8-10)	4074 (3289-4675)
35	2	81 (71-91)	98 (84-110)	115 (108-122)	45 (37-48)	8 (6-9)	4049 (2911-4675)
36	2	80 (69-86)	98 (87-120)	113 (104-122)	50 (43-53)	8 (7-9)	4418 (3043-5667)
37	2	86 (77-95)	98 (84-107)	119 (109-128)	41 (35-46)	9 (7-10)	3619 (2578-4667)
38	2	82 (69-91)	92 (87-97)	118 (107-130)	39 (35-43)	8 (7-9)	2978 (1844-4667)
39	2	79 (69-86)	101 (89-114)	114 (107-119)	50 (39-54)	9 (8-9)	3165 (2767-3739)
40	2	77 (64-84)	101 (88-122)	114 (100-122)	49 (41-55)	26 (8-76)	3994 (2956-4917)
41	2	79 (66-86)	105 (96-118)	114 (103-124)	56 (54-57)	8 (7-9)	3921 (3333-4311)
42	2	79 (68-83)	100 (96-102)	112 (104-117)	49 (40-53)	8 (7-9)	3681 (3087-4667)
43	2	81 (72-90)	95 (80-102)	116 (108-122)	52 (44-55)	9 (7-10)	3929 (2870-4622)
44	2	88 (79-95)	100 (87-116)	119 (113-124)	47 (38-57)	9 (7-11)	4406 (3800-5667)
45	2	80 (71-86)	101 (90-118)	114 (104-119)	52 (41-57)	9 (8-10)	3878 (3130-4333)
46	2	78 (69-86)	93 (87-109)	115 (106-122)	50 (47-53)	8 (6-9)	3780 (2261-4333)
47	2	80 (72-86)	97 (88-110)	116 (109-119)	50 (41-53)	9 (8-10)	4312 (4044-4522)
48	2	84 (74-93)	94 (89-97)	118 (105-131)	51 (41-60)	9 (8-10)	2601 (2522-4333)
49	2	88 (81-95)	103 (91-121)	119 (110-130)	47 (47-49)	10 (7-12)	3328 (3000-3933)
50	2	85 (75-93)	99 (94-104)	118 (109-124)	51 (46-55)	8 (7-9)	4038 (2733-4925)
51	2	83 (75-93)	95 (85-105)	117 (107-126)	48 (44-54)	9 (7-9)	4423 (4000-5158)
52	2	80 (72-86)	96 (88-103)	117 (108-124)	55 (53-57)	9 (9-10)	4375 (3565-5667)
53	2	81 (70-86)	94 (70-120)	115 (109-119)	50 (43-55)	9 (7-10)	3813 (3244-4333)
54	2	76 (66-83)	92 (72-112)	113 (104-122)	49 (43-52)	8 (7-9)	4181 (3217-5667)
55	2	79 (67-84)	98 (86-117)	114 (108-119)	53 (47-57)	9 (8-10)	3714 (3130-4792)
56	2	81 (68-91)	97 (86-112)	123 (107-145)	55 (51-62)	8 (7-10)	3960 (2667-5333)
57	2	82 (68-90)	101 (87-111)	113 (108-119)	54 (48-59)	9 (8-9)	4203 (3391-4711)
58	2	79 (67-86)	100 (87-117)	115 (107-119)	51 (40-58)	8 (4-10)	3387 (2200-4667)
59	6	82 (71-91)	95 (72-112)	117 (106-121)	44 (40-50)	9 (7-10)	4596 (3356-5392)
60	6	91 (81-100)	91 (82-100)	120 (112-128)	42 (40-44)	9 (5-11)	3364 (3222-3508)
61	6	82 (72-93)	101 (88-118)	115 (101-124)	36 (31-43)	8 (5-9)	3478 (3000-3967)
62	6	87 (80-94)	87 (77-91)	120 (113-126)	43 (37-47)	7 (6-7)	4545 (2783-6066)
63	6	81 (71-86)	93 (84-98)	115 (108-117)	37 (31-44)	8 (6-10)	4183 (2556-6000)
64	6	77 (69-83)	99 (96-107)	113 (105-118)	47 (42-53)	8 (6-9)	4190 (3217-5008)
65	6	86 (78-93)	100 (90-114)	118 (111-124)	42 (36-46)	8 (5-9)	3812 (3000-4522)
66	6	87 (78-94)	95 (82-105)	122 (119-129)	40 (37-42)	8 (7-11)	2929 (2929-4711)
67	6	93 (87-102)	92 (78-104)	123 (114-132)	37 (35-39)	8 (7-9)	2802 (2022-3317)
68	6	81 (73-86)	103 (86-125)	116 (107-124)	41 (36-46)	8 (7-10)	4094 (3391-5667)
69	6	80 (71-86)	94 (90-99)	115 (106-122)	36 (34-40)	8 (7-8)	3929 (2609-5667)
70	6	93 (87-100)	86 (74-93)	121 (113-126)	38 (32-43)	7 (5-9)	2902 (2435-3667)
71	6	80 (68-90)	92 (76-108)	113 (99-122)	42 (38-45)	7 (6-8)	3686 (2087-5325)
72	6	78 (71-83)	99 (88-117)	115 (106-124)	40 (34-43)	8 (7-9)	4376 (3767-5244)
73	6	87 (80-93)	105 (96-119)	118 (109-122)	39 (35-42)	8 (8-9)	3235 (3017-3478)
74	6	75 (63-83)	99 (88-115)	115 (101-127)	42 (40-45)	9 (7-10)	4222 (3043-5667)
75	6	85 (75-91)	98 (77-118)	116 (106-124)	35 (27-43)	9 (7-11)	3686 (1978-5000)
76	6	86 (77-98)	98 (86-113)	118 (108-123)	39 (36-43)	8 (5-10)	4010 (3511-4667)
77	6	87 (79-98)	99 (85-108)	118 (110-127)	42 (37-46)	8 (6-10)	3983 (3250-5391)

Entries	Row Type	Days to heading	Plant height (cm)	Days to maturity	1000-gw (g)	Spike length (cm)	Grain yield (Kg/ha)
78	6	79 (68-86)	103 (94-111)	113 (103-119)	36 (33-38)	8 (6-10)	4310 (1978-5652)
79	6	87 (77-93)	94 (78-114)	117 (110-124)	39 (37-41)	9 (8-10)	2889 (1756-3425)
80	6	83 (74-91)	102 (93-114)	118 (109-127)	42 (39-49)	7 (7-8)	4482 (2817-5866)
81	6	85 (73-95)	93 (86-98)	116 (103-127)	37 (34-39)	8 (7-10)	3915 (2089-5667)
82	6	89 (79-97)	91 (83-96)	120 (113-128)	42 (38-47)	8 (5-10)	2574 (1200-3739)
83	6	90 (82-100)	96 (84-106)	122 (113-127)	43 (39-46)	8 (5-10)	3107 (1600-4000)
84	6	80 (68-86)	102 (92-118)	114 (106-124)	39 (36-43)	8 (7-9)	4422 (2870-5042)
85	6	80 (73-86)	95 (80-114)	114 (105-122)	39 (37-42)	8 (6-10)	3502 (2644-4467)
86	6	85 (78-94)	90 (80-107)	119 (111-128)	42 (41-44)	8 (5-11)	4117 (3304-4875)
87	6	87 (79-96)	87 (78-95)	119 (112-129)	41 (38-46)	6 (5-7)	4332 (2870-5177)
88	6	82 (71-91)	99 (87-114)	118 (109-129)	33 (22-41)	7 (6-8)	4555 (3555-5667)
89	6	84 (75-92)	92 (72-109)	116 (109-122)	38 (38-40)	8 (6-9)	3723 (2778-4667)
90	6	80 (69-90)	98 (83-112)	115 (106-124)	37 (32-40)	7 (6-8)	3603 (2067-4333)
91	6	79 (69-86)	92 (77-100)	114 (103-122)	38 (34-40)	8 (7-9)	4861 (4333-5422)
92	6	83 (73-90)	103 (99-115)	120 (111-129)	38 (36-41)	9 (7-10)	3575 (2261-4667)
93	6	87 (74-95)	104 (97-114)	121 (110-127)	38 (32-42)	8 (6-9)	3415 (2017-4333)
94	6	86 (76-94)	94 (81-106)	118 (111-124)	39 (32-45)	8 (7-8)	4422 (2644-6000)
95	6	86 (77-95)	96 (83-100)	120 (114-129)	38 (31-44)	7 (6-9)	2719 (2022-3667)
96	6	84 (72-91)	97 (86-113)	119 (107-130)	42 (34-60)	8 (6-9)	4158 (2667-5300)
97	6	81 (73-85)	101 (85-121)	118 (109-124)	45 (40-47)	9 (8-10)	4660 (3333-5511)
98	6	81 (70-90)	92 (81-106)	115 (105-124)	31 (27-34)	7 (6-9)	3051 (2183-3555)
99	6	84 (75-91)	101 (87-126)	115 (104-124)	35 (27-41)	9 (6-10)	2732 (1565-3783)
100	6	87 (77-97)	100 (88-117)	119 (110-128)	38 (35-42)	8 (7-9)	3026 (2244-4000)
101	6	86 (78-92)	109 (88-130)	116 (110-122)	41 (38-43)	8 (6-10)	2680 (1022-4333)
102	6	84 (75-91)	100 (95-106)	115 (109-121)	34 (28-40)	9 (7-10)	3829 (2267-5000)
103	6	84 (71-93)	100 (88-125)	114 (102-120)	37 (35-39)	9 (6-10)	3138 (1422-4158)
104	6	82 (76-86)	103 (98-114)	116 (110-122)	38 (33-44)	7 (6-9)	3682 (2578-4667)
105	6	86 (77-94)	92 (88-96)	120 (113-125)	39 (37-43)	8 (6-9)	3366 (2467-4333)
106	6	84 (78-91)	105 (91-126)	117 (109-124)	38 (34-42)	8 (5-11)	4201 (2667-5333)
107	6	85 (77-93)	103 (88-119)	118 (106-124)	45 (42-49)	9 (6-10)	3592 (3225-4244)
108	6	87 (75-95)	103 (90-114)	118 (107-124)	43 (38-46)	7 (5-9)	3148 (1578-4333)
109	6	84 (71-94)	102 (89-120)	115 (102-124)	43 (40-50)	9 (8-9)	3925 (3217-4667)
110	6	88 (75-95)	97 (89-104)	118 (108-126)	34 (31-37)	8 (5-10)	3531 (1844-4667)
111	6	86 (64-100)	93 (87-98)	120 (114-130)	41 (39-45)	8 (6-10)	3481 (2850-3844)
112	6	79 (67-90)	104 (85-121)	114 (104-120)	42 (40-45)	8 (6-10)	4696 (1955-6333)
113 C3	3	88 (77-97)	103 (92-123)	117 (108-131)	44 (34-51)	10 (7-12)	3808 (2108-5000)
114 C1	6	92 (84-102)	100 (81-117)	122 (112-131)	42 (33-49)	6 (4-9)	3513 (2000-5217)
115 C2	6	85 (72-97)	96 (77-112)	116 (103-127)	38 (30-49)	8(5-9)	3948 (2261-6333)
116 NC	**6**	**77 (64-91)**	**84.8 (61-102)**	**114 (100-129)**	**47 (35-65)**	**8(5-9**	**5039 (1522-7222)**

@ Mean and ranges across the blocks for checks NC= DWRB137, C1= VMorales, C2= ICARAAFAT-1 and C3 = Rehane-03

8th Global Spring Barley Observation Nursery-2021 (8th GSBON-2021)

The nursery GSBON consisted of 116 entries including four checks (3-ICARDA checks and one Indian check, Lakhan). Each check was repeated seven times. This nursery was evaluated at Kanpur, Varanasi, Bajaura and Karnal locations during the season 2020-21.

The range and means for ancillary characters and grain yields (worked out as kg/ha from plot yields) across the test locations is tabulated below. Grain yield of check variety Lakhan ranged from 500 to 7456 kg /ha with a mean of 3306 kg/ha across the test locations. Thirty-one test entries gave higher yields over the check variety Lakhan. Grain yield of these entries (8th GSBON-21-Nos. (88, 48, 16, 57, 30, 94, 17, 32, 58, 19, 12, 64, 63, 82, 54, 113, 115, 38, 70, 56, 60, 113, 74, 55, 4, 52, 3, 23, 67, 11 and 78) ranged from 3315 to 4548 kg/ha.

Mean and range (in parenthesis) for ancillary traits of 8th GSBON-(21) entries

Entries	Row Type	Days to heading	Plant height (cm)	Days to maturity	1000-gw (g)	Spike length (cm)	Grain yield (Kg/ha)
1	2	96 (81-116)	84 (62-108)	130 (113-159)	45 (42-47)	9 (5-12)	3145 (1000-5789)
2	6	92 (78-113)	79 (54-90)	127 (114-162)	37 (35-40)	7 (5-8)	3210 (1000-4444)
3	2	90 (78-111)	73 (49-90)	126 (113-156)	40 (34-47)	8 (5-11)	3381 (667-5000)
4	6	89 (71-112)	83 (56-100)	125 (110-156)	35 (35-36)	8 (6-10)	3408 (667-5089)
5	2	94 (77-115)	76 (51-101)	129 (113-159)	38 (36-39)	8 (6-11)	2713 (1000-3911)
6	2	100 (92-119)	89 (58-104)	132 (113-160)	39 (39-40)	9 (5-10)	2827 (333-4300)
7	6	98 (91-112)	78 (52-100)	132 (115-161)	42 (42-43)	7 (6-8)	3303 (333-5978)
8	6	97 (86-116)	72 (48-99)	129 (116-160)	42 (39-45)	6 (5-6)	3031 (167-4778)
9	6	89 (73-113)	71 (45-96)	126 (111-157)	38 (34-42)	7 (6-7)	2558 (1000-5144)
10	6	92 (80-112)	73 (48-93)	127 (113-158)	38 (30-45)	7 (6-8)	3063 (167-6933)
11	6	87 (73-112)	78 (59-100)	124 (111-158)	47 (44-49)	7 (5-9)	3331 (1333-7233)
12	6	92 (77-114)	85 (58-108)	127 (112-158)	38 (36-39)	8 (6-10)	3655 (667-6256)
13	6	99 (91-118)	80 (67-103)	131 (113-159)	45 (39-50)	6 (5-8)	2432 (333-4944)
14	6	89 (75-112)	81 (57-100)	126 (113-158)	41 (38-44)	6 (6-7)	2727 (2773-5356)
15	6	90 (74-113)	79 (50-103)	126 (112-158)	43 (40-46)	7 (6-8)	3286 (1000-6444)
16	6	87 (71-112)	79 (51-100)	125 (108-160)	42 (38-46)	7 (6-9)	4003 (667-7778)
17	6	86 (70-111)	83 (56-97)	124 (109-156)	40 (37-44)	8 (6-10)	3737 (1000-6444)
18	6	89 (76-115)	81 (61-103)	126 (111-162)	37 (35-39)	7 (5-9)	2877 (333-5444)
19	6	87 (72-112)	76 (61-92)	125 (111-159)	41 (38-44)	7 (5-9)	3655 (1333-4811)
20	6	92 (74-116)	78 (51-100)	129 (115-163)	39 (38-40)	7 (7-8)	3109 (167-5722)
21	6	89 (73-112)	80 (61-99)	126 (111-157)	38 (33-43)	7 (5-9)	3299 (1333-5756)
22	6	94 (81-116)	81 (52-108)	130 (118-161)	37 (37-38)	8 (6-10)	2638 (833-4011)
23	6	96 (87-118)	78 (56-102)	128 (114-162)	40 (36-44)	6 (5-7)	3363 (667-6900)
24	6	93 (80-117)	70 (55-96)	129 (110-163)	37 (34-41)	8 (6-10)	2819 (500-5278)
25	6	103 (95-124)	74 (39-103)	134 (116-165)	39 (34-44)	6 (5-6)	2244 (2222-3567)
26	6	90 (78-112)	78 (58-99)	126 (113-159)	32 (30-34)	7 (5-11)	2814 (667-5378)
27	6	92 (75-113)	83 (58-96)	128 (113-160)	38 (37-39)	8 (6-10)	2931 (333-5056)
28	6	93 (80-116)	78 (52-92)	128 (112-160)	39 (37-41)	8 (6-10)	2553 (667-3956)
29	6	95 (81-117)	74 (49-84)	128 (110-162)	43 (41-45)	7 (6-9)	1956 (167-3547)
30	6	88 (73-112)	74 (57-95)	125 (112-161)	40 (34-47)	7 (6-8)	3768 (667-7033)
31	6	95 (81-112)	75 (52-99)	132 (115-158)	45 (40-49)	7 (6-9)	2034 (333-3427)
32	6	94 (81-115)	82 (57-95)	128 (112-159)	40 (39-42)	6 (6-8)	3688 (667-5556)
33	6	92 (81-113)	81 (52-102)	127 (112-159)	38 (37-39)	7 (6-8)	3129 (333-6833)
34	6	101 (91-124)	74 (49-100)	133 (116-164)	41 (37-46)	7 (5-9)	2558 (167-4389)

Entries	Row Type	Days to heading	Plant height (cm)	Days to maturity	1000-gw (g)	Spike length (cm)	Grain yield (Kg/ha)
35	6	97 (87-114)	73 (59-97)	128 (116-160)	40 (39-41)	6 (5-7)	2899 (667-5478)
36	6	100 (95-111)	77 (51-101)	133 (116-157)	38 (33-43)	7 (5-9)	2450 (333-5522)
37	6	94 (81-116)	82 (65-108)	129 (112-159)	36 (31-40)	6 (6-7)	3189 (333-7533)
38	6	91 (76-116)	88 (62-104)	126 (111-158)	40 (37-44)	7 (6-8)	3550 (667-6711)
39	6	95 (88-114)	82 (59-101)	129 (114-158)	41 (36-45)	8 (6-10)	2796 (667-4427)
40	6	96 (88-116)	79 (59-95)	129 (113-160)	37 (37-38)	6 (5-8)	2619 (333-4344)
41	6	91 (81-114)	85 (59-99)	128 (112-162)	41 (38-43)	7 (6-9)	3147 (667-4878)
42	6	97 (77-122)	78 (49-106)	137 (116-163)	48 (43-52)	7 (6-9)	2402 (167-5300)
43	6	101 (91-120)	76 (49-103)	133 (116-158)	41 (39-44)	8 (5-12)	2432 (167-4133)
44	6	95 (83-118)	78 (64-102)	126 (110-162)	35 (34-36)	7 (5-10)	2309 (1333-2889)
45	6	94 (74-123)	93 (69-108)	131 (116-165)	37 (36-38)	7 (5-8)	2616 (167-4444)
46	6	90 (77-111)	86 (74-108)	126 (113-159)	39 (37-41)	8 (6-11)	2981 (1000-6078)
47	6	100 (89-122)	76 (52-97)	130 (113-158)	41 (38-44)	7 (5-8)	1571 (167-2344)
48	6	92 (78-116)	77 (59-98)	128 (113-161)	37 (36-37)	8 (6-10)	4061 (333-8333)
49	6	96 (81-116)	74 (45-90)	132 (116-162)	40 (38-42)	6 (6-7)	2297 (167-4067)
50	6	89 (79-111)	83 (61-103)	124 (111-156)	42 (40-45)	6 (5-7)	2688 (500-5256)
51	6	89 (75-112)	79 (55-97)	127 (113-158)	45 (43-46)	7 (6-7)	3276 (833-6444)
52	6	92 (80-111)	73 (46-90)	128 (112-161)	35 (32-38)	7 (5-9)	3399 (667-5920)
53	6	91 (75-112)	74 (55-100)	126 (110-158)	32 (31-34)	6 (5-7)	2809 (500-4833)
54	6	90 (72-113)	76 (49-100)	127 (112-161)	33 (31-36)	8 (6-8)	3605 (667-6833)
55	6	94 (85-111)	78 (56-103)	128 (116-159)	43 (41-45)	6 (5-7)	3410 (1000-6022)
56	6	91 (77-113)	81 (61-100)	127 (113-158)	33 (30-35)	7 (6-8)	3472 (667-4787)
57	6	87 (71-111)	75 (54-100)	125 (110-158)	43 (39-46)	7 (5-8)	3817 (333-7278)
58	6	92 (80-116)	85 (61-106)	127 (112-161)	36 (32-39)	7 (5-10)	3658 (1333-5911)
59	6	90 (71-116)	81 (52-100)	127 (112-164)	41 (40-42)	7 (6-7)	2608 (833-3867)
60	6	91 (78-114)	79 (52-99)	127 (113-157)	37 (33-42)	7 (5-9)	3449 (1000-4767)
61	6	88 (71-112)	79 (57-97)	125 (110-162)	30 (30-30)	7 (6-9)	2278 (1000-3413)
62	2	99 (89-120)	72 (47-90)	132 (112-162)	48 (45-51)	7 (5-8)	2559 (167-4178)
63	2	92 (72-116)	84 (55-100)	130 (116-163)	47 (46-49)	7 (6-9)	3642 (333-5067)
64	2	87 (72-112)	77 (51-104)	124 (111-155)	38 (35-41)	8 (6-10)	3643 (1000-6178)
65	2	97 (88-116)	79 (58-106)	128 (112-161)	42 (37-48)	9 (6-11)	2241 (667-4111)
66	2	93 (75-121)	78 (54-100)	135 (113-162)	46 (44-48)	7 (5-9)	2295 (667-4522)
67	2	94 (77-115)	80 (50-102)	130 (114-162)	51 (51-52)	9 (8-10)	3335 (333-6833)
68	2	93 (66-123)	74 (55-100)	130 (113-164)	38 (34-42)	8 (5-11)	2588 (333-5544)
69	2	86 (70-111)	86 (66-102)	128 (109-156)	43 (41-45)	9 (7-11)	2554 (1167-3422)
70	2	86 (70-111)	78 (56-100)	123 (109-157)	43 (42-44)	8 (6-9)	3506 (667-6344)
71	2	91 (75-112)	80 (53-100)	125 (112-155)	41 (38-44)	7 (5-9)	3137 (1667-4600)
72	2	92 (81-112)	78 (50-104)	127 (113-159)	43 (43-44)	8 (6-10)	3276 (667-6667)
73	2	97 (88-117)	74 (56-96)	128 (112-161)	38 (35-41)	7 (5-8)	2642 (1000-4333)
74	2	88 (74-111)	78 (51-101)	125 (109-159)	37 (33-41)	8 (6-10)	3421 (1000-5107)
75	2	90 (77-114)	78 (63-94)	127 (113-162)	41 (41-42)	7 (5-9)	3121 (1000-5556)
76	2	92 (73-120)	83 (54-97)	128 (112-164)	43 (41-46)	9 (7-11)	3232 (167-5000)
77	2	96 (87-112)	78 (64-101)	129 (116-159)	45 (42-48)	8 (6-11)	3176 (1000-4360)
78	2	89 (71-114)	77 (55-97)	126 (110-162)	45 (42-49)	8 (6-11)	3315 (2693-6678)
79	2	92 (78-123)	80 (56-104)	126 (109-165)	39 (37-40)	8 (5-10)	3049 (1000-5333)
80	2	93 (77-116)	81 (60-102)	127 (112-161)	40 (39-42)	7 (5-9)	3274 (1000-6000)
81	2	94 (80-117)	74 (49-96)	127 (112-159)	44 (40-48)	7 (5-10)	2836 (667-5067)

Entries	Row Type	Days to heading	Plant height (cm)	Days to maturity	1000-gw (g)	Spike length (cm)	Grain yield (Kg/ha)
82	2	89 (77-113)	76 (51-104)	124 (111-156)	41 (40-43)	9 (6-11)	3608 (1000-6889)
83	2	92 (80-115)	77 (50-99)	128 (113-163)	45 (38-52)	9 (6-12)	2754 (667-5589)
84	2	91 (74-115)	81 (52-102)	128 (112-161)	44 (44-45)	9 (7-11)	2702 (500-4511)
85	2	91 (81-112)	79 (60-94)	126 (111-158)	42 (38-46)	8 (7-9)	3287 (1667-4333)
86	2	93 (81-113)	80 (54-104)	127 (111-162)	41 (41-41)	8 (7-10)	3051 (333-4422)
87	2	90 (71-113)	79 (52-95)	126 (110-161)	40 (36-43)	7 (5-10)	2984 (167-5078)
88	2	96 (86-111)	77 (49-100)	131 (116-161)	51 (45-57)	8 (6-9)	4548 (167-8333)
89	2	87 (73-112)	83 (60-102)	123 (109-157)	40 (37-44)	8 (6-11)	2932 (1000-4056)
90	2	86 (71-111)	81 (59-103)	122 (109-157)	46 (42-50)	8 (5-10)	2724 (1000-4889)
91	2	91 (75-116)	70 (47-92)	127 (113-157)	41 (39-44)	7 (6-8)	2703 (667-3889)
92	2	99 (90-121)	69 (57-90)	130 (115-163)	39 (37-41)	8 (6-10)	2449 (667-3333)
93	2	86 (69-113)	78 (58-97)	123 (109-157)	47 (42-52)	7 (7-8)	2721 (1167-5167)
94	2	87 (72-111)	86 (64-96)	125 (111-157)	48 (46-49)	8 (6-11)	3744 (1000-6933)
95	2	90 (73-112)	84 (49-100)	126 (112-159)	46 (44-49)	9 (6-12)	2582 (167-3789)
96	6	89 (76-112)	85 (60-104)	125 (111-158)	29 (28-31)	8 (6-9)	2352 (1000-3040)
97	6	91 (77-112)	77 (57-98)	116 (112-119)	40 (39-40)	7 (6-9)	2856 (667-4689)
98	6	91 (73-115)	76 (48-99)	128 (113-158)	33 (28-38)	7 (5-9)	2644 (167-4111)
99	2	91 (80-113)	71 (55-88)	126 (113-158)	36 (35-37)	7 (5-8)	3041 (1333-4411)
100	2	92 (73-116)	74 (49-93)	127 (109-163)	37 (34-40)	7 (7-9)	2674 (667-4544)
101	2	96 (81-119)	82 (61-95)	130 (112-162)	38 (36-40)	9 (5-11)	2615 (500-4367)
102	2	88 (71-112)	80 (50-108)	125 (111-155)	39 (37-42)	8 (6-9)	2639 (1000-4333)
103	6	93 (81-112)	75 (49-102)	129 (112-157)	34 (32-36)	7 (6-9)	3064 (333-4800)
104	2	99 (91-120)	80 (56-96)	131 (113-162)	39 (38-40)	9 (6-10)	2062 (333-3956)
105	2	96 (81-118)	86 (64-103)	129 (112-160)	35 (33-37)	8 (5-11)	2379 (333-3444)
106	2	93 (76-116)	91 (68-106)	127 (112-156)	42 (42-42)	10 (6-13)	2217 (1000-4467)
107	6	90 (74-116)	80 (55-102)	126 (111-159)	36 (34-37)	7 (6-7)	3233 (1333-5267)
108	6	93 (77-121)	80 (61-90)	128 (111-162)	35 (32-38)	7 (5-8)	2298 (1000-4213)
109	6	98 (91-112)	70 (48-92)	133 (116-160)	32 (32-33)	8 (5-11)	2244 (167-4533)
110	6	96 (88-113)	73 (64-94)	129 (112-165)	38 (37-39)	7 (6-8)	2371 (333-4000)
111	6	77 (68-85)	82 (54-103)	113 (109-119)	33 (32-35)	8 (6-12)	2757 (1000-3778)
112	6	92 (75-112)	82 (56-98)	129 (110-162)	36 (33-40)	8 (6-9)	2974 (500-4444)
113 C2	6	88 (71-117)	82 (52-104)	126 (109-162)	41 (35-47)	8 (5-11)	3046 (667-6733)
114 C1	6	99 (89-123)	78 (49-106)	132 (112-165)	40 (35-47)	6 (5-8)	3047 (667-6733)
115 C3	2	95 (74-123)	74 (43-100)	129 (109-165)	40 (35-47)	7 (5-10)	3057 (667-6733)
116 (NC)	**6**	**85 (70-115)**	**86 (64-108)**	**121 (110-163)**	**40 (35-47)**	**8 (5-11)**	**3057 (667-6733)**

*Mean and ranges across the blocks NC= Lakhan; C1= Rihane-03, C2= ICARAAFAT-2 and C3= Furat-03 are ICARDA-Checks

Elite International Barley Germplasm Nursery (EIBGN 2020-21)

EIBGN was constituted with 45-germplasm lines and six released varieties (BH946, BH959, BHS400, RD2715, DWRB101 and DWRB137) as checks. These 45 promising germplasm lines were selected from different international trials and nurseries based on their performance in *rabi* 2019-20 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, Ludhiana, Khudwani and Karnal centres either did not send the data or the data sent was partial. Each entry was sown in a plot of two rows each of 2.5 m length and spaced at 30 cm, except at Chatha centre where the plot size used was two rows of 2 m x 30 cm. The data for grain yield recorded in grams (g) per plot was converted into q/ha and analysed centre-wise and zone-wise and 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.

In NWPZ, highest location mean for grain yield was observed at Durgapura (34.3 q/ha) followed by Pantnagar (31.9 q/ha), Hisar (27.6 q/ha) and Chatha (16.2 q/ha) giving 27.5 q/ha as zonal mean for grain yield. Highest zonal mean for grain yield was recorded in the entry 7thGSBON-2020-123 (38.2 q/ha) followed by nine more entries in the first NSG with grain yield ranging from 31.9 to 38.2 q/ha in this group. Across the testing-locations, DWRB137 was the best zonal check. Zonal pooled analysis revealed that no test entry outperformed this check. However, six entries namely, 7thGSBON-2020-123, IBON-HI-2020-155, IBON-HI-2020-48, IBYT-HI-2020-6, IBON-HI-2020-51 and 7thGSBON-2020-90 registered grain yields comparable to this check.

In NEPZ, highest location mean for grain yield was observed at Kanpur (22.0 q/ha) followed by Varanasi (19.8 q/ha) and Ayodhya (15.3 q/ha) with 19.1 q/ha as zonal mean. DWRB101 was the best check at Kanpur and BHS400 was the best check at Varanasi and Ayodhya locations. BHS400 was also adjudged to be the best zonal check. Two test entries IBON-HI-2020-6 and 7thGSBON-2020-90 recorded numerically higher yields (37.9 and 33.8 q/ha, respectively) over the best zonal check.

In North Hill Zone highest location mean for grain yield was observed at Khudwani (44.6 q/ha) followed by Bajaura (24.6 q/ha) and Shimla (18.9 q/ha) with 29.4 q/ha as zonal mean. DWRB101 was the best check at Shimla and BHS400 was the best check at Bajaura and Khudwani locations. BHS400 was also the best zonal check with 34.6 q/ha mean grain yield. . In five test entries namely, IBON-HI-2020-15, 7thGSBON-2020-18, IBON-HI-2020-55, IBYT-HI-2020-6 and IBON-HI-2020-51 numerically higher grain yields (35.0 to 38.7 q/ha) over the best zonal check were recorded.

Across the zones three test entries namely, IBYT-HI-2020-6 and IBON-HI-2020-51 (NWPZ and NHZ) and 7thGSBON-2020-90 (NWPZ and NEPZ) have recorded higher zonal means for grain yield over the respective best zonal check in more one zone.

Parentage of EIBGN (2020-21) entries

SN	Entry	**Trait**	**Parentage**
1.	IBYT-HI-2020-6	GY	BLLU//LEGACY/CHAMICO
2.	IBYT-HI-2020-13	GY	BLLU/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
3.	IBYT-HI-2020-11	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/TOCTE
4.	7thGSBYT-2020-2	GY	Cerise/Shyri//Aleli/3/Mpyt169.1Y/Laurel//Olmo/4/Canela/5/MADRE SELVA
5.	7thGSBYT-2020-7	GY	ChiCm/An57//Albert/3/Alger/Ceres.362-1-1/4/Arta/5/Mzq/Gva//PI002917/3/WI2291/WI2269 /4/WI3213
6.	7thGSBYT-2020-10	GY	ChiCm/An57//Albert/3/Alger/Ceres362-1-1/4/Arta/5/Nawair 1
7.	7thGSBYT-2020-11	GY	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/MADRE SELVA
8.	7thGSBYT-2020-14	GY	Gloria'S'/Copal'S'//As46/Aths/3/Rhn-03/4/Lignee527/Aths//Lignee527/NK1272
9.	7thGSBYT-2020-15	GY	Hma-02//11012-2/CM67/3/Alanda/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Lignee527/Aths//Lignee527/NK1272
10.	7thGSBYT-2020-20	N	ALISO/CI3909-2//FALCON-BAR/3/HIGO/4/Alanda-01//Gerbel/Harma/3/Gloria'S'/Celo'S'//Teran78
11.	IBON-HI-2020-55	GY	Xena/CANELA/DEFRA
12.	IBON-HI-2020-25	GY	BLLU/3/BREA/DL70//3*CABUYA
13.	IBON-HI-2020-31	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
14.	IBON-HI-2020-28	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/TOCTE
15.	IBON-HI-2020-12	GY	MERIT,B/CANELA/3/MSEL//LM 844/QUILMES PAMPA
16.	IBON-HI-2020-10	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CHAMICO/TOCTE//CONGONA
17.	IBON-HI-2020-48	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
18.	IBON-HI-2020-94	GY	PENCO/CHEVRON-BAR/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
19.	IBON-HI-2020-155	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY
20.	IBON-HI-2020-51	GY	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
21.	IBON-HI-2020-50	GY	CIRU/BGCLM 157.MBV
22.	IBON-HI-2020-6	GY	LBIRAN/UNA80//LIGNEE640/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1
23.	IBON-HI-2020-3	GY	MN BRITE/LEGACY//DOÑA JOSEFA
24.	IBON-HI-2020-15	GY	CANELA/B081J
25.	IBON-HI-2020-71	GY	CANELA/DIAMALT
26.	7thGSBYT-2020-22	N	ALISO/CI3909-2//FALCON-BAR/3/HIGO/4/Petunia1
27.	7thGSBON-2020-123	N	Rhn-03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Aths/Lignee686 /4/Avt/Attiki//Aths/3/Giza121/Pue
28.	7thGSBON-2020-129	N	Rihane-03/3/Alanda/Hamra//Alanda-01
29.	7thGSBON-2020-140	N	Carbo/Hamra/4/Rhn-08/3/DeirAlla106//DL71/Strain205/5/ICB_116132
30.	7thGSBON-2020-150	N	Keel/MADRE SELVA
31.	IBON-HI-2020-104	GY	CANELA//LIMON/BICHY2000
32.	7thGSBON-2020-92	GY	Gloria'S'/Copal'S'//As46/Aths/3/Rhn-03/4/Lignee527/Aths//Lignee527/NK1272
33.	7thGSBON-2020-88	GY	Rhn-03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Lignee527/Aths //Lignee527/NK1272
34.	7thGSBON-2020-103	GY	M126/CM67//As/Pro/3/Alanda/4/Ssn/Bda//Arar/3/F2CC33MS/CI07555/5/Lignee640/Lignee527//Lignee527/Rihane/6/Avt/Attiki//M-Att-73-337-1/3/Aths/Lignee686/5/AwBlack/Aths//Arar/3/9Cr279-07/Roho/4/DD-14/Rhn-03
35.	7thGSBON-2020-101	GY	Gloria'S'/Copal'S'//As46/Aths/3/Rhn-03/4/AwBlack/Aths//Rhn-08/3/Malouh
36.	7thGSBON-2020-90	GY	Rihane-03//Lignee527/Aths/6/QB813-2/5/Aths/Lignee686/4/Rhn-03/3/Bc/Rhn//Ky63-1294

37.	7thGSBON-2020-18	GY	CAPUL/CABUYA//ICB_116134
38.	7thGSBON-2020-20	GY	Rihane-03/3/As46/Aths*2//Aths/Lignee686/4/Momtaz
39.	7thGSBON-2020-99	GY	Arda/Moroc9-75//MADRE SELVA
40.	IBON-HI-2020-75	TGW	CANELA/B081J
41.	IBON-HI-2020-85	TGW	CANELA/FNC1
42.	IBON-HI-2020-97	TGW	CANELA/5/GOB/HUMAI10/3/MPYT169.1Y/LAUREL//OLMO/4/CANELA
43.	IBON-HI-2020-101	TGW	CANELA//LIMON/BICHY2000
44.	IBON-HI-2020-108	TGW	CANELA//LIMON/BICHY2000
45.	IBON-HI-2020-140	TGW	B081J/SLOOP
46.	BH 946	Check	
47.	BH 959	Check	
48.	BHS 400	Check	
49.	RD 2715	Check	
50.	DWRB 101	Check	
51.	DWRB137	Check	
52.	BH 946	Check	

GY= grain yield; TGW = high 1000-grain weight, N= Huskless

Grain yield, ranking and grouping of barley genotypes evaluated under EIBGN-2020 at different locations of NWPZ in *rabi* 2020-2021 season

Entries	Chatha			Durgapura			Hisar			Pantnagar			NWPZ		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBYT-HI-2020-6	19.2	13	1	70.6	1	1	29.3	16	0	26.1	37	0	36.3	4	1
IBYT-HI-2020-13	21.9	9	1	37.2	19	0	21.3	40	0	29.9	29	0	27.6	23	0
IBYT-HI-2020-11	22.4	8	1	40.6	14	0	28.0	17	0	26.8	35	0	29.4	18	0
7thGSBYT-2020-2	9.4	41	0	47.2	7	0	35.3	5	0	28.1	32	0	30.0	16	0
7thGSBYT-2020-7	9.0	43	0	50.6	4	0	24.7	28	0	21.6	41	0	26.5	28	0
7thGSBYT-2020-10	10.1	39	0	27.2	30	0	24.0	31	0	22.5	38	0	21.0	41	0
7thGSBYT-2020-11	11.1	37	0	23.9	35	0	24.7	28	0	29.1	30	0	22.2	38	0
7thGSBYT-2020-14	11.2	36	0	33.9	23	0	22.0	37	0	22.3	40	0	22.3	36	0
7thGSBYT-2020-15	12.7	33	0	47.2	7	0	31.3	10	0	20.8	42	0	28.0	21	0
7thGSBYT-2020-20	13.5	30	0	44.4	11	0	33.1	7	0	19.8	43	0	27.7	22	0
IBON-HI-2020-55	9.1	42	0	14.4	43	0	25.8	24	0	19.8	43	0	17.3	44	0
IBON-HI-2020-25	8.5	44	0	44.4	11	0	31.1	12	0	30.1	28	0	28.5	20	0
IBON-HI-2020-31	19.8	12	1	37.8	17	0	23.8	34	0	42.2	7	0	30.9	12	0
IBON-HI-2020-28	13.5	30	0	17.8	41	0	21.1	41	0	32.4	20	0	21.2	40	0
IBON-HI-2020-12	18.1	16	1	37.8	17	0	27.1	21	0	34.9	15	0	29.5	17	0
IBON-HI-2020-10	15.6	25	1	51.1	3	0	24.4	30	0	44.6	3	1	34.0	7	1
IBON-HI-2020-48	24.3	4	1	47.8	6	0	31.1	12	0	43.7	5	1	36.7	3	1
IBON-HI-2020-94	23.0	6	1	44.4	11	0	21.8	39	0	41.0	8	0	32.6	9	1
IBON-HI-2020-155	25.1	1	1	33.3	24	0	48.3	1	1	41.0	9	0	36.9	2	1

Entries	Chatha			Durgapura			Hisar			Pantnagar			NWPZ		
	GY	**Rk**	**G**	**GY**	**Rk**	**G**	**GY**	**Rk**	**G**	**GY**	**Rk**	**G**	**GY**	**Rk**	**G**
IBON-HI-2020-51	16.6	21	1	46.7	9	0	35.0	6	0	44.2	4	1	35.6	5	1
IBON-HI-2020-50	14.1	27	0	20.0	37	0	33.0	8	0	28.2	31	0	23.8	32	0
IBON-HI-2020-6	12.4	34	0	40.0	15	0	44.3	2	1	26.2	36	0	30.7	13	0
IBON-HI-2020-3	18.1	17	1	36.7	20	0	25.0	26	0	45.1	2	1	31.2	11	0
IBON-HI-2020-15	12.1	35	0	20.0	37	0	26.0	23	0	33.5	18	0	22.9	34	0
IBON-HI-2020-71	15.6	26	1	26.7	31	0	31.7	9	0	53.5	1	1	31.9	10	1
7thGSBYT-2020-22	6.7	45	0	10.0	44	0	25.0	26	0	0.0	45	0	9.5	45	0
7thGSBON-2020-123	24.9	3	1	70.0	2	1	27.0	22	0	31.0	26	0	38.2	1	1
7thGSBON-2020-129	25.0	2	1	29.4	27	0	23.9	33	0	28.1	33	0	26.6	27	0
7thGSBON-2020-140	21.7	10	1	39.4	16	0	40.6	3	0	33.8	17	0	33.9	8	1
7thGSBON-2020-150	15.7	24	1	29.4	27	0	20.6	43	0	43.1	6	0	27.2	25	0
IBON-HI-2020-104	20.2	11	1	22.8	36	0	22.6	36	0	37.7	10	0	25.8	29	0
7thGSBON-2020-92	18.9	14	1	29.4	27	0	35.9	4	0	36.9	12	0	30.3	15	0
7thGSBON-2020-88	17.2	19	1	36.1	21	0	15.9	44	0	31.3	25	0	25.1	30	0
7thGSBON-2020-103	17.0	20	1	46.1	10	0	27.2	19	0	31.8	22	0	30.5	14	0
7thGSBON-2020-101	22.9	7	1	32.8	25	0	27.2	19	0	33.1	19	0	29.0	19	0
7thGSBON-2020-90	23.2	5	1	49.4	5	0	30.6	15	0	36.9	12	0	35.0	6	1
7thGSBON-2020-18	13.0	32	0	18.9	39	0	25.3	25	0	31.6	23	0	22.2	37	0
7thGSBON-2020-20	16.4	22	1	25.6	32	0	15.3	45	0	22.5	39	0	19.9	43	0
7thGSBON-2020-99	10.7	38	0	18.9	39	0	23.3	35	0	37.0	11	0	22.5	35	0
IBON-HI-2020-75	10.0	40	0	32.2	26	0	20.7	42	0	32.0	21	0	23.7	33	0
IBON-HI-2020-85	16.2	23	1	35.6	22	0	22.0	38	0	34.6	16	0	27.1	26	0
IBON-HI-2020-97	13.9	28	0	15.6	42	0	24.0	32	0	30.4	27	0	20.9	42	0
IBON-HI-2020-101	18.4	15	1	8.9	45	0	28.0	18	0	31.6	23	0	21.7	39	0
IBON-HI-2020-108	17.4	18	1	25.6	32	0	31.3	11	0	35.0	14	0	27.3	24	0
IBON-HI-2020-140	13.5	29	0	25.6	32	0	30.7	14	0	27.8	34	0	24.4	31	0
GM	**16.2**			**34.3**			**27.6**			**31.8**			**27.5**		
CD	**11.0**			**18.0**			**5.8**			**10.1**			**6.4**		
Checks															
BH 946	11.7			20.0			35.3			34.5			25.4		
BH 959	18.6			62.7			34.4			37.6			38.3		
BHS 400	22.1			43.3			27.2			40.7			33.3		
RD 2715	13.5			41.3			32.4			24.0			27.8		
DWRB 101	14.5			32.7			32.1			39.5			29.7		
DWRB137	20.6			60.0			32.5			46.6			40.0		
DOS	**24.11.2020**			**11.11.2020**			**10.11.2020**			**11.11.2020**					

Grain yield, ranking and grouping of barley genotypes evaluated under EIBGN-2020 at different locations of NEPZ in *rabi* 2020-2021 season

Entries	Kanpur			Varanasi			Ayodhya			NEPZ		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBYT-HI-2020-6	26.6	13	1	18.9	18	0	12.2	41	0	19.2	18	0
IBYT-HI-2020-13	22.6	21	1	13.9	32	0	10.8	43	0	15.8	35	0
IBYT-HI-2020-11	30.6	8	1	22.2	12	0	14.8	27	0	22.5	12	0
7thGSBYT-2020-2	33.3	5	1	28.9	7	0	10.8	43	0	24.3	5	0
7thGSBYT-2020-7	25.3	15	1	10.6	39	0	12.2	41	0	16.0	34	0
7thGSBYT-2020-10	25.3	15	1	18.9	18	0	13.5	38	0	19.2	18	0
7thGSBYT-2020-11	37.3	2	1	15.6	26	0	14.2	31	0	22.3	14	0
7thGSBYT-2020-14	23.9	18	1	22.2	12	0	10.8	43	0	19.0	21	0
7thGSBYT-2020-15	35.3	3	1	18.9	18	0	15.5	22	0	23.2	11	0
7thGSBYT-2020-20	17.6	34	1	12.5	33	0	13.8	36	0	14.6	39	0
IBON-HI-2020-55	14.3	38	1	15.8	24	0	17.2	7	0	15.8	36	0
IBON-HI-2020-25	6.3	43	0	15.8	24	0	16.5	12	0	12.9	41	0
IBON-HI-2020-31	8.9	42	0	9.2	40	0	13.8	36	0	10.6	44	0
IBON-HI-2020-28	30.9	7	1	7.5	43	0	12.5	40	0	17.0	29	0
IBON-HI-2020-12	10.9	41	0	22.5	11	0	15.2	24	0	16.2	32	0
IBON-HI-2020-10	18.3	32	1	2.5	45	0	14.5	30	0	11.8	42	0
IBON-HI-2020-48	4.3	44	0	9.2	40	0	15.8	20	0	9.8	45	0
IBON-HI-2020-94	17.6	34	1	5.8	44	0	16.5	12	0	13.3	40	0
IBON-HI-2020-155	15.4	36	1	29.7	6	0	25.0	1	1	23.4	8	0
IBON-HI-2020-51	13.7	39	1	19.7	14	0	17.0	10	0	16.8	30	0
IBON-HI-2020-50	22.0	22	1	19.7	14	0	16.4	14	0	19.4	16	0
IBON-HI-2020-6	25.4	14	1	71.4	1	1	17.0	10	0	37.9	1	1
IBON-HI-2020-3	28.7	10	1	23.1	10	0	18.4	3	0	23.4	8	0
IBON-HI-2020-15	32.0	6	1	19.7	14	0	15.7	21	0	22.5	13	0
IBON-HI-2020-71	18.7	31	1	36.4	3	0	15.0	25	0	23.4	8	0
7thGSBYT-2020-22	2.0	45	0	36.4	3	0	16.4	14	0	18.3	23	0
7thGSBON-2020-123	23.4	20	1	19.7	14	0	15.4	23	0	19.5	15	0
7thGSBON-2020-129	18.3	33	1	15.0	28	0	17.8	4	0	17.0	27	0
7thGSBON-2020-140	21.6	23	1	15.0	28	0	15.8	16	0	17.5	26	0
7thGSBON-2020-150	21.6	23	1	15.0	28	0	14.5	28	0	17.0	27	0
IBON-HI-2020-104	21.6	23	1	11.7	35	0	14.8	26	0	16.0	33	0
7thGSBON-2020-92	21.6	23	1	15.0	28	0	20.5	2	1	19.0	20	0
7thGSBON-2020-88	14.9	37	1	11.7	35	0	17.8	4	0	14.8	38	0
7thGSBON-2020-103	13.3	40	0	8.3	42	0	12.8	39	0	11.5	43	0
7thGSBON-2020-101	28.3	11	1	11.7	35	0	14.5	28	0	18.1	24	0
7thGSBON-2020-90	21.6	23	1	66.0	2	1	13.8	32	0	33.8	2	1
7thGSBON-2020-18	20.2	28	1	17.2	21	0	17.8	6	0	18.4	22	0
7thGSBON-2020-20	24.8	17	1	12.2	34	0	15.8	17	0	17.6	25	0
7thGSBON-2020-99	23.5	19	1	17.2	21	0	17.2	7	0	19.3	17	0
IBON-HI-2020-75	20.2	28	1	15.6	26	0	13.8	33	0	16.5	31	0

Entries	Kanpur			Varanasi			Ayodhya			NEPZ		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBON-HI-2020-85	30.2	9	1	27.2	8	0	15.8	17	0	24.4	4	0
IBON-HI-2020-97	26.8	12	1	27.2	8	0	17.2	7	0	23.7	6	0
IBON-HI-2020-101	20.2	28	1	10.6	38	0	13.8	33	0	14.8	37	0
IBON-HI-2020-108	37.5	1	1	17.2	21	0	15.8	17	0	23.5	7	0
IBON-HI-2020-140	33.5	4	1	30.6	5	0	13.8	33	0	26.0	3	0
GM	**22.0**			**19.8**			**15.3**			**19.0**		
CD	**24.2**			**14.2**			**6.5**			**9.9**		
Checks												
BH 946	36.8			19.3			16.5			24.2		
BH 959	33.9			22.7			15.1			23.9		
BHS 400	45.5			24.7			16.1			**28.8**		
RD 2715	45.2			9.7			15.1			23.3		
DWRB 101	46.3			16.0			14.3			25.5		
DWRB137	36.0			22.7			15.2			24.6		
DOS	**21.11.220**			**27.11.2020**			**19.11.2020**					

Zonal means for grain yield, ranking and grouping of barley genotypes evaluated under EIBGN-2020 at different locations of NHZ in *rabi* 2020-2021 season

Entries	Shimla			Bajaura			Khudwani			NHZ		
	GY	Rk	G	GY	Rk	G	GY	Rk	G	GY	Rk	G
IBYT-HI-2020-6	21.1	6	0	38.5	3	1	49.0	17	1	36.2	4	1
IBYT-HI-2020-13	16.7	40	0	12.7	42	0	48.2	18	1	25.9	34	0
IBYT-HI-2020-11	18.7	23	0	13.5	41	0	20.7	44	0	17.6	45	0
7thGSBYT-2020-2	20.5	12	0	22.2	27	0	25.7	43	0	22.8	40	0
7thGSBYT-2020-7	21.4	3	0	19.0	33	0	32.3	39	0	24.2	37	0
7thGSBYT-2020-10	21.5	2	0	29.7	13	0	42.3	27	0	31.2	20	1
7thGSBYT-2020-11	20.3	14	0	21.4	29	0	47.3	21	1	29.7	26	0
7thGSBYT-2020-14	16.9	39	0	39.8	2	1	45.7	24	0	34.1	7	1
7thGSBYT-2020-15	16.9	38	0	31.7	10	0	44.0	25	0	30.9	21	1
7thGSBYT-2020-20	19.6	17	0	22.3	26	0	55.3	9	1	32.4	14	1
IBON-HI-2020-55	20.8	10	0	26.8	19	0	63.6	2	1	37.1	3	1
IBON-HI-2020-25	19.1	20	0	10.7	44	0	60.3	5	1	30.0	24	0
IBON-HI-2020-31	18.8	22	0	14.9	39	0	36.9	34	0	23.5	39	0
IBON-HI-2020-28	17.6	31	0	17.9	36	0	30.3	41	0	21.9	41	0
IBON-HI-2020-12	15.4	45	0	29.9	12	0	26.9	42	0	24.1	38	0
IBON-HI-2020-10	17.6	33	0	9.3	45	0	37.8	33	0	21.6	42	0
IBON-HI-2020-48	18.3	25	0	19.9	31	0	35.3	35	0	24.5	36	0
IBON-HI-2020-94	18.6	24	0	23.2	24	0	38.6	31	0	26.8	30	0
IBON-HI-2020-155	19.3	18	0	18.8	34	0	59.4	6	1	32.5	13	1
IBON-HI-2020-51	17.4	35	0	27.2	17	0	60.3	4	1	35.0	5	1
IBON-HI-2020-50	18.1	28	0	33.2	7	0	51.1	13	1	34.1	6	1
IBON-HI-2020-6	16.7	41	0	28.9	16	0	55.3	8	1	33.6	9	1
IBON-HI-2020-3	18.3	27	0	16.5	37	0	63.6	3	1	32.8	12	1

Entries	Shimla			Bajaura			Khudwani			NHZ		
	GY	**Rk**	**G**	**GY**	**Rk**	**G**	**GY**	**Rk**	**G**	**GY**	**Rk**	**G**
IBON-HI-2020-15	19.9	16	0	29.1	15	0	66.9	1	1	38.6	1	1
IBON-HI-2020-71	24.6	1	1	22.9	25	0	53.6	12	1	33.7	8	1
7thGSBYT-2020-22	20.3	13	0	10.8	43	0	31.1	40	0	20.7	43	0
7thGSBON-2020-123	20.6	11	0	33.1	8	0	38.6	32	0	30.8	23	1
7thGSBON-2020-129	17.7	30	0	38.0	4	1	41.1	28	0	32.3	17	1
7thGSBON-2020-140	17.1	36	0	29.5	14	0	32.8	37	0	26.5	31	0
7thGSBON-2020-150	21.3	4	0	24.8	21	0	54.4	11	1	33.5	10	1
IBON-HI-2020-104	21.1	7	0	16.0	38	0	58.6	7	1	31.9	18	1
7thGSBON-2020-92	17.1	37	0	30.7	11	0	49.4	16	1	32.4	15	1
7thGSBON-2020-88	16.3	42	0	14.8	40	0	46.9	22	1	26.0	33	0
7thGSBON-2020-103	17.5	34	0	32.3	9	0	42.8	26	0	30.8	22	1
7thGSBON-2020-101	18.3	26	0	26.9	18	0	41.1	28	0	28.8	29	0
7thGSBON-2020-90	18.1	29	0	34.9	6	1	46.1	23	1	33.0	11	1
7thGSBON-2020-18	18.8	21	0	44.2	1	1	49.4	14	1	37.5	2	1
7thGSBON-2020-20	15.7	44	0	36.7	5	1	34.4	36	0	29.0	28	0
7thGSBON-2020-99	17.6	32	0	24.8	20	0	54.4	10	1	32.3	16	1
IBON-HI-2020-75	16.3	43	0	24.3	22	0	16.9	45	0	19.2	44	0
IBON-HI-2020-85	19.3	19	0	22.2	28	0	47.8	19	1	29.7	25	0
IBON-HI-2020-97	20.3	15	0	24.2	23	0	49.4	14	1	31.3	19	1
IBON-HI-2020-101	21.1	8	0	18.3	35	0	39.4	30	0	26.3	32	0
IBON-HI-2020-108	20.9	9	0	19.6	32	0	47.8	19	1	29.4	27	0
IBON-HI-2020-140	21.3	5	0	20.7	30	0	32.8	38	0	24.9	35	0
GM	**18.9**			**24.6**			**44.6**			**29.4**		
CD	**1.08**			**9.27**			**21.12**			**7.92**		
BH 946	18.6			15.5			46.5			26.9		
BH 959	18.6			29.1			48.0			31.9		
BHS 400	19.6			31.6			52.7			**34.6**		
RD 2715	19.1			16.7			43.5			26.4		
DWRB 101	22.5			22.2			41.7			28.8		
DWRB137	18.1			22.3			42.5			27.6		
DOS	**19.11.2020**			**18.11.2020**			**27.10.2020**					

Range and Mean across the 10-locations for ancillary characters of barley genotypes evaluated under EIBGN-(2020)

Entries	RT (6/2)	Days to 75% heading	Days to 75% maturity	Plant height (cm)	Tillers/meter	Spike length (cm)	Grains/ spike	1000-gw (g)
IBYT-HI-2020-6	6	93 (71-108)	132 (114-147)	73 (59-90)	116 (79-136)	8.3 (7-9.4)	52 (41-69)	41 (36-42)
IBYT-HI-2020-13	6	99 (90-123)	135 (121-164)	76 (43-98)	98 (62-126)	7 (4-8.6)	43 (23-60)	43 (33-48)
IBYT-HI-2020-11	6	93 (71-122)	134 (111-164)	77 (47-105)	89 (45-104)	7.6 (7-9.1)	50 (27-72)	46 (36-52)
7thGSBYT-2020-2	2	88 (68-108)	130 (107-147)	84 (56-105)	104 (90-138)	8 (6.8-9)	26 (17-30)	49 (38-54)
7thGSBYT-2020-7	2	96 (79-111)	133 (112-146)	80 (58-101)	128 (48-174)	7.8 (6-9)	24 (15-28)	48 (34-54)
7thGSBYT-2020-10	2	95 (73-111)	131 (110-146)	84 (54-99)	118 (92-166)	8.6 (7-10.8)	26 (15-33)	49 (40-52)
7thGSBYT-2020-11	2	94 (73-109)	132 (114-146)	81 (62-100)	100 (75-125)	7.9 (6-10.5)	24 (17-32)	46 (32-48)
7thGSBYT-2020-14	6	99 (84-112)	133 (114-152)	91 (64-123)	84 (36-124)	7.4 (6-8.7)	52 (27-66)	45 (36-54)
7thGSBYT-2020-15	6	89 (68-112)	131 (111-148)	82 (60-108)	82 (40-108)	7.6 (4.7-9.5)	46 (25-60)	43 (31-54)
7thGSBYT-2020-20	6	94 (78-111)	130 (118-147)	88 (55-110)	74 (42-94)	8.3 (6.7-9)	54 (29-66)	40 (37-43)
IBON-HI-2020-55	2	89 (71-101)	130 (112-146)	81 (56-112)	91 (77-132)	8.1 (6-10)	22 (16-27)	56 (53-64)
IBON-HI-2020-25	6	88 (70-101)	130 (114-148)	68 (43-92)	91 (79-142)	7.7 (5-9.1)	49 (24-66)	37 (30-43)
IBON-HI-2020-31	6	91 (68-116)	131 (114-148)	81 (46-102)	93 (56-131)	7.9 (6.3-11)	57 (36-78)	41 (28-50)
IBON-HI-2020-28	6	92 (71-117)	134 (118-161)	81 (44-101)	74 (54-103)	8.5 (6-9.1)	57 (41-72)	46 (38-51)
IBON-HI-2020-12	6	88 (58-114)	130 (106-150)	87 (45-110)	88 (35-121)	7.7 (5.2-9)	53 (29-66)	39 (30-45)
IBON-HI-2020-10	6	94 (71-115)	133 (112-148)	78 (43-96)	97 (45-156)	8.2 (6.7-11)	54 (27-78)	40 (34-46)
IBON-HI-2020-48	6	93 (71-121)	132 (118-147)	77 (40-943)	118 (52-166)	7.5 (4.7-10)	46 (19-84)	41 (32-51)
IBON-HI-2020-94	6	95 (76-122)	135 (117-161)	79 (50-99)	116 (67-168)	8.3 (6.5-10)	49 (33-72)	41 (32-47)
IBON-HI-2020-155	6	91 (71-119)	131 (116-153)	79 (56-106)	87 (43-132)	8.1 (6.7-10)	62 (44-78)	38 (27-42)
IBON-HI-2020-51	6	94 (77-122)	132 (116-152)	80 (41-106)	92 (48-142)	7.6 (5.3-8.8)	53 (28-66)	41 (35-45)
IBON-HI-2020-50	6	93 (70-120)	131 (117-148)	80 (49-107)	86 (62-147)	7.8 (6-9.1)	58 (28-72)	39 (31-43)
IBON-HI-2020-6	6	94 (72-117)	133 (113-154)	84 (49-102)	111 (77-167)	6.9 (5.5-7.1)	47 (33-60)	42 (36-47)
IBON-HI-2020-3	6	92 (70-117)	131 (113-154)	83 (58-101)	87 (79-127)	7.4 (5.3-8.9)	57 (40-66)	44 (34-52)
IBON-HI-2020-15	2	99 (82-120)	135 (120-154)	78 (56-94)	117 (83-176)	7.8 (6.8-10)	27 (22-35)	48 (37-53)
IBON-HI-2020-71	2	94 (79-112)	132 (120-148)	88 (74-105)	138 (98-189)	7.9 (6.7-9)	27 (18-35)	52 (46-56)
7thGSBYT-2020-22	0	85 (0-127)	115 (0-147)	70 (0-106)	21 (0-52)	6.7 (0-9.7)	42 (0-72)	34 (0-48)
7thGSBON-2020-123	6	92 (68-106)	133 (114-152)	91 (73-114)	109 (59-174)	8.5 (6-10.7)	52 (29-70)	43 (38-49)
7thGSBON-2020-129	6	97 (79-111)	133 (121-149)	83 (59-106)	87 (43-147)	8.4 (6.6-10)	56 (28-72)	37 (28-45)
7thGSBON-2020-140	6	93 (73-115)	130 (115-148)	84 (58-117)	71 (55-97)	7.8 (6.2-8)	59 (28-84)	47 (38-49)
7thGSBON-2020-150	2	89 (68-106)	129 (112-146)	77 (60-936)	123 (85-197)	7.6 (6-8.5)	25 (21-28)	45 (36-48)
IBON-HI-2020-104	2	88 (68-101)	129 (110-146)	79 (61-103)	109 (78-187)	8.6 (6.8-12)	27 (23-32)	48 (40-57)
7thGSBON-2020-92	6	98 (79-116)	133 (117-147)	82 (52-107)	98 (76-145)	6.7 (5.5-9)	47 (25-78)	44 (40-48)
7thGSBON-2020-88	6	90 (68-116)	131 (110-147)	86 (53-107)	75 (45-124)	7.8 (5.2-10)	52 (27-72)	41 (36-42)
7thGSBON-2020-103	6	100 (88-113)	131 (120-148)	89 (58-105)	87 (42-110)	7.8 (6.2-9)	57 (31-72)	43 (33-48)
7thGSBON-2020-101	6	100 (88-114)	132 (118-148)	87 (58-109)	108 (76-125)	7.2 (4.8-8.4)	52 (23-66)	46 (36-52)
7thGSBON-2020-90	6	100 (85-115)	134 (117-151)	79 (46-106)	90 (64-136)	6.1 (4.7-6.3)	46 (20-60)	41 (30-45)
7thGSBON-2020-18	6	93 (79-113)	132 (118-151)	87 (66-105)	85 (62-142)	8.5 (5.5-9.2)	54 (42-72)	39 (31-42)
7thGSBON-2020-20	6	99 (86-116)	133 (120-151)	91 (53-118)	77 (48-104)	6.8 (5-7.3)	53 (36-66)	41 (30-50)
7thGSBON-2020-99	2	98 (79-117)	133 (121-154)	83 (58-105)	126 (62-194)	9.7 (6.2-11)	25 (13-32)	44 (35-49)
IBON-HI-2020-75	2	96 (71-121)	132 (116-148)	82 (57-104)	76 (46-110)	8.2 (6.8-9.4)	25 (21-31)	43 (27-53)
IBON-HI-2020-85	6	91 (68-112)	130 (107-148)	87 (53-108)	77 (62-113)	8.2 (6-10)	36 (17-84)	45 (38-51)
IBON-HI-2020-97	2	91 (69-114)	130 (108-150)	85 (62-108)	84 (64-150)	7.8 (6.7-9)	35 (22-72)	40 (37-43)
IBON-HI-2020-101	2	90 (69-112)	131 (106-147)	88 (75-112)	113 (52-166)	8.4 (6.6-10)	26 (21-32)	41 (35-49)

Entries		RT (6/2)	Days to 75% heading	Days to 75% maturity	Plant height (cm)	Tillers/meter	Spike length (cm)	Grains/ spike	1000-gw (g)
IBON-HI-2020-108		2	90 (68-111)	131 (107-149)	85 (75-109)	103 (68-118)	8.6 (7.5-10)	26 (24-32)	40 (33-51)
IBON-HI-2020-140		2	90 (68-111)	132 (111-148)	83 (70-106)	110 (70-134)	8.7(7-10.6)	27 (21-30)	41 (28-50)
	Checks*								
1	BH 946	6	103 (71-193)	141 (110-216)	88 (19-131)	76 (23-289)	8 (6-11)	60 (24-90)	40 (28-48)
2	BH 959	6	98 (62-189)	138 (107-215)	74 (47-106)	104 (67-167)	7 (3-9)	52 (31-73)	39 (27-49)
3	BHS 400	6	107 (70-192)	142 (114-216)	89 (53-130)	111 (48-195)	7 (5-10)	52 (25-84)	40 (30-52)
4	RD 2715	6	98 (67-192)	138 (106-217)	89 (52-113)	78 (31-164)	8 (6-11)	56 (21-85)	41 (24-51)
5	DWRB 101	2	100 (69-191)	139 (107-215)	79 (41-103)	97 (38-165)	8 (5-11)	28 (20-56)	46 (27-56)
6	DWRB137	6	98 (62-195)	139 (106-216)	70 (39-97)	89 (46-174)	7 (5-10)	54 (25-78)	45 (31-61)

*Mean and ranges across the five blocks

National Barley Genetic Stock Nursery (NBGSN-2020)

Th NBGSN nursery comprising of a set of 20 promising entries 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). However, Ludhiana, Ayodhya and Khudwani centres did not report on utilization of the supplied genetic stocks. Details of the genetic stocks supplied and their utilization at different centres is given in the following table.

Utilization of genotypes of National Barley Genetic Stock Nursery (NBGSN) at different locations

Genotype	Centre	Pedigree	Special feature	RT	Source
BH-1025	HAU, Hisar	K 958/BH 393	Yellow rust and leaf rust resistant	2	EBDSN 2019-20
HBL-863	Bajaura	HBL 276 x Dyar Local	Yellow rust and leaf rust resistant	6	EBDSN 2019-20
RD-3005	Durgapura	DWR16/RD2503//RD2667	Yellow rust and leaf rust resistant	6	EBDSN 2019-20
RD-3008	Durgapura	Clipper/RD2668//DWRB73	Yellow rust and leaf rust resistant and tolerant to leaf blight	2	EBDSN 2019-20
BH-1018	HAU, Hisar	EIBGN-HI-55 (2013)	Yellow rust resistant and tolerant to leaf blight	2	EBDSN 2019-20
RD-3002	Durgapura	RD2575/RD2552	Yellow rust resistant	6	EBDSN 2019-20
RD-3010	Durgapura	Clipper/RD2668//DWRB73	Yellow rust resistant	2	EBDSN 2019-20
DWRB 182	IIWBR, Karnal	DWRUB52/ DWRB 78	Better malting quality, low beta- glucan, resistant to yellow rust & moderately resistant to leaf blight	2	EBDSN 2019-20
DWRB 197	IIWBR, Karnal	DWRUB52/ DWR84	Better malt quality	2	AVT 2019-20
DWRB 209	IIWBR, Karnal	MARINE/DWR84	Better malt quality	2	IVT 2019-20
DWRB 211	IIWBR, Karnal	DWRUB64/UBE1105// DWRB73/DWR37	Better malt quality & low beta-glucan	2	IVT 2019-20
BH 1026	Hisar	VLB 132 / BH 902	Better malt quality	2	IVT 2019-20
BH 1027	Hisar	VLB 132 / BH 885	Better malt quality	2	IVT 2019-20
RD3025	Durgapura	RD2552/DL419//RD2508	Low beta-glucan & high FAN content	2	IVT 2019-20
BCLA3	IIWBR, Karnal	EB921/Alfa93	Aphid resistance	2	NBDSN 2019-20
BCLA11-6	IIWBR, Karnal	BCU390/Alfa93	Aphid resistance	6	NBDSN 2019-20
PL891	PAU, Ludhiana	IBON 343 /12thHSBN-176	High yielding 2-rowed huskless barley	2	AVT HLS
BBM839	IARI,RS, Shimla	HBL276/BHS369	Yellow rust resistant	6	EBDSN 2019-20
BBM852	IARI,RS, Shimla	BBM556/HBL113	Yellow rust resistant	2	EBDSN 2019-20
BBM854	IARI,RS, Shimla	BHS365/BHS169	Yellow rust resistant	2	EBDSN 2019-20

Utilization of genotypes of NBGSN at different locations

Genotype	Utilization											Utilization Frequency (11)
	Durgapura	Chatha	Hisar	Karnal	Pantnagar	Kanpur	Ayodhya	Varanasi	Khudwani	Bajaura	Shimla	
BH-1025	H	STG	H		H	AG			H	SAS		7
HBL-863						AG			H		H	3
RD-3005			H			H		H	H			4
RD-3008	H	SSLT		H	H	H			H		H	7
BH-1018			H	H		H	H					4
RD-3002	H		H		H	H	H	H	H	H		8
RD-3010	H		H			AG	H			H		5
DWRB 182			H	H	H	AG				H		5
DWRB 197			H		H	AG				SAS		4
DWRB 209		SRR				AG						3
DWRB 211	H		H		H	AG				SAS		5
BH 1026	H					H						2
BH 1027	H				H	H						3
RD3025					H	AG				H		3
BCLA3	H			H	H	H	H					5
BCLA11-6			H	H		AG		H				4
PL891	H				H	AG					H	4
BBM839	H				H	AG	H		H		H	6
BBM852	H				H	AG	H					4
BBM854					H	AG	H					3

H=Used in hybridization; STG = Selected for tillering and grain yield; SRR - selected for rust resistance; AG = added in germplasm; SAS=selected on agronomic score

Breeder and Nucleus Seed Production Programme during 2020-21

Breeder Seed Indent

A consolidated quantity of 644.24q breeder seed indent of 28 varieties was received from DAC&FW for production during 2020-21 and supply during 2021-22. Eight states *viz*., Punjab, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Rajasthan, Uttar Pradesh and Uttarakhand and four public sector agencies *viz*., National Seeds Corporation, IFFDC, NAFED & NDDB 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 (230.00q) followed by NSAI (130.30q), Uttar Pradesh (120.0q) and National Seed Corporation (105.0q).

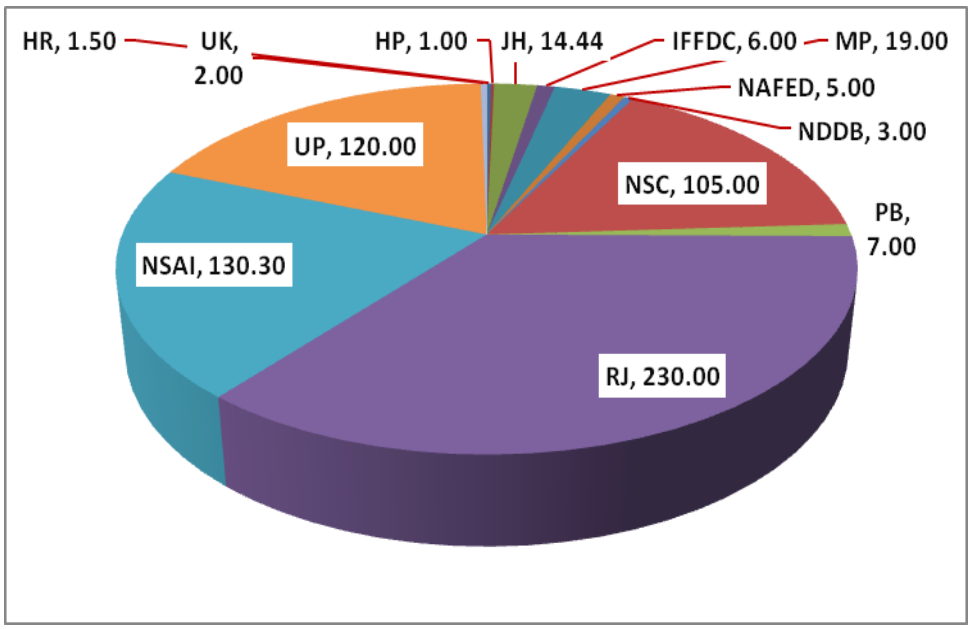


Fig: Breeder seed indent of 13 indenting agencies

Breeder Seed Allocation and Production

Total 638.06q breeder seed of 24 varieties was allocated among 10 BSP centres. The indent of 6.18q breeder seed of four very old varieties *viz*., K 603, K 226, PL 56 and RS 6 was not accepted by the BSP centres due to insufficient nucleus seed availability. However, the indenting agency has withdrawn breeder seed indent of DWRB 101 (32.0q) before sowing the seed. Among all 24 varieties maximum breeder seed indent was received for the variety DWRB 137 (121.66q) followed by RD 2899 (80.0q), BH 393 (53.0q) and RD 2786 (50.0q).

A total of 830.00q with a surplus of 186.16q over the total allocated quantity (606.6q) of breeder seed of 22 varieties was produced by 10 BSP centres during 2020-21. Among 10 breeder seed production centres, maximum breeder seed was reported from RARI, Durgapura (394.40q) with surplus of 157.20q against allocation followed by IIWBR, Karnal (172.0q) and CCSHAU, Hisar (123.50q). CCSHAU, Hisar reported deficit breeder seed production of BH 393 (-19.85q) and BH 946 (-13.90q), RARI, Durgapura reported (-16.60q) deficit breeder seed production of RD 2786 against allocation of 50.0q. Top ten breeder seed producing varieties contribute to the tune of 70.90% in total allocation whereas these varieties contribute 83.94% share in total breeder

seed production during 2020-21. Total 39.76q nucleus seed of 24 varieties was produced against 22.65q allocation in BSP-1 with a surplus of 17.11q seed during 2020-21 at 10 centres.

Table: Breeder Seed production of top 10 varieties during 2020-21

SN.	Variety	Year of Notification	Breeder Seed (q)			Nucleus Seed (q)		
			Allocation	Production	Surplus /Deficit	Allocation	Production	Surplus/ Deficit
1	DWRB 137	2018	121.66	170.00	48.34	3.00	4.00	1.00
2	RD 2899	2018	80.00	94.90	14.90	2.50	8.00	5.50
3	RD 2907	2018	45.00	85.00	40.00	1.50	3.00	1.50
4	BH 959	2015	45.00	78.00	33.00	1.50	1.70	0.20
5	RD 2035	1994	34.20	63.10	28.90	1.25	2.00	0.75
6	RD 2794	2016	20.00	61.00	41.00	1.00	3.00	2.00
7	HUB 113	2014	40.00	40.20	0.20	1.00	1.05	0.05
8	RD 2715	2009	3.00	36.00	33.00	0.10	0.10	0.00
9	PL 426	1996	29.90	35.00	5.10	1.25	1.75	0.50
10	BH 393	2002	53.35	33.50	-19.85	1.50	2.00	0.50
	% Share		**70.90%**	**83.94%**				

Table: Breeder and Nucleus Seed production of all 10 BSP Centres during 2020-21

SN	Centre	Breeder Seed (q)			Nucleus Seed (q)		
		Allocation	Production	Surplus /Deficit	Allocation	Production	Surplus/ Deficit
1	BHU Varanasi	40.00	40.20	0.20	1.00	1.05	0.05
2	CCSHAU Hisar	120.25	123.50	3.25	4.10	5.80	1.70
3	CSAUT, Kanpur	22.00	26.00	4.00	1.00	1.80	0.70
4	GBPUA&T, Pantnagar	1.00	1.00	0.00	0.10	0.50	0.40
5	HPKV. Palampur	0.50	7.00	6.50	0.10	0.30	0.20
6	IARI- RS, Karnal	2.50	0.00	-2.50	0.20	0.46	0.26
7	ICAR-IIWBR Karnal	126.66	172.00	45.34	5.00	4.65	-0.35
8	PAU, Ludhiana	54.95	62.40	7.45	2.95	4.50	1.55
9	RARI, Durgapura	237.20	394.40	157.20	8.10	20.20	12.10
10	VPKAS, Almora	1.00	3.50	2.50	0.10	0.50	0.40
	Total	**606.06**	**830.00**	**223.94**	**22.65**	**39.76**	**17.11**

Test Stock Multiplication

NSC, New Delhi as reported 39.0q test stock seed was multiplied for one newly identified variety DWRB 182.

Table 1: Centre-wise Breeder and Nucleus Seed Indent and Production during 2020-21

SN	Centre	Variety	Year of Notification	Breeder Seed (q)				Nucleus Seed (q)		
				DAC Indent	Allocation	BSP IV	Surplus/ Deficit	Allocation	Production	Surplus/ Deficit
1	BHU Varanasi	HUB 113 (Mahamana 113)	2014	40.00	40.00	40.20	0.20	1.00	1.05	0.05
		Total			**40.00**	**40.20**	0.20	**1.00**	**1.05**	0.05
2	CCSHAU, Hisar	BH 946	2014	20.90	20.90	7.00	-13.90	1.00	1.50	0.50
		BH 393	2002	53.35	53.35	33.50	-19.85	1.50	2.00	0.50
		BH 902	2010	1.00	1.00	5.00	4.00	0.10	0.60	0.50
		BH 959	2015	45.00	45.00	78.00	33.00	1.50	1.70	0.20
		Total			**120.25**	**123.50**	3.25	**4.10**	**5.80**	1.70
3	CSAUT, Kanpur	K 1055 (Prakhar)	2018	22.00	22.00	26.00	4.00	1.00	1.80	0.80
4	GBPUA&T, Pantnagar	UPB 1008	2011	1.00	1.00	1.00	0.00	0.10	0.50	0.40
		Total			**1.00**	**1.00**	0.00	**0.10**	**0.50**	0.40
5	HPKV. Palampur	HBL 713	2016	0.50	0.50	7.00	6.50	0.10	0.30	0.20
		Total			**0.50**	**7.00**	6.50	**0.10**	**0.30**	0.20
6	IARI- RS, Karnal	BHS 380	2019	2.50	2.50	0.00	-2.50	0.20	0.46	0.26
		Total			**2.50**	**0.00**	-2.50	**0.20**	**0.46**	0.26
7	IIWBR, Karnal	DWRB 101	2015	32.00	0.00	0.00	0.00	1.50	0.15	-1.35
		DWRB 137	2018	121.66	121.66	170.00	48.34	3.00	**4.00**	1.00
		DWRB 160 (Malt Sona)	2020	5.00	5.00	2.00	-3.00	0.50	0.50	0.00
		Total			**126.66**	**172.00**	13.34	**5.00**	**4.65**	-0.35
8	PAU, Ludhiana	PL 172	1987	4.40	4.40	4.40	0.00	0.20	1.00	0.80
		PL 891	2020	17.65	17.65	20.00	2.35	1.00	**1.00**	0.00
		PL 426	1996	29.90	29.90	35.00	5.10	1.25	1.75	0.50
		PL 807	2009	3.00	3.00	3.00	0.00	0.50	**0.75**	0.25
		Total			**54.95**	**62.40**	7.45	**2.95**	**4.50**	1.55
9	RARI, Durgapura	RD 2052	1991	5.00	5.00	21.00	16.00	0.25	**0.10**	-0.15
		RD 2899	2018	80.00	80.00	94.90	14.90	2.50	**8.00**	5.50
		RD 2907	2018	45.00	45.00	85.00	40.00	1.50	**3.00**	1.50
		RD 2035	1994	34.20	34.20	63.10	28.90	1.25	**2.00**	0.75
		RD 2715	2009	3.00	3.00	36.00	33.00	0.10	**0.10**	0.00
		RD 2786	2013	50.00	50.00	33.40	-16.60	1.50	**4.00**	2.50
		RD 2794	2016	20.00	20.00	61.00	41.00	1.00	**3.00**	2.00
		Total			**237.20**	**394.40**	157.20	**8.10**	**20.20**	12.10
10	VPKAS, Almora	VLB 118 (VL Jau118)	2015	1.00	1.00	3.50	2.50	0.10	**0.50**	0.40
		Total		**1.00**	**1.00**	**3.50**	2.50	**0.10**	**0.50**	0.40
		Grand Total		**638.06**	**606.06**	**830.00**	**223.94**	**22.65**	**39.76**	**17.11**

Table 3: Variety-wise Breeder and Nucleus Seed Indent and Production during 2020-21

SN	Variety	Year of Notification	Breeder Seed (q)				Nucleus Seed (q)		
			DAC Indent	Allocation	Production	Surplus/Deficit	Allocation	Production	Surplus /Deficit
1	PL 891	2020	17.65	17.65	20.00	2.35	1.00	1.00	0.00
2	DWRB 160	2020	5.00	5.00	2.00	-3.00	0.50	0.50	0.00
3	BHS 380	2019	2.50	2.50	0.00	-2.50	0.20	0.46	0.26
4	K 1055 (Prakhar)	2018	22.00	22.00	26.00	4.00	1.00	1.80	0.80
5	DWRB 137	2018	121.66	121.66	170.00	48.34	3.00	4.00	1.00
6	RD 2899	2018	80.00	80.00	94.90	14.90	2.50	8.00	5.50
7	RD 2907	2018	45.00	45.00	85.00	40.00	1.50	3.00	1.50
8	HBL 713	2016	0.50	0.50	7.00	6.50	0.10	0.30	0.20
9	RD 2794	2016	20.00	20.00	61.00	41.00	1.00	3.00	2.00
10	BH 959	2015	45.00	45.00	78.00	33.00	1.50	1.70	0.20
11	DWRB 101	2015	32.00	0.00	0.00	0.00	1.50	0.15	-1.35
12	VLB 118 (VL Jau 118)	2015	1.00	1.00	3.50	2.50	0.10	0.50	0.40
13	HUB 113 (Mahamana 113)	2014	40.00	40.00	40.20	0.20	1.00	1.05	0.05
14	BH 946	2014	20.90	20.90	7.00	-13.90	1.00	1.50	0.50
15	RD 2786	2013	50.00	50.00	33.40	-16.60	1.50	4.00	2.50
16	UPB 1008	2011	1.00	1.00	1.00	0.00	0.10	0.50	0.40
17	BH 902	2010	1.00	1.00	5.00	4.00	0.10	0.60	0.50
18	PL 807	2009	3.00	3.00	3.00	0.00	0.50	0.75	0.25
19	RD 2715	2009	3.00	3.00	36.00	33.00	0.10	0.10	0.00
20	BH 393	2002	53.35	53.35	33.50	-19.85	1.50	2.00	0.50
21	PL 426	1996	29.90	29.90	35.00	5.10	1.25	1.75	0.50
22	RD 2035	1994	34.20	34.20	63.10	28.90	1.25	2.00	0.75
23	RD 2052	1991	5.00	5.00	21.00	16.00	0.25	0.10	-0.15
24	PL 172	1987	4.40	4.40	4.40	0.00	0.20	1.00	0.80

Molecular diversity analysis of new entries in coordinated trials

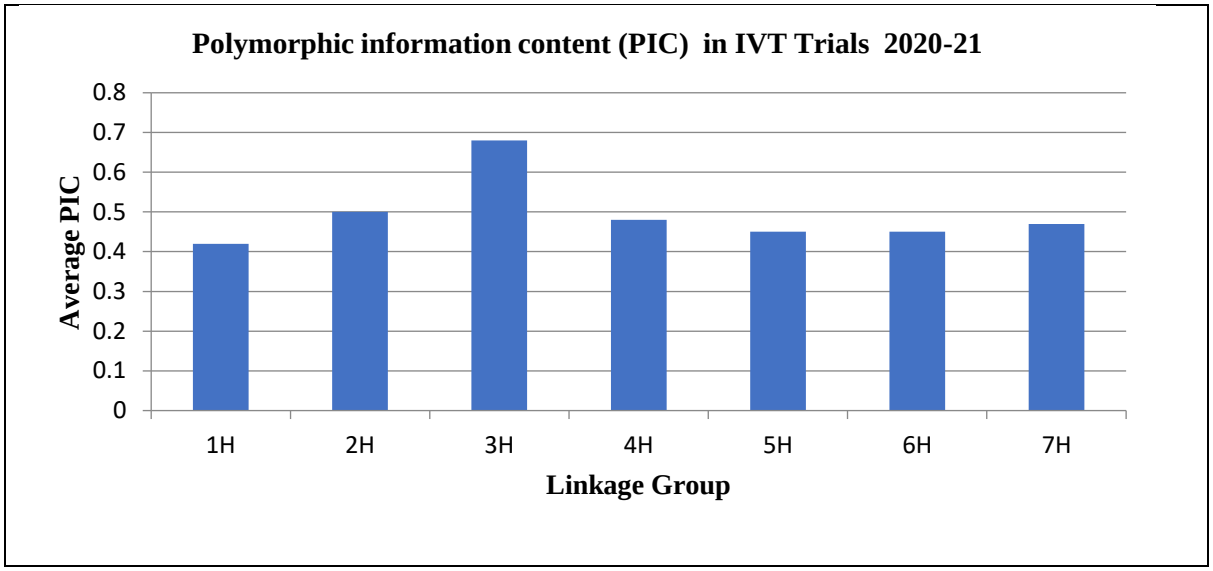
Barley coordinated trials entries and checks were characterized at molecular level to analyze genetic variability in all India coordinated barley improvement programme during 2020-2. Total 100 genotypes were screened with a set of 46 barley specific SSR/STS markers covering seven chromosomes to develop 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 95 alleles were scored for PCR based amplification profiles for screened genotypes. The number of alleles ranged from 1 to 4 with an average of 1.73 alleles per locus. The band fragment size varied from 90 bp to 1500 bp with PIC values ranging from 0.0 to 0.69 across molecular markers.

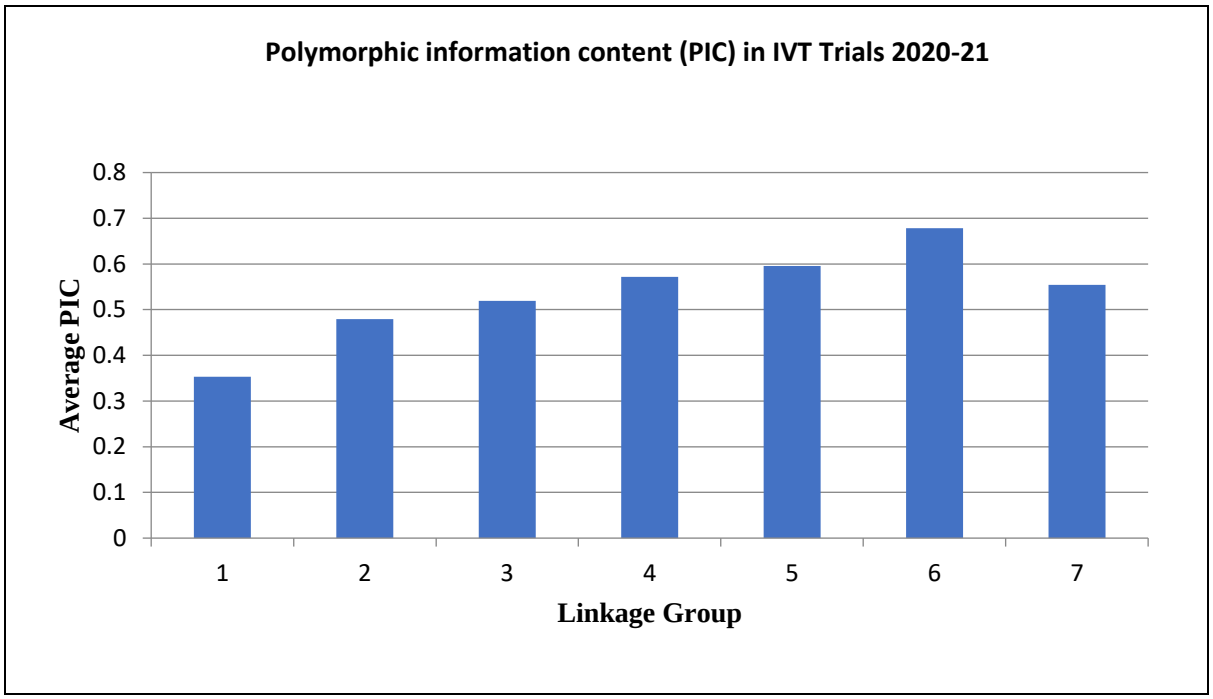
Allele molecular weight data of amplified profiles were converted to develop binary format (allele presence = "1" and allele absence = "0") for genetic diversity analysis with NTSYS-PC version 2.1. IVT and AVT trials were scored to develop two binary datasets and analyzed. The similarity matrix developed were used to construct dendrograms using Sequential Agglomerative Hierarchical Nesting (SAHN) based Unweighted Pair Group Method of Arithmetic Means (UPGMA) to infer genetic relationships. For estimating the similarity matrix, null alleles were treated as missing data to reduce the biased genetic or similarity measures. These genotypes were grouped within similarity coefficient (GS) value around 0.52 to 0.99 and showed sufficient genetic variability at molecular level.

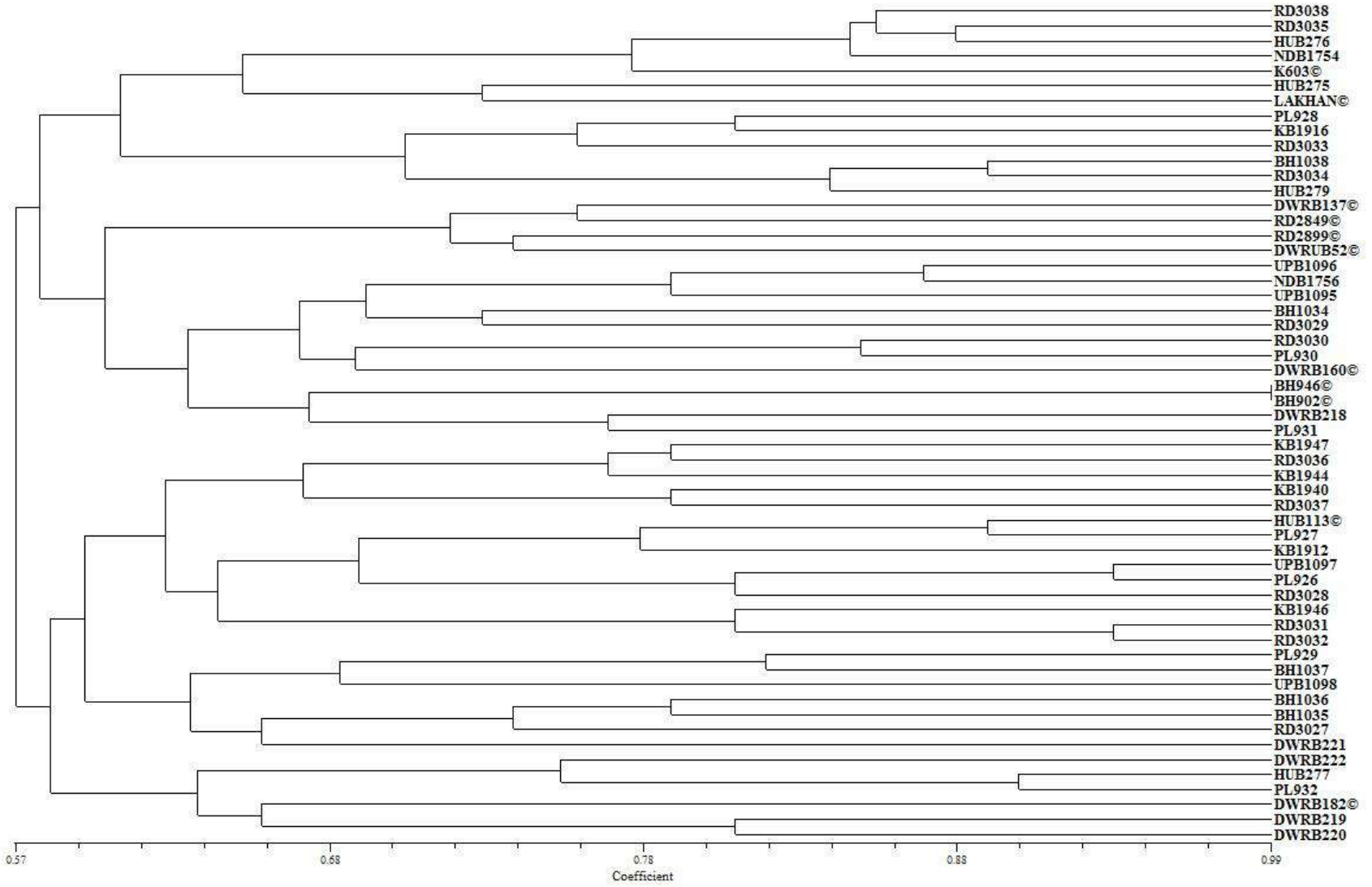
Molecular statistics were also evaluated for AVT and IVT trial level. In IVT trials, average PIC across seven linkage groups of barley varies from 0.41 to 0.69 and chromosome 3H was found most variable. The UPGMA based dendrogram generated distinguished entries at separate nodes within 0.57-.99 similarity coefficient (GS) value. For AVT trials, all entries except BHS483 and 484 were clearly distinguished at molecular level in UPGMA clustering in range of 0.55-.92 similarity coefficient. Average PIC across linkage groups varies from .36 to .69 for test entries and their respective check. For barley trials for 2020-21, all the test entries could be distinguished using screened markers.

In both dendrograms, all entries except BHS483 and BHS484 are placed at separate nodes thus distinguishing from their check lines, respectively. Entries KB1822 and KB1909 were not reported because of non-germination problem.

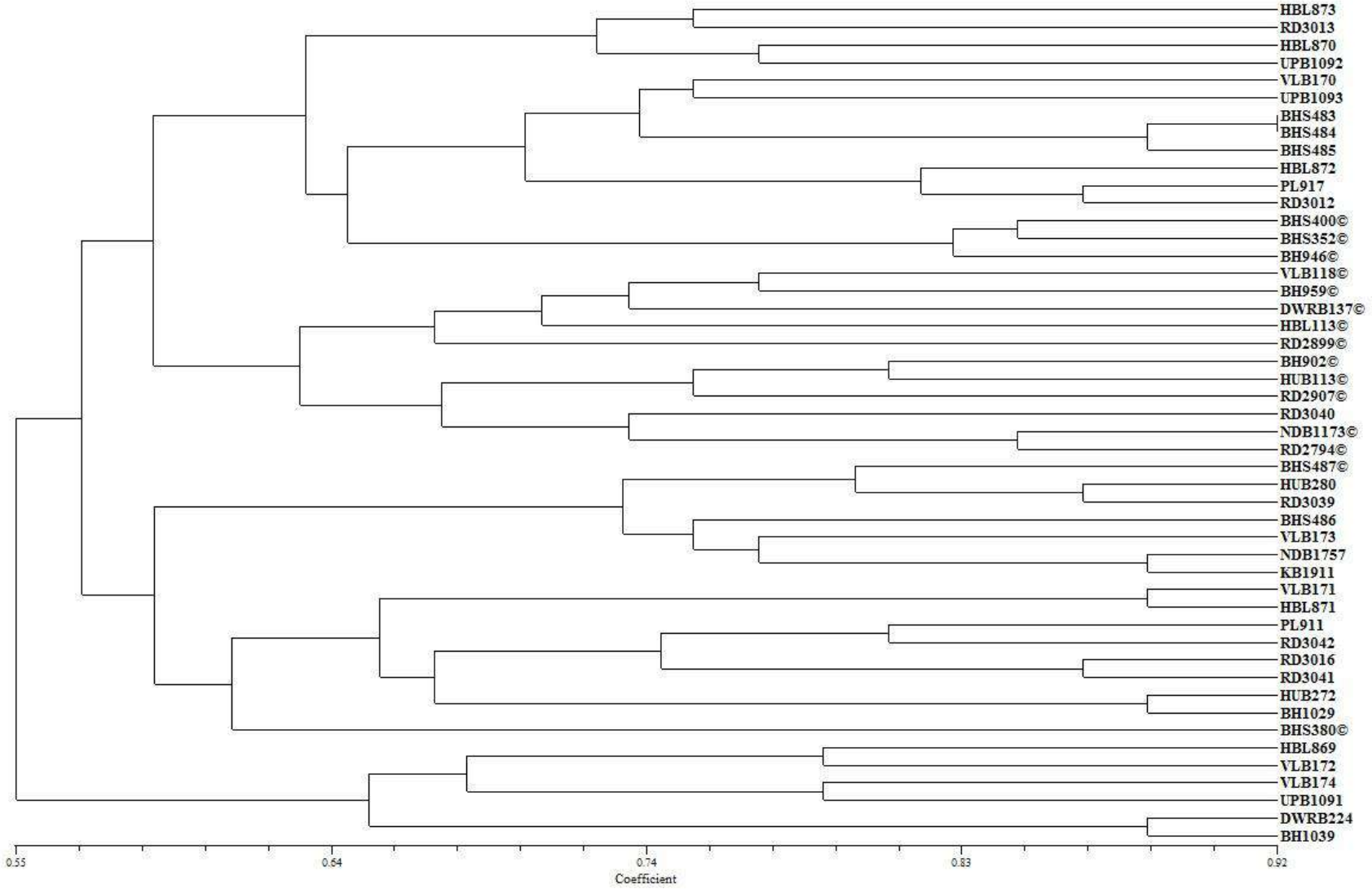
Molecular statistics were comparable with previous crop seasons AVT trials suggesting that genetic variability in barley improvement programme have been maintained. The eventual intend of this effort is to develop molecular markers-based amplification profiles for varietal characterization and to assess the level of genetic diversity in Indian barley.


Polymorphic information content (PIC) in IVT Trials 2020-21
Average PIC
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1H
2H
3H
4H
5H
6H
7H
Linkage Group


Polymorphic information content (PIC) in IVT Trials 2020-21
Average PIC
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
Linkage Group



UPGMA based clustering of Barley IVT trials 2020-21 based on molecular profiles of entries and check lines



UPGMA based clustering of Barley AVT trials 2020-21 based on molecular profiles of entries and check lines

Molecular Profiles of Barley Trials (2020-21)

Marker	Chr	CCSHAU, Hisar							ICAR-IARI RS, Shimla				
		BH1029	BH1034	BH1035	BH1036	BH1037	BH1038	BH1039	BHS483	BHS484	BHS485	BHS486	BHS487
Bmac154	1H	110	130	110	110	110	130	110	140	140	140	130	110
Bmac213	1H	168	180	168	168	180	180	155	155	155	155	168	180
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	110	126	110	110	110	126	126	126	110	110
MGB402	1H	240	260	240	240	260	240	240	260	260	260	260	260
ScSSR10477	1H	150	150	200	200	150	200	160	200	200	200	150	200
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	155	180	155	155	155	180	155	155	155	180	180
EBmac640	2H	190	176	176	176	176	190	176	190	190	190	176	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	125	125	125	125	125	125	149	149	149	149	149
EBmac623	2H	154	168	168	168	168	168	168	168	168	168	154	154
cMWG658	2H	580	600	580	580	600	600	580	600	600	600	600	580
Ebmatc39	2H	170	150	170	170	170	170	170	170	170	150	190	170
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	140	122	140	140	122	122	122	122	122	122	122	122
Bmag877	3H	153	153	165	153	153	165	165	153	153	153	165	165
Ebmac541	3H	140	140	140	140	120	140	140	120	106	106	140	140
MWG 847	3H	150	150	150	150	150	150	150	150	150	150	345	345
Bmag225	3H	165	165	165	165	185	165	140	165	165	140	185	140
HvLTPPB	3H	216	200	200	216	216	200	216	216	216	216	200	200
Bmag841	3H	115	125	115	115	115	125	125	115	125	125	115	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	160	160	160	150	150	150	150	150	150	160	160
HVM67	4H	136	126	136	126	136	126	126	136	126	126	136	136
HvMLOH1A	4H	175	185	175	175	175	185	175	185	185	185	185	185
Ksug10	4H	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	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	119	119	119	119	119	90	90	90	90	90	119

Bmag337	5H	165	145	145	145	145	145	145	145	165	165	145	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	NULL	167	167	167	157	147	167	157	157	167	157
GMS61	5H	145	135	135	135	135	145	135	135	135	135	135	145
Bmac303	5H	119	138	119	119	119	119	138	138	138	138	119	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	220	220	236	220	180	236	210	220	220	220	220
Bmac500	6H	150	150	110	150	110	150	150	150	150	150	150	190
GBM1215	6H	200	240	240	240	240	240	200	240	240	240	200	240
HVM11	6H	175	175	150	150	185	185	175	185	185	175	185	175
MWG2029	6H	260	245	260	260	245	260	260	245	260	245	260	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	140	140	155	140	140	140	140	140	140	140	140	155
Bmac162	7H	187	200	200	187	187	187	187	187	187	187	187	187
Bmac167	7H	184	195	195	184	184	184	184	195	184	195	195	184
Bmag110	7H	160	145	145	145	135	160	160	135	135	135	135	160

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

Marker	**Chr**	**ICAR-IIWBR, Karnal**						**CSKHPKV, RRS, Bajaura**					
		DWRB218	**DWRB219**	**DWRB220**	**DWRB221**	**DWRB222**	**DWRB224**	**HBL869**	**HBL870**	**HBL871**	**HBL872**	**HBL873**	
Bmac154	1H	140	130	130	110	110	110	110	140	130	140	130	
Bmac213	1H	155	155	155	180	155	155	155	180	180	155	155	
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	
Bmag579	1H	126	126	126	126	110	110	110	126	110	126	126	
MGB402	1H	260	260	240	240	240	240	260	240	240	260	240	
ScSSR10477	1H	150	140	160	150	140	160	160	200	200	160	140	
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	
Bmac175	2H	180	155	155	155	180	155	155	180	155	180	180	
EBmac640	2H	190	176	176	190	176	176	176	176	190	190	176	
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	
EBmac525	2H	125	125	125	125	125	125	149	149	149	149	149	
EBmac623	2H	154	154	168	154	154	168	168	154	154	154	168	
cMWG658	2H	580	600	580	600	600	600	600	580	600	600	600	
Ebmatc39	2H	190	190	190	150	150	170	190	190	190	170	190	

Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	
Bmag603	3H	140	140	140	140	122	122	140	122	122	122	122	
Bmag877	3H	165	153	153	153	153	153	165	153	165	153	153	
Ebmac541	3H	106	140	140	140	140	140	140	120	140	140	140	
MWG 847	3H	150	150	150	345	345	150	345	345	150	345	150	
Bmag225	3H	140	140	140	165	185	140	185	140	165	140	140	
HvLTPPB	3H	216	216	200	216	200	216	200	216	216	216	216	
Bmag841	3H	125	125	125	115	115	125	125	115	125	125	115	
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	
HVM40	4H	150	160	160	160	160	150	160	150	160	150	150	
HVM67	4H	126	126	126	126	136	126	126	136	126	126	126	
HvMLOH1A	4H	185	185	185	175	175	175	175	185	185	185	175	
Ksug10	4H	1500	1300	1300	1300	1500	1500	1500	1500	1300	1500	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	119	119	119	119	90	119	90	90	90	90	
Bmag337	5H	165	165	165	165	165	145	145	145	165	165	165	
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	
Bmag812	5H	147	157	157	157	157	147	167	147	167	157	147	
GMS61	5H	135	135	135	145	135	135	145	135	145	145	135	
Bmac303	5H	138	119	119	119	119	138	119	138	138	138	138	
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	
Bmac40	6H	220	236	220	236	236	236	210	220	210	220	220	
Bmac500	6H	190	150	150	190	110	150	150	110	150	150	110	
GBM1215	6H	200	200	200	240	200	200	240	240	240	240	240	
HVM11	6H	175	185	185	150	175	175	185	150	185	185	150	
MWG2029	6H	245	260	245	260	245	260	245	245	245	260	260	
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	
Bmac64	7H	140	140	155	140	140	140	140	140	155	140	140	
Bmac162	7H	200	200	187	200	200	187	200	187	200	187	187	
Bmac167	7H	195	195	184	195	195	184	184	195	195	184	184	
Bmag110	7H	160	135	135	160	160	160	135	145	160	135	145	

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

Marker	Chr	BHU, Varanasi						CSAU&T, Kanpur							
		HUB272	HUB275	HUB276	HUB277	HUB279	HUB280	KB1939	KB1911	KB1912	KB1916	KB1940	KB1944	KB1946	KB1947
Bmac154	1H	110	110	130	110	130	140	110	110	130	130	110	130	130	140
Bmac213	1H	168	155	168	155	180	155	180	168	168	155	168	180	155	180
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	126	126	110	126	110	126	126	126	110	110	110	110
MGB402	1H	240	240	260	260	240	260	260	260	240	240	260	240	240	240
ScSSR10477	1H	160	200	150	150	160	200	160	140	200	200	150	150	140	200
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	180	155	180	155	180	155	155	180	155	155	180	155	155
EBmac640	2H	190	190	190	176	190	190	190	190	176	190	176	176	176	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	149	149	125	125	125	125	125	125	125	149	149	125	149
EBmac623	2H	168	168	168	154	154	154	168	168	154	168	154	154	168	154
cMWG658	2H	580	580	580	580	600	580	580	600	580	580	580	580	600	580
Ebmatc39	2H	150	190	190	190	190	170	150	190	150	190	150	150	150	150
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	140	122	140	122	140	122	140	122	122	140	122	122	122	140
Bmag877	3H	153	NULL	165	153	165	165	165	165	165	153	153	153	153	165
Ebmac541	3H	140	120	140	106	140	140	120	140	120	120	140	140	120	120
MWG 847	3H	150	150	150	150	345	345	345	345	345	345	345	345	345	345
Bmag225	3H	165	165	185	140	165	140	185	140	165	140	165	185	165	185
HvLTPPB	3H	216	200	200	200	200	200	216	200	216	200	216	216	216	216
Bmag841	3H	115	115	115	115	125	115	125	115	225	225	115	115	115	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	160	150	160	150	160	150	160	150	150	150	150	160	160
HVM67	4H	136	126	126	136	136	136	136	136	136	136	136	136	126	136
HvMLOH1A	4H	175	185	185	175	185	175	185	175	185	175	185	185	175	185
Ksug10	4H	1500	1500	1500	1300	1500	1300	1500	1300	1500	1500	1500	1500	1500	1500
MWG634	4H	800	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	161
Bmag353	4H	119	90	90	119	119	119	119	119	119	90	119	90	119	90

Bmag337	5H	165	165	145	165	165	165	165	165	145	145	165	165	165	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	167	157	157	157	167	167	167	167	157	157	157	157	147
GMS61	5H	145	145	135	135	145	145	145	135	135	145	135	135	145	135
Bmac303	5H	119	138	138	119	119	138	119	138	119	138	138	138	119	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	210	180	210	NULL	210	236	236	210	210	236	220	210	236	220
Bmac500	6H	110	150	150	110	190	NULL	150	150	150	150	150	110	150	150
GBM1215	6H	200	240	240	200	240	240	200	240	200	240	240	240	200	240
HVM11	6H	175	185	175	175	185	175	185	175	185	185	185	175	175	175
MWG2029	6H	260	245	260	245	260	245	245	245	260	260	260	245	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	155	155	140	140	155	155	140	140	140	155	140	155	140
Bmac162	7H	187	187	200	200	187	187	200	187	187	200	187	187	187	187
Bmac167	7H	184	195	195	195	184	195	195	184	195	184	184	195	184	184
Bmag110	7H	160	160	160	135	160	135	145	135	145	160	145	145	160	145

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

Marker	**Chr**	**NDUA&T, Faizabad**			**PAU, Ludhiana**								
		NDB1757	**NDB1754**	**NDB1756**	**PL911**	**PL917**	**PL926**	**PL927**	**PL928**	**PL929**	**PL930**	**PL931**	**PL932**
Bmac154	1H	130	110	110	130	140	140	140	130	NULL	140	140	110
Bmac213	1H	168	168	180	180	155	155	168	155	180	155	180	155
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	110	110	110	110	126	110	110	126	126	126
MGB402	1H	260	260	260	240	240	240	240	240	260	260	260	260
ScSSR10477	1H	140	150	150	140	160	160	200	160	150	150	200	160
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	155	155	155	180	180	155	180	180	180	155	180
EBmac640	2H	190	190	190	190	190	176	176	190	190	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	149	125	125	125	125	125	125	125	125	125	125
EBmac623	2H	154	168	154	168	154	154	154	168	168	168	154	154
cMWG658	2H	580	580	600	580	600	580	580	580	600	600	600	580
Ebmatc39	2H	190	170	150	150	190	150	150	190	190	170	170	170

Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	140	122	140	122	122	122	140	122	122	140	122
Bmag877	3H	165	165	165	153	165	165	165	165	165	165	165	153
Ebmac541	3H	140	120	140	106	120	120	20	120	120	140	106	106
MWG 847	3H	345	150	150	150	345	150	345	345	345	345	345	150
Bmag225	3H	140	165	185	NULL	140	165	140	165	165	165	140	140
HvLTPPB	3H	200	200	200	200	216	216	216	200	216	200	216	200
Bmag841	3H	115	115	225	115	115	125	225	225	115	125	125	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	160	150	160	150	150	160	150	150	150	150	150	160
HVM67	4H	136	126	126	136	126	136	126	136	126	126	136	136
HvMLOH1A	4H	175	185	185	185	175	185	185	185	175	185	185	175
Ksug10	4H	1300	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	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	119	119	119	119	119	90	119	119	119	119
Bmag337	5H	165	145	165	165	145	145	165	145	145	165	165	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	167	167	167	157	157	157	157	167	167	167	167
GMS61	5H	145	135	135	135	135	145	135	135	135	135	135	135
Bmac303	5H	138	138	138	138	119	138	119	138	119	119	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	220	210	220	236	220	236	220	220	220	220	236	236
Bmac500	6H	NULL	150	190	110	110	110	150	110	110	190	190	110
GBM1215	6H	240	240	240	240	240	240	200	240	240	240	200	200
HVM11	6H	175	175	185	185	185	150	150	175	185	175	175	175
MWG2029	6H	245	245	260	260	245	245	260	260	245	260	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	155	155	140	140	140	140	140	140	140	140	140
Bmac162	7H	187	200	187	200	200	187	200	200	187	187	187	200
Bmac167	7H	184	195	195	184	195	195	195	184	195	184	184	184
Bmag110	7H	135	160	145	160	135	0	145	160	135	135	160	135

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

Marker	Chr	SKNAU, RARI, Durgapura												
		RD3012	RD3013	RD3016	RD3027	RD3028	RD3029	RD3030	RD3031	RD3032	RD3033	RD3034	RD3035	RD3036
Bmac154	1H	140	110	110	110	140	130	130	130	130	130	130	130	140
Bmac213	1H	155	180	168	168	155	168	155	168	168	155	180	168	180
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	110	126	110	110	110	126	126	110	110	110	110	126	110
MGB402	1H	260	240	240	240	240	260	260	240	240	240	240	260	240
ScSSR10477	1H	160	140	200	130	NULL	150	150	140	140	160	160	150	150
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	180	180	180	180	155	180	180	155	155	155	NULL	180	180
EBmac640	2H	190	176	190	190	176	190	190	176	176	190	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	125	125	125	125	125	125	125	125	125	125	125	149	149
EBmac623	2H	168	168	168	154	154	168	168	154	154	168	168	168	154
cMWG658	2H	600	580	600	600	580	580	600	580	580	600	600	580	580
Ebmatc39	2H	190	150	190	150	150	170	190	150	150	170	170	190	150
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	140	140	140	122	140	140	140	140	140	140	140	140
Bmag877	3H	0	153	165	153	153	153	165	153	153	153	165	165	165
Ebmac541	3H	120	140	NULL	120	140	140	140	140	140	106	140	120	140
MWG 847	3H	345	345	150	150	345	150	345	345	345	150	150	150	345
Bmag225	3H	140	185	165	185	165	140	185	185	185	165	165	165	165
HvLTPPB	3H	216	216	200	200	216	200	200	216	216	200	200	200	216
Bmag841	3H	115	115	115	115	125	125	125	115	115	225	125	115	125
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	150	160	160	160	160	150	160	160	150	150	150	150
HVM67	4H	126	126	136	136	136	126	126	126	136	136	136	126	126
HvMLOH1A	4H	175	185	175	175	185	185	185	175	175	175	185	185	185
Ksug10	4H	1500	1500	1300	1500	1500	1500	1500	1500	1500	1500	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	119	119	90	119	90	90
Bmag337	5H	145	145	165	145	145	165	145	145	145	165	165	145	165
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189

Bmag812	5H	167	167	167	167	157	147	167	157	157	157	157	167	147
GMS61	5H	135	145	135	135	135	135	135	145	145	135	145	135	135
Bmac303	5H	119	119	138	119	119	138	119	119	119	138	119	138	138
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	220	220	236	236	NULL	210	220	210	210	180	210	220
Bmac500	6H	110	150	150	190	110	150	190	150	150	150	150	150	110
GBM1215	6H	240	240	240	240	240	200	240	200	200	240	240	240	240
HVM11	6H	185	185	175	150	150	175	175	175	175	150	185	175	175
MWG2029	6H	245	260	245	260	245	245	260	245	245	260	260	260	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	NULL	167
Bmac64	7H	140	155	140	140	140	140	140	140	140	140	140	155	155
Bmac162	7H	200	187	200	187	200	187	187	187	187	200	187	200	187
Bmac167	7H	184	184	184	184	184	184	195	184	195	184	184	184	195
Bmag110	7H	135	145	160	145	145	160	135	160	160	135	160	160	145

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

Marker	**Chr**	**SKNAU, RARI, Durgapura**						**GBPUA&T, Pantnagar**						
		RD3037	**RD3038**	**RD3039**	**RD3040**	**RD3041**	**RD3042**	**UPB1091**	**UPB1092**	**UPB1093**	**UPB1095**	**UPB1096**	**UPB1097**	**UPB1098**
Bmac154	1H	110	130	140	130	110	110	130	130	140	110	110	140	110
Bmac213	1H	168	168	168	155	180	180	155	180	155	180	180	168	168
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	110	126	126	126	110	110	110	126	126	110	110	110	126
MGB402	1H	260	260	260	240	240	240	260	240	260	260	260	240	240
ScSSR10477	1H	140	150	200	150	200	200	150	160	160	150	150	160	160
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	155	155	155	180	155	180	180	155	155	180	180	180
EBmac640	2H	176	190	190	176	190	190	176	190	190	190	190	176	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	149	125	125	125	125	149	149	149	125	125	125	149
EBmac623	2H	154	168	154	154	168	154	168	168	168	154	168	154	168
cMWG658	2H	580	580	580	580	600	580	600	580	600	600	580	580	580
Ebmatc39	2H	190	190	170	170	190	190	150	170	170	170	150	150	190
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	140	122	122	140	140	140	122	140	140	122	122	122

Bmag877	3H	153	165	165	153	153	153	165	153	153	165	165	165	165
Ebmac541	3H	140	120	106	140	140	120	140	140	140	140	140	120	140
MWG 847	3H	345	150	345	345	150	150	150	345	345	150	150	150	345
Bmag225	3H	165	165	165	165	165	165	185	140	140	185	185	185	165
HvLTPPB	3H	216	200	200	216	200	200	200	216	216	200	200	216	200
Bmag841	3H	125	115	115	125	115	115	115	125	115	225	225	125	115
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	150	160	150	150	150	150	150	160	160	160	160	150
HVM67	4H	126	136	136	126	136	136	126	126	136	126	126	136	126
HvMLOH1A	4H	175	175	175	175	175	185	185	185	185	185	185	185	175
Ksug10	4H	1300	1500	1300	1500	1300	1500	1500	1500	1500	1500	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	90	90	90	119	119	119	119
Bmag337	5H	165	145	165	165	165	165	145	165	145	165	165	145	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	147	167	167	167	167	167	157	167	167	167	167	157	167
GMS61	5H	135	135	145	135	145	145	135	145	145	135	135	145	145
Bmac303	5H	138	138	138	138	138	138	138	138	138	138	138	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	180	210	236	236	220	220	210	210	210	210	236	236	236
Bmac500	6H	150	150	190	150	150	110	190	150	150	150	150	110	190
GBM1215	6H	240	240	240	240	240	240	200	240	200	240	240	240	240
HVM11	6H	150	150	175	175	175	185	175	185	175	185	185	150	185
MWG2029	6H	260	260	245	260	245	260	260	260	260	245	260	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	155	155	140	140	155	155	140	140	140	155	140	140
Bmac162	7H	187	200	187	200	200	200	187	200	187	187	200	200	187
Bmac167	7H	195	195	184	184	184	195	195	184	195	184	195	195	195
Bmag110	7H	145	160	135	160	160	160	145	135	135	145	145	145	135

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

Marker	Chr	ICAR-VPKAS, Almora					Checks							
		VLB170	VLB171	VLB172	VLB173	VLB174	BH902©	BH946©	BH959©	BHS352	BHS380	BHS400	DWRUB52	DWRB137
Bmac154	1H	140	130	110	130	130	130	140	130	140	130	140	130	130
Bmac213	1H	180	180	155	168	155	168	180	155	168	180	168	180	168
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	110	110	110	110	126	126	126	126	126	126	126	126
MGB402	1H	260	240	240	260	260	260	260	260	240	240	240	260	260
ScSSR10477	1H	200	150	NULL	140	NULL	140	150	150	150	200	150	150	140
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	155	155	180	155	180	155	180	155	180	155	180	180	180
EBmac640	2H	176	190	176	176	176	190	190	190	190	176	190	190	176
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	149	149	149	149	149	125	149	149	149	149	149	149
EBmac623	2H	168	154	168	168	154	168	168	154	168	154	154	168	154
cMWG658	2H	600	600	580	580	600	600	600	580	600	580	600	600	580
Ebmatc39	2H	170	190	150	190	170	170	170	150	170	170	170	150	150
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274	274
Bmag603	3H	122	122	140	122	140	140	122	140	140	140	140	122	122
Bmag877	3H	165	153	153	165	165	165	165	165	165	165	165	153	165
Ebmac541	3H	140	140	140	120	106	106	106	120	106	140	106	120	106
MWG 847	3H	345	345	345	345	150	345	345	345	345	150	345	345	345
Bmag225	3H	140	165	185	165	140	165	185	185	185	185	185	185	185
HvLTPPB	3H	216	216	200	200	200	216	216	216	216	216	216	216	216
Bmag841	3H	115	125	125	115	115	115	115	115	125	115	115	125	125
ABG500	4H	189	189	189	189	189	189	189	189	189	189	189	189	189
HVM40	4H	150	160	160	160	150	150	160	160	150	160	160	150	160
HVM67	4H	136	126	126	136	136	126	126	136	126	136	126	136	136
HvMLOH1A	4H	185	185	175	185	185	175	175	185	175	175	175	185	185
Ksug10	4H	1500	1500	1500	1500	1500	1300	1500	1500	1500	1500	1500	1300	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	90	90	119	90	90	90	119	90	119	90	119	119	119
Bmag337	5H	145	145	145	145	145	145	165	145	145	145	145	165	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189	189

Bmag812	5H	147	167	147	167	157	167	167	167	157	147	157	157	167
GMS61	5H	145	145	145	145	135	145	145	145	135	145	135	145	145
Bmac303	5H	138	138	119	119	138	138	119	119	119	138	138	119	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	220	210	210	210	220	210	220	236	NULL	220	220	210	236
Bmac500	6H	110	190	150	110	150	150	190	190	150	190	150	190	190
GBM1215	6H	240	240	240	200	200	240	200	240	240	240	200	200	240
HVM11	6H	185	185	185	150	175	175	150	175	185	175	185	150	150
MWG2029	6H	245	260	245	260	260	245	245	260	245	260	245	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	155	140	140	155	155	155	155	155	155	155	140	140
Bmac162	7H	187	200	200	200	187	200	200	200	187	200	187	200	200
Bmac167	7H	195	184	195	184	195	195	184	195	184	195	184	195	195
Bmag110	7H	160	160	135	135	145	145	145	145	160	160	160	145	184

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

Marker	**Chr**	**Checks**											
		DWRB160	**DWRB182**	**HBL113**	**HUB113**	**LAKHAN**	**K603**	**NDB1173**	**RD2794**	**RD2849**	**RD2899**	**RD2907**	**VLB118**
Bmac154	1H	130	130	130	130	140	110	130	130	130	130	140/130	130
Bmac213	1H	180	155	168	155	155	155	180	180	180	168	180	168
Bmag382	1H	109	109	109	109	109	109	109	109	109	109	109	109
Bmag579	1H	126	126	126	126	110	126	126	126	126	126	126	126
MGB402	1H	260	260	260	260	240	260	260	260	260	240	240	240
ScSSR10477	1H	140	150	150	150	200	160	150	150	150	150	150	140
HvHVA1	1H	136	136	136	136	136	136	136	136	136	136	136	136
Bmac175	2H	180	180	180	155	155	180	155	180	180	180	180	155
EBmac640	2H	190	190	176	190	190	190	190	190	190	190	190	190
Bmag15	2H	181	181	181	181	181	181	181	181	181	181	181	181
EBmac525	2H	149	149	149	149	149	149	149	149	149	149	149	149
EBmac623	2H	168	154	154	168	168	168	154	154	154	154	168	154
cMWG658	2H	580	580	580	600	600	580	580	600	580	580	600	580
Ebmatc39	2H	170	170	190	190	150	170	170	150	150	150	150	170
Bmag006	3H	274	274	274	274	274	274	274	274	274	274	274	274

Bmag603	3H	122	140	140	140	140	140	122	122	122	140	140	140
Bmag877	3H	165	165	153	153	165	153	153	165	165	153	165	153
Ebmac541	3H	106	106	106	106	140	140	106	106	140	140	120	106
MWG 847	3H	345	345	345	345	345	150	345	345	345	345	345	345
Bmag225	3H	185	165	165	165	165	185	165	165	185	140	165	185
HvLTPPB	3H	200	200	216	216	216	200	216	216	216	216	216	216
Bmag841	3H	125	125	115	115	115	115	125	125	125	125	115	115
ABG500	4H	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	160
HVM67	4H	136	126	126	126	136	126	126	126	136	136	126	136
HvMLOH1A	4H	185	175	185	175	185	185	175	175	185	185	175	175
Ksug10	4H	1500	1300	1500	1500	1500	1500	1300	1500	1300	1500	1300	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	90	90	119	90	90	90	90	90	119	119	119
Bmag337	5H	165	145	145	145	165	145	145	145	145	165	145	145
Bmag751	5H	189	189	189	189	189	189	189	189	189	189	189	189
Bmag812	5H	167	157	157	147	157	167	157	147	167	167	167	167
GMS61	5H	145	135	135	145	145	135	145	145	145	145	145	145
Bmac303	5H	138	119	138	119	138	138	119	138	138	138	138	119
ABG458	6H	248	248	248	248	248	248	248	248	248	248	248	248
Bmac40	6H	236	210	236	236	210	210	236	210	236	210	210	180
Bmac500	6H	150	150	190	150	150	190	190	150	190	190	190	190
GBM1215	6H	240	200	240	240	240	240	240	200	200	240	240	200
HVM11	6H	175	175	175	175	185	175	175	175	175	150	150	185
MWG2029	6H	245	245	245	245	245	245	245	245	245	245	245	245
ABC15864	7H	167	167	167	167	167	167	167	167	167	167	167	167
Bmac64	7H	155	140	155	155	140	155	155	140	155	140	155	140
Bmac162	7H	187	187	187	200	187	200	200	200	200	200	200	200
Bmac167	7H	184	184	184	195	195	195	195	195	195	195	195	184
Bmag110	7H	135	135	135	135	160	160	135	135	145	135	135	160

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

Molecular Markers Used for generating molecular profiles of Barley Trails (2020-21)

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	1 cycle of 3 min @ 94C, 1 min @ 58C, 1 min @ 72C, 30 cycles of 30 secs @ 94C, 30 secs @
			CTATGAGAGGTAGAGCAGCC	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 entries in AICRP Trials 2020-21

Development of Molecular profiles: An equal number of fresh, young leaves (ten days old) of five plants from each of AVT were bulked for DNA extraction. Total genomic DNA was isolated using the modified CTAB method (Saghai-Maroof *et al*, 1984). A set of 46 SSR/STS molecular markers covering whole genome of barley was used to develop amplification profiles of genotypes. PCR reaction was conducted in reaction volume of 10 ul containing 1X PCR buffer. 200 m M dNTPs, 0.25 uM of primer, 2Mm mgcl2, 1 unit Taq polymerase and 50 ng template DNA . PCR amplification was performed using 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 'null' 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).

BARLEY CROP PROTECTION

Summary

- The field surveys were 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. The crops were also experiencing force maturity due sudden rising of day temperature in the areas.
- 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 population was found to be moderate to high in barley fields. Among natural enemies, coccinellid beetles, chrysoperla and syrphid fly were frequently noticed predating on barley aphids.
- Total 514 entries consisting 383, 108 and 23 entries in different nurseries IBDSN, NBDSN and EBDSN, respectively, were screened for resistance against various diseases, aphid and CCN at different cooperating centers during the crop season 2020-21.
- Out of 383 entries in IBDSN from different breeding centers, 30 entries were found free from yellow rust (ACI = 0) and 234 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 38 entries were found moderately resistant against leaf blight with an average score of 14-35 and HS < 57 in double digit scoring system.
- A total 108 entries evaluated in NBDSN, 7 entries found free from yellow rust, 89 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 9 entries showed moderate level of resistance resistant with an average score (double digit) 14-35 and HS < 57.
- Among 23 EBDSN entries, 3 found free from yellow rust, whereas 19 shown resistant reaction. The 3 entries also showed moderate level of resistance against leaf blight with an average score 14-35 and HS < 57.
- In seedling rust resistance evaluation, out of 108 lines of NBDSN, none of the lines was resistant to all three rusts of barley. Four lines were resistant to both leaf and stripe rust pathotypes/isolates whereas one line DWRB182 was resistant to stripe and stem rust pathotypes. In addition, 17 lines each was resistant to stripe and leaf rust pathotypes only. Resistance to all the pathotypes of *P. graminis tritici* was observed only in DWRB182.
- Twenty-three EBDSN lines were evaluated under SRT and resistance to all three rusts was not recorded in any line. However, 2 lines were resistant to leaf and stripe rusts and one was found resistant to all the pathotypes of leaf and stem rust pathogens. Resistance to all the pathotypes/isolates of *Puccinia striiformis hordei* and *P. hordei* rusts was observed in 7 and 4 lines, respectively.
- Among five different fungicidal treatments, two sprays of Tebuconazole 50% + Trifloxystrobin 25% WG @ of 0.06% was found most effective in management of yellow rust.
- A total of 108 barley NBDSN entries including checks were screened against foliar aphid, on the basis of average score of five location entries viz.,16 entries BH1029, BH1039, DWRB219, DWRB220, NDB1752, PL911, PL917, PL927, RD3031, RD3032, RD3041, RD3042, BH902(C), BH946 (C), DWRB137(C) and HUB113(C) were scored below 4.0 scale.
- A total of eight chemical were tested for their efficacy against foliar aphid in barley. Treatment of Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon)@ 400 ml/ha was found the best treatment followed by Sulfoxaflor 12 % SC @250 ml/ha in managing aphid population in barley.
- A total 108 entries of NBDSN and 23 of EBDSN were screened against the Cereal Cyst Nematode (CCN) at three locations viz. Durgapura, Ludhiana and Hisar. Most of the entries fall in the category of susceptible or highly susceptible.

BARLEY CROP PROTECTION

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 field of district Jaipur (Bassi) and Dausa (Bhandarej, Lawan, Sikandra & Kalakho areas on 24th January, 2020. The crop was at tillering stage. None of the rust was observed. Overall, the barley crop was healthy in the surveyed areas. The second survey was conducted on 10th & 11th February, 2021 in the areas of Jaipur and Dausa districts. 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 of village Bassi, Tunga, Deedwana, Ramgarh, and Salempura of district Dausa and Kanwarpura, Kansali, Paniyala, Paota and Shapura areas of district Jaipur. The third survey was conducted on 10th and 13th March, 2021 in the Bassi and Chomu areas of district Jaipur respectively. The crop has attained the maturity. None of the rust was observed; however, incidence of loose smut was noted 2 to 9 percent and covered smut & leaf stripe diseases were noted *in traces* to 2 percent in some fields of village Rampura, Chomu, Faliyawas and Uthgadha in variety RD 2794. Bacterial streak disease was also noted in traces to 5 percent in some fields of village Uthgadha (Chomu) in variety RD 2786. The crops were also experiencing force maturity due sudden rising of day temperature in the areas.

Incidence of barley rusts and pathotype distribution during 2020-21

There was insignificant incidence of barley rusts in India during 2020-21. Only a few sporadic incidents of barley stripe rust were reported from Northern India and Rajasthan. There was no report of stem and leaf rusts of barley from the farmer's fields.

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 2020-21.

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 514 barley breeding lines were screened during the crop season 2020-21 under various nurseries (IBDSN, NBDSN and EBDSN) for resistance against various diseases, aphid and CCN at different cooperating centers. There were 383 entries under IBDSN, 108 were for NBDSN and 23 for EBDSN (Fig. 1). Seedling Resistance Test (SRT) for NBDSN and EBDSN entries was conducted at DWR Regional station, Shimla.

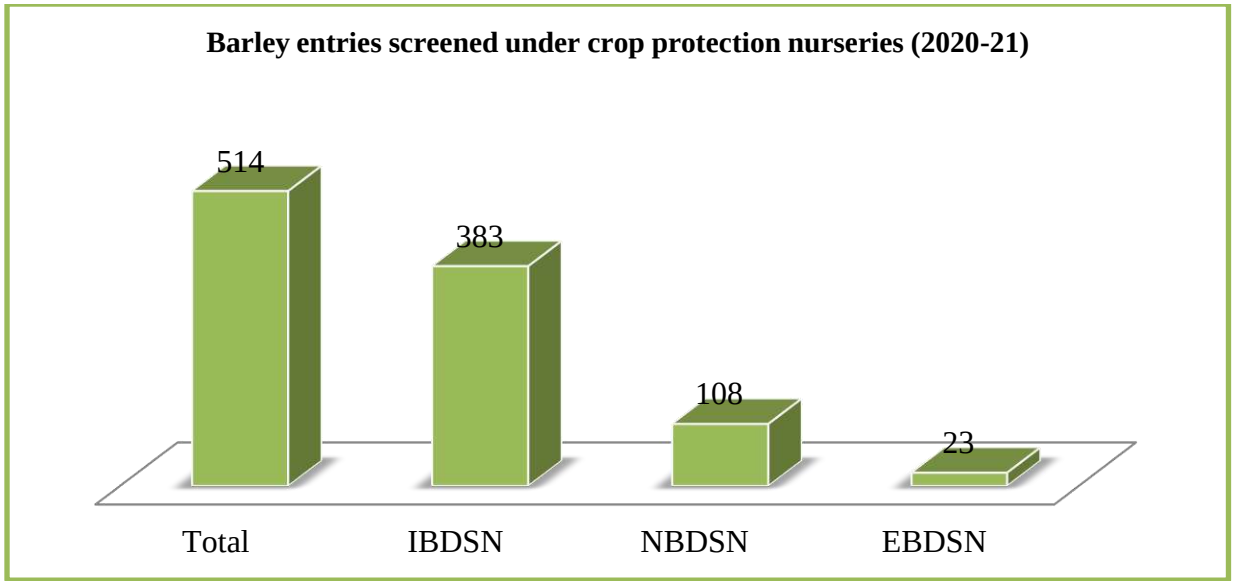


Fig.1: Barley entries screened under crop protection nurseries (2020-21)

Besides the screening of barley germplasm for disease resistance, experiments on chemical control of yellow were conducted at various locations to evaluate the efficacy of various fungicides for management of yellow rust. NBDSN entries were also screened for aphid at five locations viz., Kanpur, Ludhiana and Karnal and for CCN resistance at three locations Ludhiana, Hisar, and Durgapura.

Initial Barley Disease Screening Nursery (IBDSN) 2020-21

During the season 2020-21 a total 383 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. During the season the weather remained unfavorable and at some centers disease severity remained low, therefore yellow rust screening data from Karnal and Almora center was not considered. The screening for leaf blight was done at Pantnagar, Varanasi, Kanpur and Faizabad. The blight score at Varanasi center was too high hence score at II dough stage was 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 up to 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 2020-21 (Table 1), 30 entries were found free from yellow rust (ACI = 0) and 234 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 38 entries were found moderately resistant against leaf blight with an average score (double digit) 14-35 and HS < 57.

Yellow rust, ACI = 0, Entries – 30	BK 2024, BK 2029, BK 2055, BD 1882, BD 1883, BD 1891, BD 1897, BD 1902, BD 1908, HUBL 2023, PKB 2031, NDB 1799, UPBM 11, BL 1865, BL 2083, BL 2088, BL 2092, BL 2095, BL 2102, BL 2105, HB 2001, HB 2004, HB 2005, HB 2007, HB 2008, HB 2009, BBM 861, BBM 868, BBM 888, BBM 890

Yellow rust, ACI > 0 to 10, Entries – 234	BK 2002, BK 2003, BK 2004, BK 2005, BK 2008, BK 2009, BK 2010, BK 2011, BK 2012, BK 2013, BK 2014, BK 2018, BK 2019, BK 2020, BK 2025, BK 2026, BK 2028, BK 2030, BK 2037, BK 2042, BK 2043, BK 2044, BK 2045, BK 2046, BK 2047, BK 2048, BK 2050, BK 2051, BK 2052, BK 2053, BK 2054, BK 2056, BK 2057, BK 2058, BK 2059, BK 2060, BK 2061, BK 2062, BK 2063, BK 2064, BD 1871, BD 1872, BD 1873, BD 1874, BD 1875, BD 1876 ,BD 1877, BD 1878, BD 1879, BD 1880, BD 1881, BD 1884, BD 1885, BD 1886, BD 1887, BD 1888, BD 1889, BD 1890, BD 1892, BD 1893, BD 1895, BD 1898, BD 1899, BD 1900, BD 1901, BD 1903, BD 1904, BD 1905, BD 1906, BD 1907, BD 1909, BD 1910, HUBL 2009, HUBL 2010, HUBL 2018, HUBL 2021, HUBL 2024, HUBL 2026, HUBL 2027, HUBL 2029, PKB 2004, PKB 2007, PKB 2008, PKB 2015, PKB 2018, PKB 2019, PKB 2021, PKB 2022, PKB 2024, PKB 2030, VB 2001, VB 2002, VB 2003, VB 2004, VB 2006, VB 2007, VB 2008, VB 2009, VB 2010, VB 2011, VB 2012, VB 2017, VB 2018, VB 2020, VB 2021, VB 2022, VB 2024, VB 2026, VB 2027, VB 2028, VB 2029, NDB 1782, NDB 1783, NDB 1784, NDB 1789, NDB 1793, NDB 1800, UPBM 2, UPBM 3, UPBM 4, UPBM 7, UPBM 8, UPBM 13, UPBM 18, BH 2002, BH 2003, BH 2004, BH 2005, BH 2006, BH 2007, BH 2008, BH 2009, BH 2010, BH 2011, BH 2012, BH 2013, BH 2014, BH 2015, BH 2016, BH 2017, BH 2018, BH 2019, BH 2020, BH 2021, BH 2022, BH 2023, BH 2024, BH 2025, BH 2026, BH 2027, BH 2028, BH 2029, BH 2030, BH 2031, BH 2032, BH 2034, BH 2035, BH 2036, BH 2037, BH 2038, BH 2040, BL 1813, BL 1821, BL 1846, BL 1849, BL 1852, BL 1854, BL 1857, BL 1863, BL 1864, BL 1909, BL 1926, BL 1932, BL 1948, BL 1953, BL 1954, BL 1959, BL 1962, BL 1980, BL 1981, BL 1985, BL 1986, BL 1988, BL 1996, BL 2017, BL 2022, BL 2023, BL 2079, BL 2086, BL 2087, BL 2096, BL 2099, HB 2002, HB 2003, HB 2006, HB 2010, HB 2011, HB 2012, HB 2013, HB 2014, HB 2015, HB 2016, HB 2017, HB 2018, HB 2019, HB 2020, HB 2021, BBM 862, BBM 863, BBM 864, BBM 865, BBM 866, BBM 867, BBM 869, BBM 870, BBM 872, BBM 873, BBM 874, BBM 875, BBM 877, BBM 878, BBM 879, BBM 880, BBM 881, BBM 882, BBM 883, BBM 884, BBM 885, BBM 886, BBM 889, BBM 891, BBM 892, BBM 893, BBM 894
Leaf blight, Avg. 14-35 with HS < 57, Entries - 38	BK 2001, BK 2003, BK 2008, BK 2009, BK 2010, BK 2012, BK 2027, BK 2042, BK 2063, BD 1901, HUBL 2003, PKB 2002, PKB 2013, PKB 2016, PKB 2017, PKB 2018, PKB 2035, VB 2008, VB 2009, NDB 1783, NDB 1788, UPBM 9, UPBM 10, BH 2002, BH 2010, BH 2024, BH 2025, BH 2026, BH 2028, BH 2031, BH 2036, BH 2038, BL 1864, BL 1865, BL 1954, BL 1980, BL 1981, BL 1996

Table 1: Reactions of different entries of barley in Initial Barley Disease Screening Nursery (IBDSN), 2020-21

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
IIWBR, Karnal					
1	BK 2001	10.3	20S	34	56
2	BK 2002	6	10S	35	68
3	BK 2003	1.3	5S	35	57
4	BK 2004	2.5	10S	46	78
5	BK 2005	5	20S	36	69
6	BK 2006	12.9	30S	46	89
7	BK 2007	10.2	20S	36	57
8	BK 2008	2.5	10S	35	46
9	BK 2009	2.5	10S	35	57
10	BK 2010	4.5	10S	34	46
11	BK 2011	7.3	20S	45	89
12	BK 2012	6.3	20S	35	47
13	BK 2013	1.3	5S	46	68
14	BK 2014	2.1	10MS	36	57
15	BK 2015	25.2	80S	46	67
16	BK 2016	17.5	60S	68	99
17	BK 2017	10.3	40S	78	99
18	BK 2018	5.3	20S	47	78
19	BK 2019	2.6	10S	47	78
20	BK 2020	2.6	10S	47	78
20A	Infector	80	100S	67	78
21	BK 2021	24	80S	47	78
22	BK 2022	26.3	80S	47	68
23	BK 2023	10.3	20S	47	78
24	BK 2024	0	0	57	78
25	BK 2025	0.5	5MR	57	78
26	BK 2026	5.3	20S	57	79
27	BK 2027	10.2	30S	35	47
28	BK 2028	2.6	10S	47	67
29	BK 2029	0	0	68	78
30	BK 2030	2.6	10S	57	78
31	BK 2031	40	100S	46	67
32	BK 2032	13.8	40S	57	68
33	BK 2033	12.5	40S	46	68
34	BK 2034	11.3	40S	56	67
35	BK 2035	20.3	40S	57	78
36	BK 2036	17.5	40S	36	69
37	BK 2037	7	15S	46	89
38	BK 2038	36.3	80S	46	47
39	BK 2039	10.2	20S	57	68
40	BK 2040	17.5	40S	46	57
40A	Infector	75	100S	68	79
41	BK 2041	12.5	40S	36	46
42	BK 2042	1.3	5S	35	57
43	BK 2043	2.8	10S	57	89
44	BK 2044	2.6	10S	46	68
45	BK 2045	1.5	5S	46	57
46	BK 2046	4.1	20MS	57	67

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
47	BK 2047	8.8	20S	47	58
48	BK 2048	2.5	10S	46	67
49	BK 2049	12.6	40S	57	68
50	BK 2050	0.1	TMR	46	47
51	BK 2051	5.3	20S	57	78
52	BK 2052	6.3	20S	57	78
53	BK 2053	3.8	10S	46	67
54	BK 2054	1.3	5S	46	57
55	BK 2055	0	0	68	78
56	BK 2056	2.7	10S	57	78
57	BK 2057	0.1	TR	58	68
58	BK 2058	6.3	20S	57	99
59	BK 2059	6.5	15S	57	58
60	BK 2060	5	20S	46	68
60A	Infector	80	100S	78	89
61	BK 2061	5.3	15S	46	57
62	BK 2062	1.3	5S	57	68
63	BK 2063	2	10MS	35	47
64	BK 2064	5	20S	56	78
RARI, SKNAU, Durgapura					
65	BD 1871	6.3	20S	57	79
66	BD 1872	2.6	10S	57	89
67	BD 1873	5	20S	57	68
68	BD 1874	6.3	20S	57	99
69	BD 1875	8.8	20S	56	99
70	BD 1876	0.8	5MR	57	89
71	BD 1877	1	5MS	46	89
72	BD 1878	0.1	TMR	56	68
73	BD 1879	5	10S	46	57
74	BD 1880	3.5	10S	46	78
75	BD 1881	5.1	20S	57	89
76	BD 1882	0	0	46	67
77	BD 1883	0	0	57	58
78	BD 1884	1	5MS	47	57
79	BD 1885	4	20MS	46	67
80	BD 1886	2.5	10S	46	78
80A	Infector	75	100S	68	78
81	BD 1887	2.5	10S	46	57
82	BD 1888	2.5	10S	46	68
83	BD 1889	10	30S	36	57
84	BD 1890	5	20S	36	57
85	BD 1891	0	0	57	68
86	BD 1892	0.1	TR	47	79
87	BD 1893	0.1	TR	68	79
88	BD 1894	17.5	40S	46	57
89	BD 1895	2.5	10S	47	68
90	BD 1896	16.3	40S	46	99
91	BD 1897	0	0	56	99
92	BD 1898	1.3	5S	57	99
93	BD 1899	2.5	10S	46	67
94	BD 1900	6.3	20S	46	68

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
95	BD 1901	2.8	10S	35	57
96	BD 1902	0	0	57	79
97	BD 1903	4.1	20MS	46	89
98	BD 1904	10	40S	46	68
99	BD 1905	2.5	10S	57	79
100	BD 1906	2	10MS	46	68
100A	Infector	75	100S	78	87
101	BD 1907	4	20MS	57	89
102	BD 1908	0	0	57	78
103	BD 1909	1	5MS	57	78
104	BD 1910	4	20MS	68	78
BHU, Varanasi					
105	HUBL 2001	34	60S	46	78
106	HUBL 2002	35	80S	45	68
107	HUBL 2003	35	60S	35	57
108	HUBL 2004	39.5	80S	35	68
109	HUBL 2005	39	80S	46	68
110	HUBL 2006	29.3	80S	57	78
111	HUBL 2007	12	20S	47	78
112	HUBL 2008	15	40S	46	68
113	HUBL 2009	0.3	TS	57	78
114	HUBL 2010	6.3	20S	46	78
115	HUBL 2011	26.5	40S	46	67
116	HUBL 2012	35.1	60S	46	68
117	HUBL 2013	39.5	80S	57	68
118	HUBL 2014	22.6	80S	57	68
119	HUBL 2015	25	80S	57	78
120	HUBL 2016	22.5	80S	57	78
120A	Infector	80	100S	78	89
121	HUBL 2017	30.3	60S	47	68
122	HUBL 2018	2	10MS	57	68
123	HUBL 2019	30	80S	57	68
124	HUBL 2020	49	80S	46	57
125	HUBL 2021	4	20MS	57	78
126	HUBL 2022	22.5	80S	47	68
127	HUBL 2023	0	0	47	78
128	HUBL 2024	4	20MS	35	68
129	HUBL 2025	37	80S	46	78
130	HUBL 2026	5.3	20MS	67	89
131	HUBL 2027	0.2	TMS	57	68
132	HUBL 2028	26	80S	67	79
133	HUBL 2029	4	20MS	57	78
134	HUBL 2030	36	80S	57	78
CSAUAT, Kanpur					
135	PKB 2001	30	60S	57	68
136	PKB 2002	35	80S	35	57
137	PKB 2003	24.5	60S	68	79
138	PKB 2004	3.3	10MS	57	68
139	PKB 2005	40	80S	57	68
140	PKB 2006	42	80S	46	57
140A	Infector	75	100S	78	89

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
141	PKB 2007	8.7	20MS	46	78
142	PKB 2008	9.5	30S	47	78
143	PKB 2009	32	60S	57	78
144	PKB 2010	17.6	40S	68	68
145	PKB 2011	34	60S	46	68
146	PKB 2012	45	60S	36	57
147	PKB 2013	13.5	40S	35	48
148	PKB 2014	17	40S	35	68
149	PKB 2015	6.7	10S	46	57
150	PKB 2016	31.5	60S	35	46
151	PKB 2017	11.3	40S	24	36
152	PKB 2018	7.7	20S	35	47
153	PKB 2019	0.2	TMS	36	36
154	PKB 2020	30	60S	46	57
155	PKB 2021	1	5MS	47	58
156	PKB 2022	0.1	TMR	57	78
157	PKB 2023	30.2	60S	57	68
158	PKB 2024	5	10S	68	68
159	PKB 2025	40	80S	57	78
160	PKB 2026	23.3	60S	46	68
160A	Infector	75	100S	78	89
161	PKB 2027	13	30S	56	78
162	PKB 2028	35	80S	36	36
163	PKB 2029	44	80S	46	68
164	PKB 2030	3.8	15S	47	57
165	PKB 2031	0	0	57	68
166	PKB 2032	45.2	80S	68	79
167	PKB 2033	27.5	60S	46	68
168	PKB 2034	36.5	80S	36	47
169	PKB 2035	15.5	60S*	35	57
VPKAS, Almora					
170	VB 2001	6.5	20MS	57	79
171	VB 2002	2.5	10S	46	78
172	VB 2003	2.5	10S	36	58
173	VB 2004	2	10MS	57	68
174	VB 2005	27.5	60S	36	47
175	VB 2006	4.5	10S	46	68
176	VB 2007	5	20S	46	78
177	VB 2008	1	10MR	35	57
178	VB 2009	2.5	10S	35	57
179	VB 2010	8.8	20S	47	68
180	VB 2011	4.5	10S	46	47
180A	Infector	75	100S	78	89
181	VB 2012	7	20S	46	57
182	VB 2013	35	60S	56	78
183	VB 2014	37.5	60S	35	68
184	VB 2015	21.3	40S	57	79
185	VB 2016	13.5	40S	56	78
186	VB 2017	2	10MS	47	68
187	VB 2018	4.5	10S	46	58
188	VB 2019	11.3	40S	46	79

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
189	VB 2020	3.8	10S	45	57
190	VB 2021	6.5	20MS	46	68
191	VB 2022	1	10MR	57	78
192	VB 2023	11.3	40S	47	78
193	VB 2024	5.3	20MS	47	78
194	VB 2025	21.5	60S	46	78
195	VB 2026	3	10MR	46	68
196	VB 2027	3	10MS	46	78
197	VB 2028	5.5	10S	46	79
198	VB 2029	3.3	10MS	46	78
199	VB 2030	13.8	40S	57	68
ANDUAT, Ayodhya					
200	NDB 1776	11.3	20S	57	68
200A	Infector	75	100S	68	78
201	NDB 1777	13.8	30S	57	79
202	NDB 1778	23.8	40S	47	78
203	NDB 1779	17.5	40S	46	67
204	NDB 1780	39	40S	47	68
205	NDB 1781	25	60S	47	67
206	NDB 1782	4.5	10S	46	57
207	NDB 1783	2	10MS	35	46
208	NDB 1784	7.5	30S	57	79
209	NDB 1785	12.5	20S	36	57
210	NDB 1786	25	60S	46	67
211	NDB 1787	22.5	40S	46	78
212	NDB 1788	12.5	20S	35	57
213	NDB 1789	7.5	20S	46	68
214	NDB 1790	20	40S	47	68
215	NDB 1791	20	60S	68	79
216	NDB 1792	26.3	60S	46	67
217	NDB 1793	5.3	20MS	46	57
218	NDB 1794	25	40S	35	68
219	NDB 1795	45	60S	46	67
220	NDB 1796	32.5	60S	46	47
220A	Infector	75	100S	68	89
221	NDB 1797	33	60S	46	68
222	NDB 1798	35	60S	57	57
223	NDB 1799	0	0	57	78
224	NDB 1800	2.5	10S	46	78
GBPUAT, Pantnagar					
225	UPBM 1	21.7	40S	57	68
226	UPBM 2	2.6	10S	46	68
227	UPBM 3	7.6	20S	46	57
228	UPBM 4	5	10S	57	68
229	UPBM 5	27.6	60S	57	68
230	UPBM 6	14.5	40S	46	57
231	UPBM 7	0.5	5MR	46	67
232	UPBM 8	2	10MS	46	57
233	UPBM 9	35.1	60S	35	47
234	UPBM 10	13.5	20S	25	27
235	UPBM 11	0	0	36	36

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
236	UPBM 12	11.1	40S	57	68
237	UPBM 13	2.9	10MS	36	47
238	UPBM 14	13.3	40S	46	56
239	UPBM 15	17.6	60S	57	68
240	UPBM 16	13.3	20S	47	68
240A	Infector	75	100S	68	89
241	UPBM 17	20	20S	NG	NG
242	UPBM 18	4.7	10S	NG	NG
CCS HAU, Hisar					
243	BH 2001	15	40S	46	68
244	BH 2002	2.1	10MS	35	45
245	BH 2003	4.8	10S	36	37
246	BH 2004	4.4	15S	36	57
247	BH 2005	7.8	20MS	45	67
248	BH 2006	2.5	10S	57	79
249	BH 2007	1.3	5S	57	68
250	BH 2008	1.3	5S	57	79
251	BH 2009	8.3	20MS	46	57
252	BH 2010	3.5	10S	35	46
253	BH 2011	3.5	10S	46	78
254	BH 2012	5	10S	57	68
255	BH 2013	6.4	15S	46	68
256	BH 2014	3.3	10MS	68	79
257	BH 2015	1.1	5MS	47	78
258	BH 2016	2.6	10S	46	57
259	BH 2017	2.5	10S	36	46
260	BH 2018	2.5	10S	46	68
260A	Infector	75	100S	68	78
261	BH 2019	1	5MS	57	68
262	BH 2020	2.5	10S	36	47
263	BH 2021	1.3	5S	46	57
264	BH 2022	6.4	20S	45	67
265	BH 2023	6.4	20S	36	58
266	BH 2024	2.5	10S	35	57
267	BH 2025	2.5	10S	35	47
268	BH 2026	0.3	TS	35	36
269	BH 2027	5.2	20S	37	58
270	BH 2028	1.5	5S	35	46
271	BH 2029	3	10S	46	79
272	BH 2030	2.5	10S	36	57
273	BH 2031	7.5	20S	35	47
274	BH 2032	0.3	5R	78	78
275	BH 2033	13.8	30S	78	89
276	BH 2034	2.5	10S	47	58
277	BH 2035	0.1	TMR	36	47
278	BH 2036	0.6	5MR	35	46
279	BH 2037	1.1	5MS	36	47
280	BH 2038	1	5MS	35	46
280A	Infector	75	100S	78	89
281	BH 2039	12.5	40S	57	99
282	BH 2040	0.5	5MR	57	89

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
PAU, Ludhiana					
283	BL 1813	3.8	10S	57	78
284	BL 1821	7.3	15S	67	79
285	BL 1846	2.5	10S	47	58
286	BL 1849	1.3	5S	46	57
287	BL 1852	2.7	10S	46	57
288	BL 1854	6	20S	57	68
289	BL 1855	11.3	40S	46	57
290	BL 1857	5.5	20S	46	47
291	BL 1862	12.5	40S	46	58
292	BL 1863	2.6	10S	46	67
293	BL 1864	8.6	30S	35	57
294	BL 1865	0	0	34	46
295	BL 1909	5	20S	46	57
296	BL 1926	6.5	20MS	36	47
297	BL 1932	3.8	10S	46	46
298	BL 1934	10.3	40S	46	78
299	BL 1948	3.8	10S	46	68
300	BL 1953	3.3	10MS	46	67
300A	Infector	75	100S	68	79
301	BL 1954	2.7	10S	24	47
302	BL 1957	12.6	40S	46	78
303	BL 1959	2.8	10S	46	48
304	BL 1962	0.4	5R	47	68
305	BL 1980	1.3	5S	35	56
306	BL 1981	1.3	5S	35	48
307	BL 1985	2.5	10S	46	57
308	BL 1986	7.8	20S	46	68
309	BL 1988	2.8	10S	46	79
310	BL 1996	3	10S	35	56
311	BL 2017	2.6	10S	46	78
312	BL 2018	22	40S	46	57
313	BL 2022	3.8	10S	46	68
314	BL 2023	5	20S	46	89
315	BL 2030	26.3	60S	46	79
316	BL 2049	21.3	60S	47	68
317	BL 2050	14.3	40S	46	57
318	BL 2079	0.3	5R	67	89
319	BL 2083	0	0	57	78
320	BL 2086	5	20S	67	78
320A	Infector	75	100S	68	89
321	BL 2087	2.5	10S	57	79
322	BL 2088	0	0	67	99
323	BL 2092	0	0	68	89
324	BL 2095	0	0	68	79
325	BL 2096	0.1	TR	67	99
326	BL 2099	0.5	5MR	67	99
327	BL 2102	0	0	67	89
328	BL 2105	0	0	68	99
CSKHPKV, Bajaura					
329	HB 2001	0	0	78	99

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
330	HB 2002	1.5	5MS	57	89
331	HB 2003	0.4	5R	56	99
332	HB 2004	0	0	57	89
333	HB 2005	0	0	46	99
334	HB 2006	2.7	10MS	46	79
335	HB 2007	0	0	67	99
336	HB 2008	0	0	78	99
337	HB 2009	0	0	68	99
338	HB 2010	0.3	TMS	68	89
339	HB 2011	0.1	0	79	99
340	HB 2012	0.2	TMS	58	79
340A	Infector	75	100S	79	89
341	HB 2013	2.5	10S	68	79
342	HB 2014	0.2	TMS	78	99
343	HB 2015	2.5	10S	67	99
344	HB 2016	0.3	5R	89	99
345	HB 2017	2.8	10S	57	99
346	HB 2018	2.5	10S	57	89
347	HB 2019	1.5	5MS	36	58
348	HB 2020	1	5MS	56	99
349	HB 2021	2.1	10MS	67	99
IARI, RS, Tutikandi					
350	BBM 861	0	0	78	99
351	BBM 862	0.5	5MR	78	99
352	BBM 863	3	10MS	67	99
353	BBM 864	5	20S	46	89
354	BBM 865	0.1	TMR	57	99
355	BBM 866	2	10MS	46	99
356	BBM 867	3.5	10S	56	99
357	BBM 868	0	0	68	99
358	BBM 869	2.5	10S	78	89
359	BBM 870	4	20MS	67	99
360	BBM 871	12.6	40S	58	79
360A	Infector	75	100S	78	89
361	BBM 872	2.5	10S	68	99
362	BBM 873	5.1	20S	57	79
363	BBM 874	1.2	5MS	46	89
364	BBM 875	1	10MR	67	99
365	BBM 876	18.5	40S	57	99
366	BBM 877	2.6	10S	47	79
367	BBM 878	4	10MS	46	58
368	BBM 879	0.3	5R	78	99
369	BBM 880	1	5MS	68	99
370	BBM 881	2	5MS	57	99
371	BBM 882	0.1	TR	78	99
372	BBM 883	2	10MS	46	78
373	BBM 884	0.3	TMS	46	99
374	BBM 885	2.7	10S	57	89
375	BBM 886	4.5	10S	57	99
376	BBM 887	22	40S	46	99
377	BBM 888	0	0	68	99

IBDSN No.	Entry	Yellow rust		Foliar blight	
		ACI	HS	Avg.	HS
378	BBM 889	1.3	5MS	57	99
379	BBM 890	0	0	67	99
380	BBM 891	0.1	TR	57	99
380A	Infector	75	100S	78	99
381	BBM 892	2.5	10S	78	99
382	BBM 893	0.1	TMR	69	99
383	BBM 894	2.5	10S	68	89

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, Avg. = Mean, NS = No seed, NG = No germination, *Indicates high rust score (more than 40S) at one location only.

National Barley Disease Screening Nursery (NBDSN) 2020-21

During the crop season 2020-21, under the NBDSN trial a total 108 entries from coordinated 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 Durgapura, Hisar and Jammu were considered. Leaf rust screening was done at Ludhiana and Jammu, and it was low at Ludhiana so only one location was there, so HS is reflected in table. The leaf blight screening was done at Dharwad, Pantnagar, Varanasi, Kanpur and Faizabad. CCN screening was done at Hisar, Durgapura and Ludhiana centers. For CCN, the number of nematode cysts / plants was counted and entries having 0-4 cysts/ plant in pot were considered as resistant (R) whereas those with cysts/plant 4.1-9.0 were Moderately Resistant (MR). The entries with galls between 9.1 and 20.0 were treated as susceptible (S) and the entries with more than 20.0 galls per plant were treated as highly susceptible (HS).

Out of 108 entries evaluated during 2020-21 (Table 2), 7 entries found free from stripe rust, 58 entries showed resistant reaction having ACI less than 10. In case of leaf blight screening, 9 entries found moderately resistant against leaf blight with an average score (double digit) 14-35 but HS was less than 57. The resistant entries identified against yellow rust and blight are given below:

Yellow rust, ACI = 0, Entries – 7	DWRB222, HUB272, PL927, RD3033, RD3034, RD3039, HBL113 (C)
Yellow rust, ACI > 0 to 10, Entries – 89	BH1029, BH1034, BH1035, BH1036, BH1037, BH1038, BH1039, BHS483, BHS484, BHS485, BHS486, BHS487, DWRB218, DWRB219, DWRB220, DWRB221, DWRB224, HBL869, HBL870, HBL871, HBL872, HBL873, HUB275, HUB276, HUB277, HUB279, HUB280, K1822, KB1822, KB1911, KB1912, KB1916, KB1926, KB1939, KB1940, KB1944, KB1946, KB1947, NDB1752, NDB1754, NDB1756, PL911, PL917, PL926, PL928, PL929, PL930, PL931, RD3012, RD3013, RD3016, RD3028, RD3029, RD3030, RD3032, RD3035, RD3036, RD3037, RD3038, RD3040, RD3041, RD3042, UPB1091, UPB1092, UPB1093, UPB1095, UPB1096, UPB1097, VLB170, VLB171, VLB172, VLB173, VLB174, BH946 (C), BH959 (C), BHS352 (C), BHS380 (C), BHS400 (C), DWRB137 (C), DWRB160 (C), DWRB182 (C), DWRUB52 (C), HUB113 (C), NDB1173 (C), PL891 (C), RD2794 (C), RD2849 (C), RD2899 (C), RD2907 (C)
Leaf blight, Avg. 13-35 with HS < 57 Entries – 9	HBL870, HUB275, KB1940, PL929, PL930, PL931, RD3030, DWRB182 (C), PL891 (C)

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	Up to 100	Between 101 - 500
Entries	Nil	PL930, HBL870, HUB275, PL891©, RD3030, HUB272, PL929, VLB173, UPB1093, VLB170, BH1037

Table 2: Reactions of different entries of barley in National Barley Disease Screening Nursery (NBDSN), 2020-21

S. No.	Entry#	Yellow rust		Leaf rust	Leaf blight		CCN
		ACI	HS	HS	Avg.	HS	HS
1	BH1029	0.3	TMS	TMS	57	68	HS
2	BH1034	0.7	5MR	0	46	57	S
3	BH1035	1.7	5MS	0	46	67	HS
4	BH1036	4.7	10S	20MS	47	78	S
5	BH1037	8.3	20S	0	36	46	HS
6	BH1038	3.3	10S	0	46	89	HS
7	BH1039	3.7	10S	0	57	78	HS
8	BHS483	4.7	10S	0	46	68	HS
9	BHS484	3.3	10S	TMS	57	89	HS
10	BHS485	0.1	TMR	TMS	46	78	HS
11	BHS486	5.1	10S	5MS	57	89	HS
12	BHS487	7.7	10S	20MS	46	78	S
13	DWRB218	6.7	10S	0	36	58	S
14	DWRB219	7.3	20MS	0	36	67	HS
15	DWRB220	3.6	10S	0	46	68	HS
16	DWRB221	5.3	10S	TMS	46	68	HS
17	DWRB222	0	0	20S	56	89	S
18	DWRB223	11.3	20S	TR	57	89	HS
19	DWRB224	3.3	10S	0	57	68	S
20	HBL869	2	5MS	0	58	89	HS
21	HBL870	3.3	5S	0	34	35	HS
22	HBL871	10	20S	10MS	46	67	HS
23	HBL872	5	10S	20MS	56	99	HS
24	HBL873	3.3	10S	NG	46	67	HS
25	HUB272	0	0	10MS	35	58	HS
26	HUB275	0.3	TMS	0	35	47	HS
27	HUB276	1.3	10MR	TMS	47	78	S
28	HUB277	4.7	10S	10MS	46	89	HS
29	HUB279	3.3	10S	0	46	78	S
30	HUB280	0.1	TMR	5MS	46	56	S
31	K1822	1.7	5S	0	68	99	HS
32	KB1822	5.3	20MS	0	67	89	HS
33	KB1909	13.3	40S	10S	57	79	HS
34	KB1911	10	20S	20MS	57	68	S

S. No.	Entry#	Yellow rust		Leaf rust	Leaf blight		CCN
		ACI	HS	HS	Avg.	HS	HS
35	KB1912	10	30S	0	46	57	S
36	KB1916	6.7	20S	TMS	67	89	HS
37	KB1926	6.7	20S	5MS	46	58	S
38	KB1939	10	20S	0	58	68	S
39	KB1940	0.3	TMS	0	35	57	HS
40	KB1944	1.3	5MS	20MS	56	79	S
41	KB1946	2.7	10MS	0	47	78	HS
42	KB1947	0.2	TMR	TMR	46	67	HS
43	NDB1752	6.7	20S	TMS	56	78	S
44	NDB1754	6.7	20S	TMS	57	69	HS
45	NDB1756	0.3	5R	10MS	46	78	HS
46	PL911	0.1	TR	20S	46	78	HS
47	PL917	0.5	TMS	10S	56	67	HS
48	PL926	3	5S	0	46	78	HS
49	PL927	0	0	10MS	57	78	HS
51	PL929	3.3	10S	0	35	46	HS
52	PL930	2	5MS	TMS	24	36	S
53	PL931	5	10S	10MS	35	47	HS
54	PL932	16.7	30S	TMS	46	67	HS
55	RD3012	6.7	10S	0	56	68	HS
56	RD3013	3.3	10S	0	46	78	HS
57	RD3016	4.6	10MS	0	78	99	HS
58	RD3027	11.3	20S	0	46	57	S
59	RD3028	6.7	10S	TMS	46	78	S
60	RD3029	6.7	10S	0	36	47	HS
61	RD3030	6.7	10S	5MS	35	56	HS
62	RD3031	10.1	30S	40S	57	89	S
63	RD3032	3.3	10S	5R	46	89	HS
64	RD3033	0	0	0	57	89	HS
65	RD3034	0	0	0	46	79	HS
66	RD3035	2.8	10MS	0	67	89	HS
67	RD3036	8.7	20MS	0	46	78	HS
68	RD3037	4.8	10S	0	57	89	HS
69	RD3038	0.1	TR	0	78	99	HS
70	RD3039	0	0	TMS	67	99	HS
71	RD3040	3.6	10S	20MS	56	78	S
72	RD3041	3.5	10S	5MS	68	79	HS
73	RD3042	1.9	5S	10MS	78	99	HS
74	UPB1091	6.7	20S	20S	78	89	HS
75	UPB1092	3.3	10S	0	57	89	HS
76	UPB1093	1.4	10MR	0	36	68	HS
77	UPB1095	0.3	TMS	0	57	89	HS
78	UPB1096	0.3	5R	TR	45	78	HS
79	UPB1097	0.3	TMS	10MS	35	67	HS
80	UPB1098	13	20S	0	36	57	HS
81	VLB170	3	5S	10S	46	67	HS
82	VLB171	4.3	10MS	TMS	57	78	HS
83	VLB172	6	10S	0	57	79	HS
84	VLB173	4	10MS	0	36	67	HS
85	VLB174	3.4	10S	0	56	78	HS
86	BH902 (C)	13.5	30S	TMS	46	78	HS

S. No.	Entry#	Yellow rust		Leaf rust	Leaf blight		CCN
		ACI	HS	HS	Avg.	HS	HS
87	BH946 (C)	2.7	10MS	10MS	56	89	HS
88	BH959 (C)	6.7	20S	0	57	89	HS
89	BHS352 (C)	2.7	10MS	20S	57	78	HS
90	BHS380 (C)	1.3	10MR	0	46	68	HS
91	BHS400 (C)	5	10S	0	46	68	HS
92	DWRB137 (C)	6.9	20S	10MS	57	68	S
93	DWRB160 (C)	5	10S	5MS	47	78	HS
94	DWRB182 (C)	5.3	20MS	10S	35	56	HS
95	DWRUB52 (C)	1.9	5S	TMS	46	67	HS
96	HBL113 (C)	0	0	20MS	57	78	HS
97	HUB113 (C)	1.3	5MS	TR	57	78	HS
98	K603 (C)	40	60S	0	57	78	HS
99	KARAN16 (C)	15	40S	0	47	58	HS
100	LAKHAN (C)	32.7	60S	0	57	89	HS
101	NDB943 (C)	13.3	20S	0	57	78	HS
103	PL891 (C)	2.1	5S	TMS	35	47	S
104	RD2794 (C)	0.2	TMR	10MS	46	78	S
105	RD2849 (C)	2	5S	5MS	45	67	HS
106	RD2899 (C)	0.3	5R	10MS	46	78	HS
107	RD2907 (C)	6.7	20S	0	46	67	HS
108	VLB118 (C)	12.7	20S	20S	36	47	HS
	Infector	86.7	100S	60S	68	89	HS

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 108 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,

Elite Barley Disease Screening Nursery (EBDSN, 2020-21)

The nursery was constituted with entries showed resistance to different disease in previous years in NBDSN and EBDSN. During the crop season 2020-21, total 23 entries were screened in EBDSN. The screening of stripe rust was done at Durgapura, Ludhiana, Hisar, Almora, Bajaura, Jammu and Karnal. The disease remained low so data from Durgapura and Jammu were considered. Leaf rust screening was done at Ludhiana and Jammu and data from Jammu were considered. The leaf blight screening was done at Pantnagar, Varanasi, Kanpur and Faizabad. CCN screening was done at Hisar, Durgapura and Ludhiana centers.

Confirmed sources of resistance:

Out of 23 entries screened in EBDSN (Table 3), the following entries were confirmed for resistance against the particular disease under AICW&BIP. Three entries found free from yellow rust, whereas 19 shown resistant reaction. Out of 23 entries screened for leaf blight, 2 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 6. The resistant entries identified against yellow rust and blight are given below:

Yellow rust, ACI = 0, Entries– 3	RD 2552, KB 1817, DWRB 210
Yellow rust, ACI > 0 to 10, Entries – 19	BH 1029, HBL 113, HUB 272, KB 1707, PL 906, PL 908, RD 2794, RD 2849, RD 2907, RD 3016, RD 3024, VLB 118, VLB 166, VLB 168, KB 1830, DWRB 123, DWRB 197, DWRB 211, DWRB 217
Leaf blight, Avg. 13-35 with HS < 57, Entries - 2	RD 2899, RD 3024

Table 3: Reactions of different entries of barley in Elite Barley Disease Screening Nursery (EBDSN), 2020-21

EBDSN No.	Entry	Yellow rust	Leaf rust	Leaf blight		CCN[#]
		HS	HS	Avg.	HS	HS
1	BH 1029	5MR	TR	57	78	HS
2	HBL 113	TR	0	68	78	HS
3	HUB 272	5R	0	56	78	HS
4	KB 1707	TMR	0	57	89	HS
5	PL 906	5MR	5MS	47	68	HS
6	PL 908	TR	0	46	68	HS
7	RD 2552	0	0	46	78	HS
8	RD 2794	5S	5S	57	89	HS
9	RD 2849	5MS	TMS	46	78	HS
10	RD 2899	20MS	5MS	35	47	HS
11	RD 2907	TMR	5S	45	78	HS
12	RD 3016	10MS	0	68	89	HS
13	RD 3024	10S	10MS	35	57	HS
14	VLB 118	10S	0	46	99	HS
15	VLB 166	5MS	TMS	46	78	S
16	VLB 168	TMS	TMS	67	78	HS
17	KB 1817	0	5S	68	78	HS
18	KB 1830	TR	10MS	68	89	HS
19	DWRB 123	10S	0	47	89	HS
20	DWRB 197	5MR	0	57	89	HS
20A	Infector	100S	60S	68	89	HS
21	DWRB 210	0	TMS	46	89	S
22	DWRB 211	5MS	0	46	99	HS
23	DWRB 217	5MS	0	56	78	HS

HS- Highest score and if data from less than three centers only HS considered, ACI- Average Coefficient of Infection; [#]CCN- Cereal Cyst Nematode, HS- Highly susceptible, S- Susceptible, MR- Moderately Resistant, R- Resistant, ND- Not Determined, NG – Not germinated.

Table 4: Center wise reactions of different entries of barley in National Barley Disease Screening Nursery (NBDSN), 2020-21

S. No.	Entry*	Yellow rust			Leaf rust	Foliar blight					CCN		
		Durgapura	Jammu	Hisar	Jammu	Pantnagar	Kanpur	Faizabad	Varanasi	Dharwad	Ludhiana	Durgapura	Hisar
1	BH1029	TMS	0	0	TMS	68	68	68	25	56	S	HS	HS
2	BH1034	5MR	TR	0	0	37	46	57	24	56	S	S	S
3	BH1035	5MS	5R	0	0	45	67	47	24	46	S	S	HS
4	BH1036	10S	5MS	0	20MS	37	57	57	25	78	MR	S	MR
5	BH1037	5S	20S	0	0	46	36	46	24	46	MR	MR	HS
6	BH1038	10S	0	0	0	68	36	35	24	89	S	HS	HS
7	BH1039	10S	5R	0	0	47	57	67	24	78	S	HS	HS
8	BHS483	5MS	TR	10S	0	36	68	67	24	46	S	HS	HS
9	BHS484	0	0	10S	TMS	57	36	78	36	89	S	S	HS
10	BHS485	TMR	0	0	TMS	58	47	78	12	56	S	HS	S
11	BHS486	TMR	10S	5S	5MS	47	57	68	24	89	S	S	HS
12	BHS487	10MS	10S	5S	20MS	38	24	78	24	56	S	S	S
13	DWRB218	10S	0	10S	0	24	58	46	24	46	S	S	S
14	DWRB219	TMS	20MS	5S	0	26	36	46	24	67	S	MR	HS
15	DWRB220	TMS	0	10S	0	35	36	68	24	56	S	S	HS
16	DWRB221	5S	5R	10S	TMS	47	68	46	24	67	S	S	HS
17	DWRB222	0	0	0	20S	78	24	46	25	89	S	S	S
18	DWRB223	10S	5MS	20S	TR	48	57	46	24	89	S	MR	HS
19	DWRB224	10S	0	0	0	58	68	68	25	46	S	S	S
20	HBL869	5MR	5MS	0	0	58	36	58	47	89	S	S	HS
21	HBL870	5S	0	5S	0	35	24	35	24	34	S	S	HS
22	HBL871	10S	20S	0	10MS	57	36	57	13	67	S	S	HS
23	HBL872	10S	0	5S	20MS	99	24	67	24	78	S	S	HS
24	HBL873	10S	0	0	NG	36	57	67	24	34	S	HS	HS
25	HUB272	0	0	0	10MS	47	24	58	24	34	S	S	HS
26	HUB275	TMS	TR	0	0	47	24	47	12	24	S	HS	HS
27	HUB276	10MR	0	0	TMS	58	47	47	24	78	S	S	MR
28	HUB277	0	5MS	10S	10MS	67	12	57	24	89	S	S	HS
29	HUB279	0	0	10S	0	47	24	35	24	78	S	S	S
30	HUB280	TMR	0	0	5MS	45	36	46	35	56	S	S	MR
31	K1822	5S	0	0	0	68	99	68	25	78	S	S	HS
32	KB1822	0	20MS	0	0	57	46	79	46	89	S	MR	HS
33	KB1909	0	40S	0	10S	46	36	79	24	78	S	S	HS
34	KB1911	10S	20S	0	20MS	47	68	68	35	46	S	S	S
35	KB1912	0	0	30S	0	34	46	57	36	46	S	S	MR
36	KB1916	0	20S	0	TMS	67	57	67	35	89	S	S	HS
37	KB1926	20S	TR	0	5MS	58	46	46	24	46	S	S	MR
38	KB1939	20S	0	NG	0	37	68	NG	NG	NG	S	S	NG
39	KB1940	TMS	0	0	0	57	24	45	13	56	S	S	HS
40	KB1944	5MS	0	0	20MS	79	46	46	13	78	S	S	NG
41	KB1946	10MS	TR	0	0	38	57	46	24	78	S	S	HS
42	KB1947	TMR	TR	0	TMR	58	46	67	12	46	S	HS	HS
43	NDB1752	20S	0	0	TMS	56	46	78	24	67	S	S	S
44	NDB1754	20S	0	0	TMS	69	36	57	36	67	S	MR	HS

S. No.	Entry*	Yellow rust			Leaf rust	Foliar blight					CCN		
		Durgapura	Jammu	Hisar	Jammu	Pantnagar	Kanpur	Faizabad	Varanasi	Dharwad	Ludhiana	Durgapura	Hisar
45	NDB1756	0	5R	0	10MS	36	24	78	24	67	S	MR	HS
46	PL911	0	TR	0	20S	56	36	78	24	56	S	S	HS
47	PL917	TMS	TMS	0	10S	57	57	57	24	67	S	S	HS
48	PL926	0	5MS	5S	0	36	46	46	24	78	S	HS	HS
49	PL927	0	0	0	10MS	35	68	68	24	78	S	S	HS
50	PL928	TMS	0	0	TMS	58	68	78	24	89	S	HS	MR
51	PL929	10S	0	0	0	34	46	46	24	46	S	S	HS
52	PL930	10R	5MS	0	TMS	36	24	35	12	34	S	S	S
53	PL931	10S	0	5S	10MS	36	47	35	24	34	S	HS	HS
54	PL932	20S	0	30S	TMS	46	46	46	25	67	S	HS	MR
55	RD3012	10S	TR	10S	0	68	57	46	35	56	S	S	HS
56	RD3013	10S	0	0	0	36	24	57	24	78	S	HS	HS
57	RD3016	TMS	10MS	5S	0	99	57	78	57	89	S	HS	MR
58	RD3027	5MS	20S	10S	0	26	57	57	24	56	S	S	MR
59	RD3028	10S	0	10S	TMS	25	36	57	24	78	S	S	MR
60	RD3029	10S	0	10S	0	25	36	47	24	46	S	S	HS
61	RD3030	10S	10S	0	5MS	48	3	35	24	56	S	S	HS
62	RD3031	0	TR	30S	40S	57	57	47	24	89	S	S	S
63	RD3032	0	0	10S	5R	46	36	57	24	89	MR	HS	HS
64	RD3033	0	0	0	0	89	46	57	25	89	S	S	HS
65	RD3034	0	0	0	0	79	24	36	24	78	S	S	HS
66	RD3035	10MS	TMR	0	0	89	68	78	24	78	MR	HS	S
67	RD3036	20MS	0	10S	0	57	24	47	35	78	S	HS	HS
68	RD3037	TMR	5MS	10S	0	89	36	68	24	89	S	S	HS
69	RD3038	TR	0	0	0	99	68	78	57	99	S	HS	HS
70	RD3039	0	0	0	TMS	99	24	78	47	89	S	S	HS
71	RD3040	TMS	10S	0	20MS	45	68	78	24	46	S	MR	S
72	RD3041	TMR	0	10S	5MS	79	68	78	57	NG	S	HS	HS
73	RD3042	TMS	5S	0	10MS	99	79	78	47	89	S	S	HS
74	UPB1091	0	TR	20S	20S	89	68	68	78	89	S	MR	HS
75	UPB1092	0	0	10S	0	89	36	78	24	78	S	S	HS
76	UPB1093	10MR	TR	0	0	26	24	68	24	46	S	S	HS
77	UPB1095	0	TMS	0	0	46	57	68	35	89	S	S	HS
78	UPB1096	0	5R	0	TR	34	24	67	24	78	S	HS	HS
79	UPB1097	0	TMS	0	10MS	24	36	36	24	67	S	HS	HS
80	UPB1098	20S	5MS	15S	0	25	36	57	24	56	S	HS	HS
81	VLB170	10MR	0	5S	10S	26	36	67	24	56	S	HS	HS
82	VLB171	10MS	0	5S	TMS	68	48	67	12	78	S	HS	S
83	VLB172	10S	10MS	0	0	79	47	68	24	46	S	S	HS
84	VLB173	10MS	5MS	0	0	27	24	47	24	67	S	HS	HS
85	VLB174	10S	TR	0	0	78	24	57	35	78	S	S	HS
86	BH902 ©	10S	TMR	30S	TMS	35	56	47	24	78	S	HS	HS
87	BH946©	10MS	TR	0	10MS	45	57	67	24	89	S	HS	HS
88	BH959 ©	20S	0	0	0	47	68	67	24	89	S	HS	MR
89	BHS352©	10MS	TR	0	20S	36	46	67	36	78	MR	S	HS
90	BHS380©	10MR	0	0	0	68	36	46	36	46	S	S	HS

S. N.	Entry*	Yellow rust			Leaf rust	Foliar blight					CCN		
		Durgapura	Jammu	Hisar	Jammu	Pantnagar	Kanpur	Faizabad	Varanasi	Dharwad	Ludhiana	Durgapura	Hisar
91	BHS400©	10S	0	5S	0	36	68	57	24	56	S	S	HS
92	DWRB137 ©	0	TMS	20S	10MS	46	68	57	35	67	S	S	MR
93	DWRB160©	10S	0	5S	5MS	57	36	36	36	78	S	HS	HS
94	DWRB182©	0	20MS	0	10S	46	24	35	24	56	S	S	HS
95	DWRUB52©	TMS	0	5S	TMS	35	47	57	35	67	S	HS	HS
96	HBL113©	0	0	0	20MS	36	68	78	36	78	S	HS	HS
97	HUB113 ©	0	5MS	0	TR	46	57	78	24	78	S	S	HS
98	K603©	60S	0	60S	0	57	24	78	36	78	S	S	HS
99	KARAN16©	40S	0	5S	0	57	46	58	36	46	S	S	HS
100	LAKHAN©	60S	10MS	30S	0	68	48	68	24	89	S	HS	HS
101	NDB943©	20S	20S	0	0	68	36	68	35	78	S	HS	HS
102	NDB1173 ©	20S	5MS	0	10MS	58	46	57	24	46	S	S	S
103	PL891©	TMS	TMR	5S	TMS	47	24	NG	12	46	S	S	NG
104	RD2794 ©	TMR	TR	0	10MS	46	36	45	24	78	S	S	MR
105	RD2849©	TS	0	5S	5MS	36	24	67	24	56	S	HS	HS
106	RD2899 ©	0	5R	0	10MS	25	36	57	35	78	S	S	HS
107	RD2907 ©	0	20S	0	0	49	46	67	24	46	S	HS	HS
108	VLB118©	10MS	20S	10S	20S	47	36	35	24	46	S	HS	HS
	Infector	100S	80S	80S	60S	89	68	78	24	89	S	HS	HS

* Out of 120 entries, few check varieties were found place in many trials and only one check is retained in NBDSN thus resulting 108 entries under NBDSN.

HS- Highest score, ACI- Average Coefficient of Infection; CCN- Cereal Cyst Nematode, HS- Highly susceptible, S- Susceptible, MR- Moderately Resistant, R- Resistant, (c) - *Released Checks, ND- Not Determined, NG – Not germinated.*

Table 5: Center wise reactions of different entries of barley in Elite Barley Disease Screening Nursery (EBDSN), 2020-21

EBDSN No.	Entry	Yellow rust		Leaf rust	Leaf blight				CCN		
		Durgapura	Jammu	Jammu	Pantnagar	Kanpur	Faizabad	Varanasi	Ludhiana	Durgapura	Hisar
1	BH 1029	5MR	0	TR	46	36	46	78	S	S	HS
2	HBL 113	TR	0	0	67	58	57	78	S	S	HS
3	HUB 272	0	5R	0	34	68	35	78	S	S	HS
4	KB 1707	0	TMR	0	58	46	46	89	S	S	HS
5	PL 906	5MR	TMR	5MS	37	36	35	68	S	S	HS
6	PL 908	0	TR	0	37	24	46	68	S	S	HS
7	RD 2552	0	0	0	46	24	47	78	MR	S	HS
8	RD 2794	0	5S	5S	37	36	47	89	S	S	HS
9	RD 2849	5MS	0	TMS	36	24	35	78	S	S	HS
10	RD 2899	0	20MS	5MS	47	24	35	NG	S	S	HS
11	RD 2907	0	TMR	5S	25	12	46	78	S	HS	HS
12	RD 3016	10MS	0	0	47	36	78	89	S	HS	MR
13	RD 3024	10MS	10S	10MS	35	24	57	NG	S	S	HS
14	VLB 118	10S	5MS	0	26	12	46	99	S	HS	S
15	VLB 166	TMS	5MS	TMS	37	2	57	78	S	S	S
16	VLB 168	TMS	0	TMS	67	57	67	78	S	S	HS
17	KB 1817	0	0	5S	37	68	78	78	S	HS	S
18	KB 1830	0	TR	10MS	38	78	78	89	S	HS	HS
19	DWRB 123	10S	0	0	36	24	47	89	S	S	HS
20	DWRB 197	5MR	0	0	47	24	58	89	MR	S	HS
20A	Infector	100S	60S	60S	36	79	78	89	S	NG	HS
21	DWRB 210	0	0	TMS	25	12	67	89	S	S	S
22	DWRB 211	5MS	TR	0	26	2	68	99	S	S	HS
23	DWRB 217	0	5MS	0	56	12	69	78	S	S	HS

CCN- Cereal Cyst Nematode, HS- Highly susceptible, S- Susceptible, MR- Moderately Resistant, R- Resistant, ND- Not Determined, NG – Not germinated

Evaluation for seedling rust resistance against three rusts of barley

All the NBDSN and EBDSN lines were screened against different pathotypes of three rusts of barley under precise conditions of temperature and light. Wherever needed, confirmatory and selected testing was also undertaken. These lines were evaluated against seven pathotypes of *Puccinia striiformis hordei* (24, 57, M, G, Q, 6S0 and 7S0), five pathotypes of *P. graminis tritici* (11, 21A-2, 40A, 117-6 and 295), 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 Pst, Pt and Pgt. The detailed report is presented below.

Seedling rust resistance in NBDSN lines

A total 108 lines 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. Four lines (HUB279, RD3016, RD3039, and RD3042) were resistant to both leaf and stripe rust pathotypes/isolates. DWRB182 was resistant to stripe and stem rust pathotypes. In addition, 17 lines each was resistant to stripe and leaf rust pathotypes only. Resistance to all the pathotypes of *P. graminis tritici* was observed only in DWRB182 (Table 6). The responses of each entry against different pathotypes of rust have been given in Table 8.

Table 6: Seedling rust resistance in NBDSN lines during 2020-21

Rust/s	No. of entries	Entries
Leaf and stripe	04	HUB279, RD3016, RD3039, RD3042
Stripe and stem	01	DWRB182 (C)
Stripe	17	BHS484, DWRB137 (C), DWRB222, HUB113 (C), PL911, PL917, RD2794 (C), RD2899 (C), RD3031, RD3032, RD3033, RD3034, RD3037, RD3041, UPB1091, UPB1092, UPB1095,
Leaf	17	BH1034, BH1037, BHS380 (C), BHS400 (C), HBL869, HBL870, HBL872, HBL873, PL929, RD3013, RD3028, RD3035, RD3036, RD3038, VLB118 (C), VLB170, VLB173

Seedling rust resistance in EBDSN lines

Twenty-three EBDSN lines were evaluated for resistance to three rusts by using seven pathotypes of *Puccinia striiformis hordei*, five of *P. graminis tritici*, and 5 of *P. hordei*. Resistance to all three rusts was not recorded in any EBDSN line. However, 2 lines (PL 908, RD 3016) were resistant to leaf and stripe rusts. DWRB197 was found resistant to all the pathotypes of leaf and stem rust pathogens. Resistance to all the pathotypes/isolates of *Puccinia striiformis hordei* and *P. hordei* rusts was observed in 7 and 4 lines, respectively (Table 7). DWRB 197 conferred resistance to all the pathotypes of *P. graminis tritici*. The responses of each entry against different pathotypes of rust have been given in Table 9.

Table 9: Seedling rust resistance in EBDSN lines during 2020-21

Rust/s	#lines	Detail of lines
Leaf and stripe	02	PL 908, RD 3016
Leaf and stem	01	DWRB 197
Stripe	07	DWRB 210, KB 1817, KB 1830, RD 2552, RD 2794, RD 2899, RD 2907
Leaf	04	DWRB 217, HBL 113, VLB 118, VLB 168,

Table 8: Seedling response of NBDSN lines to the pathotypes of three rust pathogens of barley during 2020-21

S. No.	Line/Variety	PATHOTYPES																	
		Brown Rust						Black rust					Yellow rust						
		H1	H2	H3	H4	H5	Rph gene	11	21A-2	40A	117-6	295	24	57	M	G	Q	6S0	7S0
1.	BH1029	S	S	R	S	S		R	S	S	R	S	MS	R	S	S	S	R	R
2.	BH1034	R	R	R	R	R		MR	S	S	MR	S	R	R	MS	MS	S	R	S
3.	BH1035	R	R	R	R	R		R	S	MS	MR	S	S	S	S	MR	S	R	R
4.	BH1036	S	S	S	S	S		R	S	MS	MR	S	R	S	S	S	R	R	R
5.	BH1037	R	R	R	R	R		R	S	MR	MS	S	R	S	R	MS	S	R	S
6.	BH1038	S	R	MS	S	S		S	MR	S	MS	MS	R	MS	S	S	R	R	S
7.	BH1039	S	R	MS	MS	S		MR	S	R	MR	S	MS	MS	S	MS	S	S	S
8.	BHS483	S	S	S	S	S		MS	S	MR	MR	R	MS	MR	MR	R	MS	R	R
9.	BHS484	S	S	S	S	S		S	S	S	S	MS	R	R	R	R	R	R	R
10.	BHS485	NG	NG	R	MS	S		MR	R	MR	R	MS	S	S	S	MS	S	R	S
11.	BHS486	R	R	R	S	R		MS	MS	S	MS	S	R	R	MS	R	MS	R	R
12.	BHS487	S	R	MS	S	S		S	S	MR	S	S	MS	MS	R	R	S	R	S
13.	DWRB218	S	S	S	S	S		MS	S	S	MR	S	S	S	S	S	S	R	R
14.	DWRB219	R	MS	R	S	S		R	MR	R	S	R	S	S	S	R	S	R	S
15.	DWRB220	S	S	S	S	R		MR	MS	MR	MR	S	S	S	S	MR	R	R	S
16.	DWRB221	S	S	R	MS	S		R	S	S	MR	MR	S	R	S	R	S	R	R
17.	DWRB222	S	R	MS	S	S		R	R	MR	R	R	R	R	R	R	R	R	R
18.	DWRB223	MS	R	R	R	R		MR	S	MS	MR	R	MS	S	MS	R	S	S	S
19.	DWRB224	MS	MS	R	S	S		MS	S	MS	MS	MR	S	R	S	R	S	R	R
20.	HBL869	R	R	R	R	R		MR	MR	MR	S	R	R	R	NG	R	MS	R	R
21.	HBL870	R	R	R	S	R		MR	MR	S	MR	R	MS	MS	S	R	S	R	S
22.	HBL871	R	S	R	R	NG		MR	MR	MR	R	R	R	R	S	MS	R	R	NG
23.	HBL872	R	R	R	R	R		S	R	MR	MR	MR	R	R	S	R	S	R	S
24.	HBL873	R	R	R	R	R		R	S	MR	MR	S	S	MS	MS	R	R	R	S
25.	HUB272	NG	NG	MS	MS	R		NG	MS	R	NG	NG	R	R	NG	NG	NG	NG	NG
26.	HUB275	S	MS	MS	S	MS		MR	S	MS	R	R	MS	S	MS	R	MS	R	R
27.	HUB276	R	NG	R	R	R		S	R	MS	R	R	NG	NG	NG	NG	NG	NG	NG
28.	HUB277	R	R	NG	NG	MS		R	R	MR	R	R	R	S	NG	R	R	R	R
29.	HUB279	R	R	R	R	R		MR	R	R	MR	R	R	R	R	R	R	R	R
30.	HUB280	NG	NG	NG	NG	R		R	S	MR	R	NG	MR	NG	NG	NG	NG	R	S
31.	K1822	S	MS	NG	MS	S		R	S	R	R	S	R	R	R	R	R	NG	R
32.	KB1822	NG	NG	NG	MS	S		R	R	NG	R	S	NG	NG	NG	NG	NG	NG	NG
33.	KB1909	NG	NG	NG	S	NG		R	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
34.	KB1911	NG	NG	NG	R	NG		NG	NG	R	R	R	NG	NG	NG	NG	NG	NG	NG

35.	KB1912	S	S	MS	MS	S		R	R	S	R	S	R	R	NG	R	R	R	R
36.	KB1916	NG	NG	NG	NG	NG		MS	NG	R	NG	R	NG	NG	NG	NG	R	NG	R
37.	KB1926	NG	R	R	NG	NG		R	MS	R	R	R	MS	S	NG	NG	S	NG	S
38.	KB1939	NG	NG	NG	NG	NG		NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
39.	KB1940	NG	NG	NG	NG	NG		R	S	R	R	NG	NG	S	NG	NG	NG	NG	S
40.	KB1944	NG	NG	NG	NG	NG		NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
41.	KB1946	NG	NG	R	R	R		R	R	R	NG	R	NG	NG	NG	NG	NG	NG	NG
42.	KB1947	NG	NG	NG	R	NG		R	NG	R	NG	R	NG	R	NG	NG	NG	R	S
43.	NDB1752	R	S	MS	MS	MS		S	MR	R	R	MR	S	S	S	S	S	S	S
44.	NDB1754	R	S	R	R	MS		MR	S	MR	R	MR	S	S	S	MS	S	R	S
45.	NDB1756	S	R	MS	S	R		MR	MR	S	R	S	R	R	R	S	R	R	S
46.	PL911	MS	MS	MS	S	R		MS	S	S	MR	S	R	R	R	R	R	R	R
47.	PL917	S	MS	R	S	S		MR	S	MS	S	S	R	R	R	R	R	R	R
48.	PL926	R	R	R	S	R		R	R	S	MR	MS	R	R	R	R	NG	NG	R
49.	PL927	R	R	R	NG	R		R	S	S	R	S	R	R	R	R	NG	R	R
50.	PL928	S	R	R	S	R		R	S	MR	R	MR	R	R	NG	R	R	R	R
51.	PL929	R	R	R	R	R		MR	MS	R	R	S	MS	MR	MS	R	MR	R	R
52.	PL930	R	NG	R	R	S		R	R	MR	R	MR	MS	R	NG	R	S	NG	S
53.	PL931	R	NG	NG	NG	NG		R	MS	MR	R	S	S	NG	S	NG	S	NG	R
54.	PL932	R	R	R	S	R		MR	MR	MR	S	MR	S	S	S	S	S	R	R
55.	RD3012	S	S	S	S	S		MR	S	MR	S	S	S	MS	S	S	S	R	R
56.	RD3013	R	R	R	R	R	Rph3/19+7+	MR	S	S	R	S	S	S	S	S	S	R	MS
57.	RD3016	R	R	R	R	R	Rph2+7+	MR	S	MS	R	S	R	R	R	R	R	R	R
58.	RD3027	R	R	MS	R	R		MS	MS	MR	S	S	S	MS	S	MR	S	R	MS
59.	RD3028	R	R	R	R	R		MS	S	S	MR	S	S	R	S	MS	S	S	S
60.	RD3029	R	S	S	R	R		MR	MS	MR	MS	S	S	S	S	S	S	S	MS
61.	RD3030	S	R	S	MS	MS		S	S	MR	MS	S	S	S	S	S	S	R	S
62.	RD3031	S	R	R	S	S		S	MR	MR	R	MR	R	R	R	R	R	R	R
63.	RD3032	R	R	R	R	R		MS	MR	MS	MS	S	R	R	R	R	R	R	R
64.	RD3033	R	R	R	R	S		MS	S	S	S	S	R	R	R	R	R	R	R
65.	RD3034	S	R	S	S	MS		MR	R	R	MR	MR	R	R	R	R	R	R	R
66.	RD3035	R	R	R	R	R		MR	MR	S	S	MS	S	MS	S	S	S	R	S
67.	RD3036	R	R	R	R	R		R	S	MR	S	R	MS	MS	S	S	S	R	S
68.	RD3037	MS	R	MS	S	S		S	MR	MS	S	MS	R	R	R	R	R	R	R
69.	RD3038	R	R	R	R	R		MR	MS	S	S	S	R	R	NG	R	R	R	R
70.	RD3039	R	R	R	R	R		MS	MS	MR	R	MS	R	R	R	R	R	R	R
71.	RD3040	S	MS	MS	S	S		MR	S	MR	MS	R	R	MS	R	R	R	R	S
72.	RD3041	R	R	MS	S	S		MS	S	R	R	S	R	R	R	R	R	R	R

73.	RD3042	R	R	R	R	R		MS	S	MR	R	S	R	R	R	R	R	R	R
74.	UPB1091	S	R	R	MS	R		R	MR	S	S	MR	R	R	R	R	R	R	R
75.	UPB1092	S	S	R	S	MS		R	R	MR	R	R	R	R	R	R	R	R	R
76.	UPB1093	S	S	S	S	S		S	S	S	S	S	S	S	S	S	S	R	S
77.	UPB1095	S	S	MS	S	S		MR	S	S	MR	S	R	R	R	R	R	R	R
78.	UPB1096	S	S	R	S	S		MR	R	S	MR	S	R	R	R	NG	R	R	R
79.	UPB1097	R	R	R	NG	R		R	S	MR	MS	MR	MS	MS	NG	R	MR	R	R
80.	UPB1098	S	R	R	S	MS		R	S	R	MS	S	S	S	NG	S	S	NG	S
81.	VLB170	R	R	R	R	R		R	R	MS	MS	NG	MS	NG	NG	NG	S	NG	R
82.	VLB171	R	R	R	MS	R		MR	R	S	MR	MR	R	MS	S	S	MS	R	S
83.	VLB172	R	R	MS	NG	R		S	MR	R	S	MR	S	MS	S	MR	NG	R	R
84.	VLB173	R	R	R	R	R		MR	S	MR	S	MS	MS	S	R	MS	S	R	S
85.	VLB174	R	R	R	MS	R		R	S	MR	S	MR	R	R	MS	R	S	R	S
86.	BH902 (C)	S	MS	R	S	S		S	S	S	R	S	S	S	S	S	MX	R	S
87.	BH946 (C)	S	S	S	S	S		R	S	MS	MS	S	S	R	S	S	S	R	R
88.	BH959 (C)	S	R	R	MS	R		R	S	MS	R	MS	S	MS	S	S	S	S	S
89.	BHS352 (C)	S	MS	R	S	S		MR	MR	R	MR	R	MS	S	S	R	MS	R	R
90.	BHS380 (C)	R	R	R	R	R		S	R	R	S	R	NG	R	MS	MS	R	NG	NG
91.	BHS400 (C)	R	R	R	R	R	Rph3+	MS	S	MR	S	S	R	R	R	R	S	R	S
92.	DWRB137 (C)	S	R	S	R	R		MS	S	S	S	S	R	R	R	R	R	R	R
93.	DWRB160 (C)	S	R	R	MS	R		R	S	MR	R	S	MR	R	R	R	S	R	S
94.	DWRB182 (C)	S	R	MS	R	R		R	R	R	R	R	R	R	R	R	R	R	R
95.	DWRUB52 (C)	S	S	S	S	S		MS	MS	S	MR	R	S	R	S	R	S	R	S
96.	HBL113 (C)	R	R	R	NG	R	Rph3+	S	S	R	MR	S	NG	R	NG	R	NG	R	S
97.	HUB113 (C)	S	S	R	S	S		R	S	MS	R	S	R	R	R	R	R	R	R
98.	K603 (C)	S	S	S	S	S		R	R	MS	MR	S	S	S	S	S	S	R	S
99.	KARAN16 (C)	S	MS	MS	S	MS		MR	MS	MS	S	MR	S	S	R	S	S	S	S
100.	LAKHAN (C)	S	MS	MS	S	S		MR	R	MR	S	MS	S	MS	S	S	S	R	S
101.	NDB1173 (C)	S	S	MS	S	MS		MR	MR	MS	S	S	S	S	S	S	S	S	R
102.	NDB943 (C)	S	S	R	S	R		MR	MR	MR	MR	S	MS	MS	MR	R	S	S	S
103.	PL891 (C)	NG	NG	NG	NG	NG		NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
104.	RD2794 (C)	S	S	MS	S	S		R	MR	S	MR	MS	R	R	R	R	R	R	R
105.	RD2849 (C)	S	S	S	S	S		R	S	MS	MR	MS	S	S	S	R	MS	S	S
106.	RD2899 (C)	S	S	R	S	R		MS	MS	S	S	S	R	R	R	R	R	R	R
107.	RD2907 (C)	S	MS	S	S	S		S	S	MR	S	S	R	R	R	R	R	S	R
108.	VLB118 (C)	R	R	R	R	R	Rph3+	MR	MS	MR	MS	S	S	S	S	MR	S	S	S

Table 9: Seedling response of EBDSN lines to the pathotypes of three rust pathogens of barley during 2020-21

S. No.	Line/Variety	PATHOTYPES																	
		Brown Rust						Black rust					Yellow rust						
		H1	H2	H4	H5	Mix	Rph gene	11	21A-2	40A	117-6	295	57	24	M	G	Q	6S0	7S0
1	BH 1029	S	R	MS	S	MS		MR	MR	S	MR	S	R	MS	MS	S	S	R	R
2	HBL 113	R	R	R	R	R	Rph3+	MR	R	MS	MR	NG	MS	S	R	R	NG	NG	R
3	HUB 272	MS	NG	R	NG	R		MR	R	MS	MS	R	NG	R	R	NG	R	R	R
4	KB 1707	NG	NG	MS	NG	NG		R	NG	NG	NG	R	NG	NG	NG	NG	NG	NG	NG
5	PL 906	S	R	MS	R	S		MR	MR	S	MR	S	R	R	NG	R	R	R	R
6	PL 908	R	R	R	R	R	Rph2+3/19+7+	R	R	MR	R	S	R	R	R	R	R	R	R
7	RD 2552	MS	R	MS	MS	R		MR	R	S	MR	S	R	R	R	R	R	R	R
8	RD 2794	S	R	R	MS	S		MR	MR	MS	R	MS	R	R	R	R	R	R	R
9	RD 2849	S	MS	MS	MS	MS		R	R	MR	R	S	R	S	S	R	S	R	S
10	RD 2899	MS	R	R	MS	S		MS	MR	MR	MR	S	R	R	R	R	R	R	R
11	RD 2907	S	MS	MS	MS	MS		S	MR	MS	MS	S	R	R	R	R	R	R	R
12	RD 3016	R	R	R	R	R	Rph2+7+	MR	MR	S	MS	MR	R	R	R	R	R	R	R
13	RD 3024	S	R	S	R	S		R	R	MS	R	S	S	MS	S	R	S	S	S
14	VLB 118	R	R	R	R	R	Rph3+	MR	MR	MR	MS	S	S	S	S	R	S	R	S
15	VLB 166	NG	NG	R	R	NG		NG	MS	S	S	NG	R	NG	R	NG	NG	R	NG
16	VLB 168	R	R	R	R	R	Rph3/19+7+	S	S	MR	MS	S	R	R	S	R	S	R	MR
17	KB 1817	S	MS	MS	R	S		R	MR	MR	MR	MS	R	R	R	R	R	R	R
18	KB 1830	S	NG	S	R	S		R	MR	MS	S	S	R	R	R	R	R	R	R
19	DWRB 123	S	R	S	S	MS		R	R	MS	R	MR	S	S	R	S	MS	R	S
20	DWRB 197	R	R	R	R	R	Rph3/19+7+	R	R	R	R	R	S	S	S	R	S	R	S
21	DWRB 210	S	R	MS	MS	MS		R	R	S	MR	R	R	R	R	R	R	R	R
22	DWRB 211	S	MS	S	R	S		R	MR	S	R	MS	S	S	S	S	S	R	S
23	DWRB 217	R	R	R	R	R	Rph3+	R	R	S	MR	R	S	S	MS	MS	S	R	S

Management of stripe rust of barley through chemicals

The experiment was conducted in RBD with three replications at Ludhiana, Karnal, Jammu, Almora and Durgapura. Due to low disease severity data from Jammu and Karnal not considered for analysis. Yellow rust susceptible variety Jayoti was planted at six rows of 3 meter length plots at row to row distance of 25 cm and recommended packages of practices were followed. Three replications were maintained. The fungicides were sprayed after first appearance of yellow rust and observations were taken at various intervals.

Different fungicide combinations *viz.*, Picoxystrobin 7.05% + Propiconazole 11.7% SC (0.1%), Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE (0.1%), Tebuconazole 50% + Trifloxystrobin 25% WG (0.06%), Propiconazole (0.1%) and Tebuconazole (0.1%) were evaluated as two foliar sprays for the management of yellow rust (*Puccinia striiformis*) of barley at three different locations viz., Durgapura, Almora and Ludhiana during 2020-21 (Table 10). Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% followed by Tebuconazole (0.1%) was the most effective with average coefficient of infection (ACI) < 5% at all the three locations. Moreover, all the fungicides resulted in significantly less ACI as compared with the unsprayed check (Jyoti) during the cropping season.

Table 10: Chemical management of yellow rust of barley during 2020-21 at three different locations

Treatment (s)	Dose (%)	Durgapura		Almora		Ludhiana	
		ACI	Yield (q/h)	ACI	Yield (q/h)	ACI	Yield (q/h)
Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	14.00	43.91	3.67	28.75	2.00	28.75
Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	16.33	42.35	3.33	32.00	2.00	31.50
Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	4.33	45.39	0.33	35.60	1.67	32.95
Propiconazole	0.1	23.67	40.22	3.67	30.42	2.4	30.42
Tebuconazole	0.1	5.83	45.33	0.33	32.41	3.03	32.35
Control	-	98.33	21.42	33.33	27.92	60.00	26.57
SE		0.91	0.52	2.93	1.04	1.25	0.51
CD @ 5%		2.92	1.65	9.35	3.24	3.98	1.63

ENTOMOLOGY

During the cropping season of 2020-21, following experiments were allotted for entomology discipline. These are listed as below:-

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

Experiment 1: Screening of NBDSN barley entries (2020-21) against foliar aphids

A total of one hundred and nine barley NBDSN entries (including checks and infector) were screened against aphids at six locations as per the planned programme of work during 2020-21. 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.

This year on the basis of average score of five location viz.,16 entries BH1029, BH1039, DWRB219, DWRB220, NDB1752, PL911, PL917, PL927, RD3031, RD3032, RD3041, RD3042, BH902(C), BH946 (C), DWRB137(C) and HUB113(C) were scored below 4.0 scale (Table 11).

Table 11: Screening of National Barley Disease Screening Nursery (NBDSN) entries against foliar aphids during 2020-21

S. No	Entry name	Foliar aphid score (1-5 scale)					Average score	Maximum Score
		Ludhiana	Karnal	Pantnagar	Kanpur	Khudwani		
1	BH1029	5	3	2	5	4	3.8	5
2	BH1034	5	4	2	5	5	4.2	5
3	BH1035	5	4	5	4	5	4.6	5
4	BH1036	5	5	3	4	4	4.2	5
5	BH1037	5	4	5	5	5	4.8	5
6	BH1038	5	4	5	5	5	4.8	5
7	BH1039	5	3	1	3	5	3.4	5
8	BHS483	5	4	5	4	5	4.6	5
9	BHS484	5	4	5	4	5	4.6	5
10	BHS485	5	5	5	4	5	4.8	5
11	BHS486	5	4	5	4	5	4.6	5
12	BHS487	5	4	5	4	5	4.6	5
13	DWRB218	5	5	3	4	5	4.4	5
14	DWRB219	5	4	3	2	5	3.8	5
15	DWRB220	5	4	2	3	5	3.8	5
16	DWRB221	5	4	4	3	5	4.2	5
17	DWRB222	5	5	3	5	4	4.4	5
18	DWRB223	5	4	4	4	5	4.4	5
19	DWRB224	5	5	5	3	5	4.6	5
20	HBL869	5	3	5	4	4	4.2	5
21	HBL870	5	5	5	4	4	4.6	5
22	HBL871	5	4	5	5	5	4.8	5
23	HBL872	5	4	5	4	5	4.6	5
24	HBL873	5	5	4	3	5	4.4	5
25	HUB272	5	4	2	5	4	4.0	5
26	HUB275	5	4	5	5	5	4.8	5
27	HUB276	5	3	5	5	5	4.6	5
28	HUB277	5	4	4	5	4	4.4	5
29	HUB279	5	4	5	2	5	4.2	5
30	HUB280	5	4	5	5	5	4.8	5
31	K1822	5	3	3	5	4	4.0	5
32	KB1822	5	4	2	5	5	4.2	5
33	KB1909	5	4	3	4	4	4.0	5
34	KB1911	5	4	3	5	5	4.4	5
35	KB1912	5	4	3	3	5	4.0	5
36	KB1916	5	5	5	2	5	4.4	5
37	KB1926	5	4	2	4	4	3.8	5
38	KB1939	5	5	5	2	5	4.4	5
39	KB1940	5	3	5	4	5	4.4	5
40	KB1944	5	4	4	4	5	4.4	5
41	KB1946	5	4	3	4	5	4.2	5

S. No	Entry name	Foliar aphid score (1-5 scale)					Average score	Maximum Score
		Ludhiana	Karnal	Pantnagar	Kanpur	Khudwani		
42	KB1947	5	4	5	5	5	4.8	5
43	NDB1752	5	4	1	4	5	3.8	5
44	NDB1754	5	4	5	4	5	4.6	5
45	NDB1756	5	3	5	3	5	4.2	5
46	PL911	5	4	2	4	4	3.8	5
47	PL917	5	4	3	2	4	3.6	5
48	PL926	5	4	4	3	5	4.2	5
49	PL927	5	4	2	2	5	3.6	5
50	PL928	4	5	3	5	5	4.4	5
51	PL929	5	4	5	5	5	4.8	5
52	PL930	5	5	5	4	5	4.8	5
53	PL931	5	5	5	3	5	4.6	5
54	PL932	4	4	5	4	5	4.4	5
55	RD3012	5	5	5	5	4	4.8	5
56	RD3013	5	5	3	5	5	4.6	5
57	RD3016	5	4	1	5	5	4.0	5
58	RD3027	5	4	5	5	5	4.8	5
59	RD3028	5	4	5	4	5	4.6	5
60	RD3029	5	4	3	4	5	4.2	5
61	RD3030	5	3	5	4	5	4.4	5
62	RD3031	5	3	3	2	5	3.6	5
63	RD3032	5	4	2	5	4	4.0	5
64	RD3033	5	3	2	2	5	3.4	5
65	RD3034	5	4	1	5	5	4.0	5
66	RD3035	5	3	5	5	5	4.6	5
67	RD3036	5	3	5	4	5	4.4	5
68	RD3037	5	4	3	5	5	4.4	5
69	RD3038	5	5	5	5	5	5.0	5
70	RD3039	5	3	5	5	5	4.6	5
71	RD3040	5	3	4	4	5	4.2	5
72	RD3041	5	4	4	0	5	3.6	5
73	RD3042	5	3	1	5	4	3.6	5
74	UPB1091	5	3	5	5	5	4.6	5
75	UPB1092	5	4	5	4	5	4.6	5
76	UPB1093	5	4	5	4	5	4.6	5
77	UPB1095	5	3	5	4	5	4.4	5
78	UPB1096	5	3	4	3	5	4.0	5
79	UPB1097	5	4	4	4	5	4.4	5
80	UPB1098	5	5	2	3	5	4.0	5
81	VLB170	4	5	5	4	5	4.6	5
82	VLB171	5	3	5	4	5	4.4	5
83	VLB172	5	5	5	4	4	4.6	5
84	VLB173	5	5	5	4	5	4.8	5

S. No	Entry name	Foliar aphid score (1-5 scale)					Average score	Maximum Score
		Ludhiana	Karnal	Pantnagar	Kanpur	Khudwani		
85	VLB174	5	5	5	5	5	5.0	5
86	BH902 (C)	5	4	1	3	5	3.6	5
87	BH946 (C)	5	3	2	2	5	3.4	5
88	BH959 (C)	5	4	3	5	5	4.4	5
89	BHS352 (C)	5	5	5	4	5	4.8	5
90	BHS380 (C)	5	4	5	5	5	4.8	5
91	BHS400 (C)	5	4	2	4	5	4.0	5
92	DWRB137 (C)	5	3	2	5	4	3.8	5
93	DWRB160 (C)	5	4	5	5	5	4.8	5
94	DWRB182 (C)	5	4	2	4	5	4.0	5
95	DWRUB52 (C)	5	4	3	4	5	4.2	5
96	HBL113 (C)	5	5	5	4	5	4.8	5
97	HUB113 (C)	5	3	3	4	4	3.8	5
98	K603 (C)	5	3	5	4	5	4.4	5
99	KARAN16 (C)	5	4	5	5	4	4.6	5
100	LAKHAN (C)	5	3	5	5	5	4.6	5
101	NDB943 (C)	5	4	3	5	4	4.2	5
102	NDB1173 (C)	5	5	2	4	5	4.2	5
103	PL891 (C)	5	5	5	5	5	5.0	5
104	RD2794 (C)	5	4	2	5	5	4.2	5
105	RD2849 (C)	5	5	2	3	5	4.0	5
106	RD2899 (C)	5	5	3	5	5	4.6	5
107	RD2907 (C)	5	3	5	4	5	4.4	5
108	VLB118 (C)	5	5	5	3	5	4.6	5
	Infector	5	5	5	5	5	5.0	5

In addition to NBDSN lines, 5 barley promising entries along with highly susceptible check (Alfa-93) were tested against aphids at seven locations (Hisar, Karnal, Pantnagar, Kanpur, Khudwani Vijapur & Dharwad) during 2020-2120. All five tested entries viz., BCLA3, BCLA10, BCLA11-6, BCLA14 & BCLA36 were found to be in resistant category (grade 2) at five locations (Table 12). Due to low infestation of aphids at Vijapur and Dharwad locations, the data obtained was not included in the table.

Table 12: Screening of promising barley entries against foliar aphids during 2020-21

S. No	Entry name	Foliar aphid score (1-5 scale)					Average score	Maximum Score
		Hisar	Karnal	Pantnagar	Kanpur	Khudwani		
1	BCLA3	2	2	2	2	2	**2.0**	**2**
2	BCLA10	2	2	2	2	2	**2.0**	**2**
3	BCLA11-6	2	2	2	2	2	**2.0**	**2**
4	BCLA14	2	2	2	2	2	**2.0**	**2**
5	BCLA36	2	2	2	2	2	**2.0**	**2**
6	ALFA - 93	5	5	5	5	5	**5.0**	**5**

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

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

Methodology: The experiment was conducted during 2020-21 field season at four locations Ludhiana, Vijapur, Kanpur and Karnal with eight treatments.

Five tillers were tagged from each plot and the experiment was replicated three times. The aphids were counted from these tagged plants before spray and after spray to know the efficacy of each treatment. The grain yield was recorded to know the amount 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 11th Nov.2020 in the plots of 6 rows of 6m long in a replicated trial. There were eight treatments including untreated check and each was replicated three times. For recording observations, five tillers were ear marked in each plot and from these plants' observations were recorded 1 day before spray and then 1, 2, 7 and 15 days after spray.

Aphid population did not differ significantly among all treatments one day before treatment (Table D1). When observed one day after spray, Beta-Cyfluthrin 9%+ Imidacloprid 21% (1.96 aphids/tiller) recorded minimum aphids/tiller and was at par with all other treatments and better than untreated control (32.89 aphids/tiller). Similar results were recorded 2 days after treatment however Beta-cyfluthrin was the best treatments 7 (1.60 aphids/tiller) and 15 days (2.13 aphids/tiller) after spray.

Grain yield (q/ha) obtained was maximum (51.91) from Lambda cyhalothrin 5% EC treated plots followed by thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika) (51.82) treated plots. However, all the foliar insecticidal treatments recorded higher grain yield than untreated check (48.97) (Table 13).

Location: Vijapur

An experiment on management of aphids through foliar application of new bio-chemical molecules was conducted under irrigated condition. The barley variety RD 2052 was sown on 26-11-2020.The results are summarized in table 1. Aphid populations did not differ statistically among all treatments during 24 hrs before spraying. On 1st day after spray, there were overall decreased in numbers of aphids/shoot in all the treatments as compared to untreated check. While, after 2nd day of spray the minimum aphid population was noticed in Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) and it was at par with all other treatments except untreated check. On 7th day after spray, minimum no. of aphid population was recorded under Sulfoxaflor 12 % SC and it was at par with all the treatments except untreated check. Observation taken after 15th day after spray showed that significantly the lowest aphid population was reported in treatment of Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) and it was at par with all the treatments except untreated check. Thus, all the insecticidal treatments achieved significantly lower aphid populations than untreated check. The grain yield (q/ha) showed non-significant differences among all the treatments. Though, the maximum grain yield increase over check was recorded under treatment of Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) followed by the treatments of Lambda cyhalothrin 5 % EC and Acetamiorid 20 SP (Table 14).

Location: Karnal

An experiment on management of aphids through foliar application of new bio-chemical 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.

Before the application of treatments, there was no significant difference among the aphid counts made in different plots. After one of spraying, aphid populations was recorded to be lowest (2.09

aphids/tiler) in Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) i.e. 2.91 aphids/tiller followed by Imidacloprid 17.8 SL.i.e. 3.41 aphids/tiller. After 2nd day of spray again Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) had the minimum aphid population (1.64 aphis/tiller) followed by Sulfoxaflor 12 % SC (1.65 aphids/tiller). Similar trends were seen after 7 and 15 days of spraying.

The highest grain yield of 47.1 q/ha was recorded Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) treatment followed by Sulfoxaflor 12 % SC (46.0 q/ha). All the insecticidal treatment recorded significantly higher than untreated check (38.40 q/ha) (Table 15).

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 1.12.2020 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 4.51 and 5.06 aphid population. After 2 days these insecticides recorded the lowest population of 2.24 and 2.40 aphids/tiller. After 15 days after spray there were no aphids recorded in all tested treatments except control (6.11 aphids/tiller).

Grain yield q/ha was maximum (40.43 q/ha) is recorded in treatment of Lambda cyhalothrin 5% EC @500ml as compared to control which recorded the lowest yield of 24.07 q/ha. (Table 16).

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

During the 2020-21, 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 moderate to high 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.

Table 13: Management of aphids through foliar application of new bio-chemical molecules (2020-21) (Location: Ludhiana)

S. No.	Treatments	Dose ml or g / ha	Aphid population per ear head					Grain Yield (q/ha)
			Before spray	After spray				
			1 day	1 day	2 days	7 days	15 days	
1	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika)	150 ml	30.45	2.21 (1.79)*	1.97 (1.72)	1.82 (1.68)	2.35 (1.83)	51.82
2	Thiamethoxam 25% WG	50	30.78	2.28 (1.81)	1.94 (1.71)	1.78 (1.66)	2.42 (1.85)	51.64
3	Lambda cyhalothrin 5% EC	500	30.89	2.18 (1.78)	1.97 (1.72)	1.73 (1.65)	2.24 (1.82)	51.91
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	30.41	1.96 (1.72)	1.83 (1.68)	1.68 (1.63)	2.13 (1.76)	51.55
5	Imidacloprid 17.8 SL	400	30.51	1.97 (1.72)	1.88 (1.69)	1.62 (1.62)	2.22 (1.79)	51.68
6	Beta-cyfluthrin 25 SC	1450	30.89	2.23 (1.79)	1.89 (1.69)	1.60 (1.61)	2.13 (1.76)	51.46
7	Sulfoxaflor 12% SC	250 ml	30.78	2.26 (1.80)	1.98 (1.72)	1.62 (1.61)	2.22 (1.79)	51.60
8	Untreated control	-	30.44	32.89 (5.82)	32.71 (5.81)	32.04 (5.74)	33.23 (5.85)	48.97
CD (p=0.05)			NS	(0.11)	(0.11)	(0.11)	(0.13)	1.49

*Figures within parentheses arc transformed means

Date of sowing : 11.11.2020
Date of insecticidal application : 04.03.2021
Date of harvest : 30.04.2021

Plot size : 7.5 m^2
Variety : PL 807
Replications : Three

Table 14: Management of aphids through foliar application of new bio-chemical molecules (2020-21) (Location: Vijapur)

Sr. No.	Treatment	Doses g.a.i./ha	Aphid population per shoot					Grain yield (q/ha)
			Before spray (days)	After spray (days)				
				1st	2nd	7th	15th	
1	Thiamethoxam 12.6 % + Lambda cyhalothrin 9.5% ZC (Alika)	33.15 (18.9+14.25)	29.3	2.84 (8.20)	2.04 (4.20)	1.06 (1.13)	0.71 (0.00)	43.0
2	Thiamethoxam 25 % WG	12.5	36.3	3.96 (15.80)	2.82 (8.13)	1.93 (3.80)	0.71 (0.00)	44.4
3	Lambda cyhalothrin 5 % EC	25	42.9	3.96 (15.80)	2.23 (5.00)	1.40 (2.01)	0.83 (0.20)	45.9
4	Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon)	(8.49+19.81 % w/w)	36.2	2.91 (8.47)	1.64 (2.73)	1.30 (1.73)	0.71 (0.00)	47.1
5	Imidacloprid 200 SL (Confidor 17.8)	20	43.5	3.41 (11.67)	2.16 (4.87)	1.38 (2.00)	0.75 (0.07)	45.9
6	Acetamiorid 20 SP	20	29.2	3.86 (14.93)	3.12 (9.80)	2.69 (7.27)	0.79 (0.13)	42.1
7	Sulfoxaflor 12 % SC	30	35.4	3.69 (13.73)	1.65 (2.73)	1.45 (2.13)	0.75 (0.07)	46.0
8	Untreated Check	-	31.0	5.43 (29.53)	5.35 (28.60)	4.48 (20.13)	3.10 (9.10)	38.4
	S. Em ± C.D. at 5%) C.V. %		1.53 NS 14.42	NS 20.7	0.58 8.70	0.57 12.40	0.51 14.80	0.15 10.12

*Figures followed with same letter(s) are not differed statistically

Date of sowing : 26/11/2020 Date of insecticide application : 07/01/2021 Date of harvesting: 24 /03/20201

Design : R.B.D Replications : Three Spacing : 23 cm between row

No. of rows / plot : 6 Plot size : Gross: 6.0m x 1.38m Net : 5.0 m x 0.92m

Variety : RD 2052 Condition : Irrigated

Table 15: Management of aphids through foliar application of new bio-chemical molecules (2020-21). (Location: Karnal)

S. No.	Treatments	Doses g.a.i./ha	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)	33.15 (18.9+14.25)	150 ml	43.12	4.22 (2.28)*	2.44 **(**1.85**)**	0.69 (1.30)	0.81 (1.34)	52.10
2	Thiamethoxam 25% WG	12.5	50	45.11	3.45 (2.11)	3.33 **(**2.08**)**	0.62 (1.26)	0.74 (1.31)	51.99
3	Lambda cyhalothrin 5% EC	25	500	41.23	3.92 (2.22)	2.56 **(**1.88**)**	0.64 (1.28)	0.84 (1.35)	51.26
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	(8.49+19.81 % w/w)	400	42.00	3.02 (2.00)	3.11 **(**2.03**)**	0.60 (1.26)	0.79 (1.33)	52.39
5	Imidacloprid 17.8 SL	20	400	48.52	3.58 (2.14)	3.89 **(**2.21**)**	0.53 (1.23)	0.81 (1.34)	51.35
6	Beta-cyfluthrin 25 SC	20	1450	40.82	4.11 (2.26)	6.67 **(**2.77**)**	0.60 (1.26)	0.90 (1.37)	52.02
7	Sulfoxaflor 12% SC	30	250 ml	46.58	5.23 (2.50)	4.22 (2.28)	2.56 (1.88)	2.44 **(**1.85**)**	52.36
8	Untreated control	-	-	44.25	34.21 (5.93)	36.11 **(**6.09**)**	30.00 **(**5.56**)**	28.33 **(**5.41**)**	50.25
CD (p=0.05)				NS	(0.16)	(0.11)	0.14	0.18	0.09

***** Figures in parentheses indicate V_{n+1} transformed value

Date of sowing : 09-11-2020 Plot size : Six row of six meter length at 25 cm spacing
Date of insecticide application : 19-02-2021 Variety : DWRUB64
Date of harvest : 11-04-2021 Replication : Three

Table 16: Management of aphids through foliar application of new bio-chemical molecules (2020-21) (Location: Kanpur)

S. No.	Treatments	Actual dose ml/g/ha	Aphid population per main shoot					Grain yield (q/ha)	Increase yield (q/ha) over untreated
			Before spray	After spray					
			1 day	1day	2 days	7 days	15 days		
1.	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika)	150 ml.	14.44	8.62 (17.05)	5.60 (13.69)	1.40 (6.80)	0	30.73	6.66
2.	Thiamethoxam 25% WG	50 g	11.60	7.40 (15.79)	4.02 (11.54)	1.10 (6.02)	0	32.07	8.00
3.	Lambda cyhalothrin 5% EC	500ml	13.60	4.51 (12.25)	2.24 (8.53)	0.20 (2.56)	0	40.43	16.36
4.	Beta-Cyfluthrin 9%+ Imidacloprid 21%	400ml	11.40	6.40 (14.65)	3.35 (10.47)	0.46 (3.89)	0	35.62	11.55
5.	Imidacloprid 17.8 EC	400ml	11.75	7.06 (15.34)	3.73 (11.09)	1.00 (5.74)	0	35.44	10.37
6.	Beta-cyfluthrin 25 SC	1450ml	12.60	5.66 (13.69)	2.73 (9.46)	0.43 (3.63)	0	38.66	14.59
7.	Thiamethoxam 30% FS	100ml	10.60	5.06 (12.92)	2.40 (8.91)	0.40 (3.63)	0	38.87	14.80
8.	Untreated control	-	12.40	13.55 (21.56)	25.73 (30.45)	30.76 (33.65)	6.11	24.07	-
S.Em ±		-	NS	0.681	0.959	0.775	-	0.406	-
CD 5%		-	NS	1.832	2.937	2.374	-	1.244	-

Date of sowing : 01.12.2020
Date of before spry data : 29.01.2021
Date of insecticidal application : 30.01.2021
Date of harvest : 13.04.2021
Design : R.B.D.
Plot size : 3 m x 5m = 15 Sq m
Variety : K551
No. of rows/plot : 23
Replication : Three

CO-OPERATORS

Plant Pathology		
S N	**Centre**	**Cooperators**
1	Karnal	Dr. Sudheer 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	Faizabad	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		
S N	**Centre**	**Cooperators**
1	Karnal	Dr. Poonam Jasrotia
2	Vijapur	Ms. E. Premabati Devi
3	Ludhiana	Dr. Beant Singh
4	Kanpur	Dr. J. Kumar
5	Pantnagar	Dr. Deepshikha
6	Khudwani	Dr. Shabir Hussain Wani
7	Dharwad	Dr. Gurudatt M. Hegde
Nematology		
S N	**Centre**	**Cooperators**
1	Durgapura	Dr. S. P Bishnoi
2	Ludhiana	Dr. Ramanna Koulagi
3	Hisar	Dr. Saroj Yadav

BARLEY RESOURCE MANAGEMENT

To increase the production, productivity and profitability of the barley growing farmers, updating the package of practices of barley cultivation is a continuous process and the need of the hour for changing scenario. Resource management group (barley) conducted six special trials at different locations and in total conducted 48 trials, out of which 45 were reported, while three trials (Two at Agra and one at Kanpur) were rejected by the monitoring team due to faulty layout or poor germination.

Details of barley trials proposed and conducted during 2020-21

Trial Name	Number of trials			
	Proposed	**Not conducted /Failed**	**Data Received**	**Data Reported**
Special trials				
Date of sowing (NWPZ, NEPZ, CZ NHZ)	11	2(MT)	9	9
N and Zn scheduling (NWPZ)	5	-	5	5
Yield Maximisation (NWPZ, NEPZ, CZ, NHZ)	11	-	11	11
Nano fertiliser application (NWPZ)	6	-	6	6
Zn application x varieties (NWPZ, NEPZ, CZ, NHZ)	11	1(MT)	10	10
Irrigation levels and silicon (NWPZ, CZ)	4	-	4	4
Total	48	3	45	45

SPL 1: Productivity enhancement through adjusting sowing dates in barley

There was no significant difference in three sowing dates (first November to 25th November) but it was significantly superior to December sowing in NWPZ. In NEPZ, the yield was highest in 11-15 November sowing and thereafter yield decreased significantly. In Central zone (Udaipur), the yield increased as the sowing delays till 1-5 December with variety DWRB137 and till November 20-25 November with variety RD2899 but yield level was very poor. In NHZ, the yield increased as the sowing delays till 11-15 November and thereafter it decreased significantly.

Table 1	**NORTH WESTERN PLAINS ZONE**				**Pooled**	**2020-21**
	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	47.56	48.66	48.08	42.15	46.61	
DWRB 160	45.23	45.13	45.38	37.81	43.39	
MEAN	46.40	46.89	46.73	39.98	45.00	
CD (0.05) DOS(A) 1.22	Variety(B) 0.65	B within A 1.29	A within B 1.52			
	Earhead/ m^2					
BH 946	395.4	378.9	340.9	313.8	357.3	
DWRB 160	407.4	383.3	374.5	354.8	380.0	
MEAN	401.4	381.1	357.7	334.3	368.6	
CD (0.05)	DOS(A) 11.7	Variety(B) 7.22	B within A 14.4	A within B 15.5		

			Grains/Earhead		
BH 946	43.28	43.60	41.62	39.85	42.09
DWRB 160	54.46	53.42	50.45	46.70	51.26
MEAN	48.87	48.51	46.03	43.27	46.67
CD (0.05)	DOS(A) 0.99	Variety(B) 0.75	B within A 1.50	A within B 1.45	
			1000 Grain Weight, g		
BH 946	47.60	49.60	51.21	45.92	48.58
DWRB 160	28.14	29.39	29.83	29.24	29.15
MEAN	37.87	39.50	40.52	37.58	38.87
CD (0.05)	DOS(A) 1.06	Variety(B) 0.78	B within A 1.56	A within B 1.53	

Table 1.1	**NORTH WESTERN PLAINS ZONE**			**Ludhiana**	**2020-21**
		DOS X Varieties		Yield, q/ha	
Varieties			Date of sowing		
	November1-5	November 11-15	November20-25	December 1-5	Mean
BH 946	48.90	49.60	51.79	45.68	48.99
DWRB 160	48.09	51.50	52.84	44.46	49.22
MEAN	48.50	50.55	52.31	45.07	49.11
		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	0.66	2.27	3.28
Variety	(B)	N.S.	0.59	1.93	4.18
B within A		N.S.	1.18	3.86	
A within B			1.06	3.47	
				Karnal	
BH 946	30.42	37.26	47.58	42.39	39.41
DWRB 160	39.07	41.03	46.58	36.69	40.84
MEAN	34.74	39.14	47.08	39.54	40.13
		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	1.10	3.82	6.74
Variety	(B)	*	0.36	1.17	3.10
B within A		**	0.72	2.34	
A within B			1.21	3.96	
				Hisar	
BH 946	44.59	42.77	40.26	39.95	41.89
DWRB 160	46.10	44.89	43.98	38.65	43.40
MEAN	45.34	43.83	42.12	39.30	42.65
		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	*	0.93	3.22	5.34
Variety	(B)	N.S.	0.52	1.70	4.22
B within A		N.S.	1.04	3.397	
A within B			1.19	3.87	
				Durgapura	
BH 946	66.33	65.00	52.7	40.57	56.15
DWRB 160	47.67	43.10	38.13	31.43	40.08
MEAN	57.00	54.05	45.42	36.00	48.12
		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	**	1.24	4.31	6.34
Variety	(B)	**	0.64	2.10	4.64
B within A		**	1.29	4.20	
A within B			1.54	5.03	

Table 1a **NORTH EASTERN PLAINS ZONE** **Pooled** **2020-21**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	November11-15	November 21-55	December 1-5	December 11-15	Mean
			Yield, q/ha		
DWRB137	41.57	39.41	34.85	29.00	36.20
HUB113	42.93	40.71	35.38	29.81	37.21
MEAN	42.25	40.06	35.12	29.40	36.71
CD (0.05)	DOS(A) 0.56	Variety(B) 0.80	B within A 1.60	A within B 1.26	
			Earhead/ m^2		
DWRB137	329.3	322.2	303.8	288.5	311.0
HUB113	322.7	346.8	332.7	308.5	327.7
MEAN	326.0	334.50	318.25	298.50	319.3
CD (0.05)	DOS(A) 7.19	Variety(B) 4.71	B within A 9.42	A within B 9.78	
			Grains/Earhead		
DWRB137	37.00	36.90	33.08	26.41	33.35
HUB113	42.21	38.74	34.86	27.97	35.94
MEAN	39.61	37.82	33.97	27.19	34.64
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	43.32	44.90	41.15	39.85	42.31
HUB113	39.84	39.75	36.15	37.82	38.39
MEAN	41.58	42.33	38.65	38.84	40.35
CD (0.05)	DOS(A) 1.06	Variety(B) 0.78	B within A 1.56	A within B 1.53	

Table 1a.1 **NORTH EASTERN PLAINS ZONE** **Varanasi** **2020-21**

DOS X Varieties Yield, q/ha

Varieties		Date of sowing				
		November11-15	November 21-25	December 1-5	December 11-15	Mean
DWRB137		43.7	46.6	43.03	38.27	42.90
HUB113		45.1	48.1	44.27	39.63	44.27
MEAN		44.4	47.35	43.65	38.95	43.59
			F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)		**	0.28	0.96	1.56
Variety	(B)		**	0.17	0.56	1.36
B within A			N.S.	0.34	1.12	
A within B				0.37	1.20	
						Kumarganj
DWRB137		39.43	32.21	26.66	19.73	29.51
HUB113		40.76	33.32	26.50	19.99	30.14
MEAN		40.09	32.77	26.58	19.86	29.82
			F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)		**	0.34	1.19	2.83
Variety	(B)		N.S.	0.63	2.04	7.28
B within A			N.S.	1.25	4.09	
A within B				0.95	3.10	

Table 1b* **CENTRAL ZONE** **Udaipur** **2020-21**

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	10.59	11.36	14.67	17.38	13.50
RD2899	8.29	9.60	10.66	10.53	9.77
MEAN	9.44	10.48	12.66	13.96	11.63
CD (0.05)	DOS(A) 2.34	Variety(B) 1.80	B within A 3.59	A whthin B 3.36	
			Earhead/ m²		
DWRB137	189.3	161.3	223.0	255.3	207.3
RD2899	164.3	163. 7	237.0	222. 7	196.9
MEAN	176.8	162.5	230.0	239.0	202.1
CD (0.05) 49.8	DOS(A) 44.0	Variety(B) 19.6	B within A 39.1	A within B	
			Grains/Earhead		
DWRB137	35.47	36.4	36.13	40.40	37.10
RD2899	32.13	40.2	36.67	26.13	33.78
MEAN	33.80	38.30	36.40	33.27	35.44
CD (0.05) 6.55	DOS(A) 4.11	Variety(B) 3.73	B within A 7.47	A within B	
			1000 Grain Weight, g		
DWRB137	46.09	45.81	47.70	48.51	47.03
RD2899	46.41	45.26	46.63	44.66	45.74
MEAN	46.25	45.54	47.16	46.58	46.38
CD (0.05)	DOS(A) 1.23	Variety(B) 1.25	B within A 2.49	A within B 2.11	

*Poor Yield

Table 1c **NORTHERN HILLZONE** **POOLED 2020-21**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	October25-30	November 5-10	November15-20	November25-30	Mean
Yield, q/ha					
BHS400	39.93	41.11	37.62	33.06	37.93
VLB118	36.17	38.58	33.70	30.00	34.61
MEAN	38.05	39.84	35.66	31.53	36.27
CD (0.05)	DOS(A) 2.66	Variety(B) 1.34	B within A 2.68	A within B 3.26	
			Earhead/ m2		
BHS400	426.0	433.0	401.2	364.0	406.0
VLB118	367.3	368.8	346.8	327.7	352.7
MEAN	396.7	400.9	374.0	345.8	379.3
CD (0.05)	DOS(A) 13.3	Variety(B) 9.64	B within A 19.3	A within B 19.0	
			Grains/Earhead		
BHS400	25.18	25.85	23.63	25.09	24.94
VLB118	23.71	24.29	21.69	22.16	22.96
MEAN	24.44	25.07	22.66	23.63	23.95
CD (0.05)	DOS(A) 1.88	Variety(B) 0.88	B within A 1.76	A within B 2.09	

1000 Grain Weight, g

BHS400	42.97	42.43	41.83	40.61	41.96
VLB118	43.80	43.38	43.22	41.88	43.07
MEAN	43.39	42.90	42.52	41.24	42.51
CD (0.05)		DOS(A) 0.78	Variety(B) 0.39	B within A 0.79	A within B 0.96

Table 1c.1 **NORTHERN HILL ZONE** **Malan 2020-21**

DOS X Varieties Yield, q/ha

Varieties	Date of sowing				
	October25-30	November 5-10	November15-20	November25-30	Mean
BHS400	38.64	37.88	35.50	30.72	30.72
VLB118	35.97	35.45	31.43	27.82	27.82
MEAN	37.31	36.66	33.46	29.27	29.27

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	*	1.66	5.74	11.89
Variety	(B)	*	0.86	2.81	8.73
B within A		N.S.	1.72	5.62	
A within B			2.06	6.71	

Bajaura

BHS400	41.22	44.33	39.73	35.40	40.17
VLB118	36.37	41.71	35.97	32.17	36.56
MEAN	38.79	43.02	37.85	33.78	38.36

		F. Test	S.E.m	C.D.	C.V.(%)
DOS	(A)	*	1.30	4.51	8.32
Variety	(B)	**	0.66	2.16	5.97
B within A		N.S.	1.32	4.32	
A within B			1.60	5.23	

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

The trial was conducted at five locations in NWPZ with N and Zn applications The productivity was at par among treatments when nitrogen was in three splits and urea and Zn was applied as foliar spray. Although there was no significant difference in protein content when split twice or thrice or with foliar spray of urea and Zn but highest was obtained when nitrogen was split thrice (1/3 at basal+1/3 at tillering (35-40 DAS) +1/3 at flag leaf stage).

Table 2 **NORTH WESTERN PLAIN ZONE** **POOLED** **2020-21**
N and Zn Scheduling

	Earhead/ m^2	Grains/Earhead	1000 Gr. Wt, g	Yield, q/ha	Protein
T1	358.0	34.4	51.1	46.9	11.53
T2	355.2	34.3	51.9	48.3	12.03
T3	360.2	34.7	51.5	49.4	11.93
T4	371.0	34.5	51.8	49.1	11.40
T5	385.7	33.9	52.9	50.7	12.02
T6	362.7	34.7	51.7	46.8	11.13
T7	371.2	35.1	52.6	51.2	10.57
T8	357.3	34.6	51.3	46.6	11.77
T9	362.1	35.9	52.0	49.3	10.97
Mean	364.8	34.7	51.9	48.7	11.50
S.E.(M)	5.95	0.699	0.853	1.175	0.32
C.D.	14.0	1.6	2.0	2.8	0.95

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 5.0% 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 2.1 **NORTH WESTERN PLAIN ZONE** **2020-21**
N and Zn Scheduling Yield, q/ha

	Ludhiana	**Karnal**	**Agra**	**Hisar**	**Durgapura**
T1	48.45	48.17	40.25	37.86	60.13
T2	53.44	49.92	42.65	38.3	57.00
T3	53.78	49.36	44.35	39.93	59.56
T4	49.11	48.36	48.25	34.75	64.96
T5	51.04	47.13	52.31	36.23	66.96
T6	45.03	49.80	47.75	31.05	60.20
T7	49.62	50.93	54.56	35.49	65.56
T8	50.70	46.71	46.32	31.80	57.23
T9	50.41	46.85	50.08	39.19	60.00
Mean	50.10	48.60	47.40	36.10	61.30
S.E.(M)	3.03	1.61	1.13	4.02	2.28
C.D.	9.09	4.83	3.40	12.1	6.84
C.V.	10.48	5.74	4.15	19.3	6.45

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

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 superior to other combinations. In NEPZ, in addition to RDF 125%+10t FYM+PGR treatment, RDF 150%+PGR and RDF + 10t FYM were also better and at par. In NHZ, similar treatments RDF 125%+10t FYM+PGR and RDF 150%+PGR were superior to others. In all the zones, the yield increased with the increase in level of fertiliser and also with the addition of FYM and PGRs. Hisar centre in NWPZ and Kumarganj centre in NEPZ could not be included in pooled analysis due to treatment difference. Udaipur centre has very poor yield data (table 3c), not enough for yield maximisation.

Table 3 NORTH WESTERN PLAIN ZONE POOLED 2020-21
Yield maximisation

	Earhead/ m^2	Grains/Earhead	1000 GW g	Yield, q/ha
1. Control (No fertiliser)	311.4	39.0	40.3	28.11
2. RDF 50%+10t FYM	362.3	43.5	41.0	45.05
3. RDF 50%+10t FYM+PGR	368.1	43.9	41.2	46.55
4. RDF 75%+10t FYM	382.6	44.1	41.5	48.53
5. RDF 75%+10t FYM+PGR	378.5	43.4	41.2	49.94
6. RDF	392.1	42.6	41.8	51.26
7. RDF+PGR	372.1	45.2	41.2	52.91
8. RDF + 10t FYM	378.5	44.0	40.8	50.96
9. RDF + 10t FYM+PGR	389.3	46.8	40.5	56.65
10. RDF 125%+PGR	396.2	45.1	41.8	54.52
11. RDF 125%+10t FYM+PGR	390.1	45.7	42.1	57.79
12. RDF 150%+PGR	392.5	44.3	41.9	55.82
Mean	376.1	44.0	41.3	49.84
S.E.(M)	4.92	0.70	0.48	0.68
C.D.	11.6	1.6	1.1	1.60

Table 3.1 NORTH WESTERN PLAIN ZONE 2020-21
Yield maximisation Yield, q/ha

	Ludhiana	**Karnal**	**Durgapura**	**Hisar***
1. Control (No fertiliser)	24.58	25.50	30.10	32.20
2. RDF 50%+10t FYM	48.32	47.00	47.23	-
3. RDF 50%+10t FYM+PGR	48.37	48.00	48.57	38.65
4. RDF 75%+10t FYM	50.84	47.00	54.23	39.85
5. RDF 75%+10t FYM+PGR	50.91	49.11	55.97	41.26
6. RDF	52.43	49.60	58.07	40.26
7. RDF+PGR	54.66	50.15	58.57	41.47
8. RDF + 10t FYM	50.92	49.62	51.23	40.86
9. RDF + 10t FYM+PGR	55.38	50.28	62.97	41.16
10. RDF 125%+PGR	51.41	48.39	65.57	41.47
11. RDF 125%+10t FYM+PGR	54.61	49.40	66.47	41.67
12. RDF 150%+PGR	53.98	50.29	63.57	40.36
Mean	49.70	47.03	55.21	39.93
S.E.(M)	1.57	1.15	1.42	1.70
C.D.	3.81	2.80	3.45	4.16
C.V.	5.47	4.25	4.46	7.40

*Not included in poled analysis due to treatment difference

Table 3a NORTH EASTERN PLAIN ZONE POOLED 2020-21
Yield maximisation

	Earhead/ m^2	Grains/Earhead	1000 GW, g	Yield, q/ha
1. Control (No fertiliser)	215.5	35.3	42.9	29.0
2. RDF 50%+10t FYM+PGR	276.5	34.5	43.6	34.5
3. RDF 75%+10t FYM	308.7	35.7	43.2	37.7
4. RDF 75%+10t FYM+PGR	289.3	35.8	44.4	40.3
5. RDF	290.0	33.8	44.3	40.9
6. RDF+PGR	277.3	36.1	44.3	40.4
7. RDF + 10t FYM	310.8	35.6	43.8	42.6
8. RDF + 10t FYM+PGR	324.0	33.8	44.9	41.9
9. RDF 125%+PGR	325.0	35.7	44.1	40.8
10. RDF 125%+10t FYM+PGR	318.5	35.8	43.9	43.4
11. RDF 150%+PGR	303.0	38.4	43.6	43.0
Mean	294.4	35.5	43.9	39.5
S.E.(M)	6.26	0.70	0.42	0.51
C.D.	14.9	1.7	1.0	1.2

Table 3a.1 NORTH EASTERN PLAIN ZONE 2020-21
Yield maximisation Yield, q/ha

	Varanasi	**Kanpur**	**Kumarganj***
1. Control (No fertiliser)	20.77	37.30	26.33
2. RDF 50%+10t FYM	-	-	36.81
3. RDF 50%+10t FYM+PGR	28.12	40.86	37.29
4. RDF 75%+10t FYM	32.54	42.83	38.69
5. RDF 75%+10t FYM+PGR	36.11	44.56	39.74
6. RDF	38.22	43.53	41.00
7. RDF+PGR	36.82	44.02	42.05
8. RDF + 10t FYM	39.13	45.98	43.46
9. RDF + 10t FYM+PGR	37.47	46.27	44.52
10. RDF 125%+PGR	39.17	42.48	42.26
11. RDF 125%+10t FYM+PGR	41.75	45.05	42.50
12. RDF 150%+PGR	43.49	42.50	41.84
Mean	35.78	43.22	39.71
S.E.(M)	0.72	0.73	0.47
C.D.	1.75	1.78	1.13
C.V.	3.47	2.92	2.03

*Not included in poled analysis due to treatment difference

Table 3b **NORTHERN HILL ZONE** **POOLED** **2020-21**

Yield maximisation

	Earhead/ m^2	Grains/Earhead	1000 GW, g	Yield, q/ha
1. Control (No fertiliser)	227.3	16.1	37.2	14.6
2. RDF 50%+10t FYM	293.2	22.8	40.8	29.4
3. RDF 50%+10t FYM+PGR	294.7	23.0	41.2	29.1
4. RDF 75%+10t FYM	313.2	23.9	41.7	32.9
5. RDF 75%+10t FYM+PGR	301.3	25.8	41.4	33.0
6. RDF	298.8	25.5	42.5	33.5
7. RDF+PGR	301.0	25.3	41.6	33.0
8. RDF + 10t FYM	318.0	25.5	42.6	36.1
9. RDF + 10t FYM+PGR	318.7	25.7	41.4	36.6
10. RDF 125%+PGR	316.2	25.2	41.9	36.1
11. RDF 125%+10t FYM+PGR	324.7	27.4	42.4	40.0
12. RDF 150%+PGR	321.7	28.1	41.9	40.0
Mean	302.4	24.5	41.4	32.9
S.E.(M)	4.98	1.10	0.37	1.09
C.D.	11.8	2.6	0.9	2.6

Table 3b.1 **NORTHERN Hill ZONE** **2020-21**

Yield maximisation Yield, q/ha

	Malan	**Bajaura**
1. Control (No fertiliser)	13.63	15.50
2. RDF 50%+10t FYM	22.46	36.42
3. RDF 50%+10t FYM+PGR	23.49	34.62
4. RDF 75%+10t FYM	25.59	40.30
5. RDF 75%+10t FYM+PGR	27.45	38.50
6. RDF	28.62	38.40
7. RDF+PGR	29.21	36.80
8. RDF + 10t FYM	29.50	42.72
9. RDF + 10t FYM+PGR	32.64	40.60
10. RDF 125%+PGR	34.43	37.80
11. RDF 125%+10t FYM+PGR	37.77	42.20
12. RDF 150%+PGR	38.88	41.10
Mean	28.64	37.08
S.E.(M)	1.80	1.23
C.D.	4.37	2.99
C.V.	10.9	5.76

Table 3c.1 **CENTRAL ZONE**			**2020-21**
Udaipur*	**Yield maximisation**		Yield, q/ha
1. Control (No fertiliser)	16.79	8. RDF + 10t FYM	18.49
2. RDF 50%+10t FYM		9. RDF + 10t FYM+PGR	19.66
3. RDF 50%+10t FYM+PGR	15.19	10. RDF 125%+PGR	22.68
4. RDF 75%+10t FYM	18.86	11. RDF 125%+10t FYM+PGR	20.41
5. RDF 75%+10t FYM+PGR	19.58	12. RDF 150%+PGR	24.97
6. RDF	15.90	Mean	19.10
7. RDF+PGR	17.54		
S.E.(M)= 1.39 C.D.= 3.39 C.V. = 12.61		*Poor yield	

SPL4: Enhancing nutrient use efficiency through nano fertiliser in barley

The experiment was conducted at Six locations, five in NWPZ and one at Udaipur (CZ) 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 (Table 4a and 4a). Nano nitrogen affected the barley productivity significantly only at low level of nitrogen.

Table 4 NORTH WESTERN PLAIN ZONE POOLED 2020-21

Nano Fertiliser

Treatments	Earhead/ m^2	Grains/ Earhead	1000 gr. wt, g	Yield, q/ha	Yield gain, Kg grain/ kg N applied
T1	311.9	39.8	41.0	26.9	-
T2	336.2	44.4	41.6	37.0	1010kg/2spray of NN
T3	343.8	45.6	41.8	41.4	1450kg/15kgN+2spray of 500ml NN
T4	362.1	46.1	41.8	43.4	1650kg/15kgN+2spray of 1000ml NN
T5	368.5	46.3	42.0	46.1	1950kg/22.5kgN+2spray of 500ml NN
T6	376.7	47.6	41.3	47.7	2080kg/22.5kgN+2spray of 1000ml NN
T7	382.3	46.7	42.2	49.4	2250kg/30kgN+2spray of 500ml NN
T8	387.9	47.8	41.0	49.6	2270kg/30kgN+2spray of 1000ml NN
Mean	358.7	45.5	41.6	42.7	-
S.E.(M)	5.57	1.01	0.51	0.79	-
C.D.	13.1	2.4	1.2	1.9	-

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

Table 4.1	**Nano Fertiliser (Yield, q/ ha)**					**2020-21**
Treatments	**NWPZ**					**CZ**
	Ludhiana	**Karnal**	**Agra**	**Hisar**	**Durgapura**	**Udaipur**
T1	17.39	26.83	33.17	22.18	35.12	26.97
T2	35.07	44.00	36.80	25.14	44.23	39.64
T3	35.71	48.00	40.64	30.32	52.57	47.99
T4	35.90	48.67	44.7	31.06	56.47	49.08
T5	39.33	49.78	46.73	33.72	60.95	51.17
T6	39.57	50.60	48.85	36.09	63.20	51.90
T7	42.34	52.15	51.57	41.11	60.06	52.51
T8	42.37	52.29	53.85	44.37	55.23	53.05
Mean	35.96	46.54	44.54	33.00	53.48	46.54
S.E.(M)	1.73	1.49	0.94	2.21	2.12	1.62
C.D.	5.26	4.53	2.85	6.70	6.44	4.92
C.V.	8.35	5.56	3.65	11.59	6.88	6.03

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

Zinc treatments soil application, foliar application (0.5% zinc sulphate) and in combinations were used in two varieties in each zone.

In NWPZ, Soil application with zinc sulphate @ 25 kg/ha was found superior compared to all soil and foliar application. It produced 9.2 percent more yield compared to no zinc application. In NEPZ. 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. It produced 9.78 percent more yield compared to no zinc application. In NHZ, the trial was conducted at Bajaura and Malan. Soil application with zinc sulphate @ 25 kg/ha followed by foliar application at heading and early milk stage were at par and superior to other treatments. It obtained 10.5 percent more yield compared to no zinc application.

Table 5 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	45.03	46.37	49.49	44.78	49.50	49.66	47.47
DWRB 123	43.02	43.89	46.71	43.89	46.94	47.80	45.37
MEAN	44.03	45.13	48.10	44.33	48.22	48.73	46.42
CD (0.05)	Zn(A) 1.38	Variety(B) 0.59	B within A 1.45		A within B 1.72		
			Earhead/ m^2				
BH 946	392.2	407.5	421.3	407.7	411.0	425.4	410.9
DWRB 123	420.9	428.2	432.7	427.5	426.6	433.6	428.3
MEAN	406.6	417.8	427.0	417.6	418.8	429.5	419.6
CD (0.05)	Zn(A) 11.0	Variety(B) 5.34	B within A 13.1		A within B 14.4		
			Grains/Earhead				
BH 946	44.14	44.61	42.38	43.41	43.45	43.21	43.53
DWRB 123	26.36	27.18	27.00	25.95	26.60	26.86	26.66
MEAN	35.25	35.89	34.69	34.68	35.02	35.03	35.09
CD (0.05)	Zn(A) 0.92	Variety(B) 0.60	B within A 1.47		A within B 1.39		
			1000 Gr. Wt, g				
BH 946	42.61	43.74	45.03	43.24	44.85	45.57	44.17
DWRB 123	48.00	48.82	50.24	49.64	49.92	49.46	49.35
MEAN	45.31	46.28	47.64	46.44	47.39	47.52	46.76
CD (0.05)	Zn(A) 1.06	Variety(B) 0.58	B within A 1.42		A within B 1.46		

Fe (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	36.9	33.6	35.3	33.6	36.3	42.6	36.4
DWRB 123	38	34.3	36.8	33.8	38.3	37.1	36.4
MEAN	37.5	34.0	36.1	33.7	37.3	39.9	36.4

Ze

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
BH 946	28.2	28.7	31	39.7	34.5	35.5	32.9
DWRB 123	32.1	29.5	32.1	29.1	36	38.4	32.9
MEAN	30.2	29.1	31.6	34.4	35.3	37.0	32.9

Table 5.1 **NORTH WESTERN PLAIN ZONE** **2020-21**

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	41.78	45.69	45.97	42.42	45.37	45.87	44.51
DWRB 123	40.788	42.81	43.44	40.82	42.94	43.38	42.36
MEAN	41.28	44.25	44.70	41.62	44.15	44.62	43.44

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.58	1.84	3.29
Varieties	(B)	**	0.42	1.29	4.07
B within A		N.S.	1.02	3.15	
A within B			0.93	2.86	

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	44.61111	45.94	47.30389	45.98611	45.95833	46.55556	46.05991
DWRB 123	42.98611	46.10	46.26389	44.56944	45.54167	46.13889	45.2662
MEAN	43.79861	46.02	46.78389	45.27778	45.75	46.34722	45.66306

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	N.S.	0.97	3.05	5.20
Varieties	(B)	*	0.237	0.71	2.14
B within A		N.S.	0.567	1.74	
A within B			1.05	3.23	

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	41.41	38.45	42.89	36.97	46.14	42.44	41.38
DWRB 123	43.78	39.34	46.14	42.89	48.80	48.06	44.83
MEAN	42.59	38.89	44.52	39.93	47.47	45.25	43.11

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	*	1.54	4.85	8.74
Varieties	(B)	**	0.62	1.92	6.15
B within A		N.S.	1.53	4.72	
A within B			1.88	5.80	

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	52.33	55.40	61.80	53.73	60.53	63.77	57.93
DWRB 123	44.53	47.30	51.00	47.27	50.47	53.63	49.03
MEAN	48.43	51.35	56.40	50.50	55.50	58.70	53.48

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	1.32	4.16	6.05
Varieties	(B)	**	0.62	1.91	4.93
B within A		N.S.	1.52	4.69	
A within B			1.70	5.25	

Table 5a 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	39.35	40.57	41.57	41.66	42.39	43.42	41.49
HUB 113	39.97	41.21	42.45	42.02	43.14	43.66	42.07
MEAN	39.66	40.89	42.01	41.84	42.77	43.54	41.78
CD (0.05)	Zn(A) 0.42	Variety(B) 0.60	B within A 1.46		A within B 1.12		
			Earhead/ m^2				
DWRB137	308.1	314.8	246.8	322.0	259.3	335.6	253.3
HUB 113	334.4	344.6	272.7	344.3	281.7	358.0	274.0
MEAN	321.3	329.7	259.9	333.2	270.4	346.8	263.8
CD (0.05)	Zn(A) 4.45	Variety(B) 3.81	B within A 9.34		A within B 7.96		
			Grains/Earhead				
DWRB137	35.48	35.82	37.21	36.45	37.30	37.49	36.62
HUB 113	32.91	33.48	34.87	34.85	35.41	35.05	34.43
MEAN	34.19	34.65	36.04	35.65	36.36	36.27	35.53
CD (0.05)	Zn(A) 0.0.56	Variety(B) 0.50	B within A 1.21		A within B 1.02		
			1000 GW, g				
DWRB137	39.64	40.67	40.74	41.32	42.17	42.73	41.21
HUB 113	38.71	39.75	39.08	40.06	40.06	41.47	39.86
MEAN	39.17	40.21	39.91	40.69	41.11	42.10	40.53
CD (0.05)	Zn(A) 0.54	Variety(B) 0.39	B within A 0.95		A within B 0.87		

2020-21

Table 5a.1 NORTH EASTERN PLAIN ZONE

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	35.56	35.80	36.24	35.90	36.55	37.98	36.34
HUB113	36.92	37.50	37.98	37.20	38.66	39.00	37.88
MEAN	36.24	36.65	37.11	36.55	37.60	38.49	37.11

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.10	0.30	0.63
Varieties	(B)	**	0.12	0.38	1.41
B within A		N.S.	0.30	0.93	
A within B			0.23	0.72	

Kanpur

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
DWRB137	45.69	47.67	48.47	49.70	50.20	50.27	48.67
HUB113	45.70	48.10	49.31	49.77	50.77	50.47	49.02
MEAN	45.70	47.88	48.89	49.73	50.48	50.37	48.84

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.20	0.63	1.00
Varieties	(B)	N.S.	0.16	0.49	1.38
B within A		N.S.	0.39	1.20	
A within B			0.34	1.05	

Kumarganj

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
DWRB137	36.81	38.25	39.99	39.38	40.43	42.02	39.48
HUB113	37.29	38.02	40.08	39.10	39.98	41.50	39.33
MEAN	37.05	38.13	40.03	39.24	40.21	41.76	39.40

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	**	0.48	1.52	2.99
Varieties	(B)	N.S.	0.72	2.22	7.77
B within A		N.S.	1.77	5.45	
A within B			1.34	4.13	

Table 5b **NORTHERN HILL 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	36.40	37.58	39.84	38.28	39.70	41.65	38.91
HUB 113	33.24	35.50	38.02	35.64	37.72	38.43	36.42
MEAN	34.82	36.54	38.93	36.96	38.71	40.04	37.67
CD (0.05)	Zn(A) 2.33	Variety(B) 1.14	B within A 2.79	A within B 2.97			
			Earhead/ m^2				
DWRB137	352.0	394.5	408.8	398.7	399.5	418.2	395.3
HUB 113	323.0	343.3	347.5	324.7	353.3	363.0	342.5
MEAN	337.5	368.9	378.2	361.7	376.4	390.6	368.9
CD (0.05)	Zn(A) 19.8	Variety(B) 9.28	B within A 22.7	A within B 25.5			
			Grains/Earhead				
DWRB137	24.43	25.59	27.13	26.50	25.97	26.99	26.10
HUB 113	23.95	24.16	26.08	25.14	24.55	25.62	24.92
MEAN	24.19	24.87	26.60	25.82	25.26	26.31	25.51
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				
DWRB137	41.69	41.99	42.40	42.83	43.07	43.31	42.55
HUB 113	42.18	42.39	42.35	42.13	42.98	43.20	42.54
MEAN	41.93	42.19	42.37	42.48	43.02	43.25	42.54
CD (0.05)	Zn(A) 0.61	Variety(B) 0.33	B within A 0.81	A within B 0.83			

Table 5b.1 **NORTHERN HILL ZONE** **2020-21**

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	31.87	32.89	32.89	34.75	35.41	39.29	35.28
VLB 118	28.20	30.77	30.77	31.89	33.77	35.82	32.27
MEAN	30.03	31.83	31.83	33.32	34.59	37.56	33.77

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	*	1.43	4.50	10.36
Varieties	(B)	*	0.80	2.47	10.08
B within A		N.S.	1.97	6.06	
A within B			1.99	6.14	

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	40.93	42.27	42.23	41.8	44.00	44.00	42.54
VLB 118	38.27	40.23	42.87	39.4	41.67	41.03	40.58
MEAN	39.60	41.25	42.55	40.6	42.83	42.52	41.56

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	N.S.	1.14	3.58	6.69
Varieties	(B)	*	0.494	1.52	5.04
B within A		N.S.	1.21	3.73	
A within B			1.42	4.38	

Table 5c * **CENTRAL ZONE** **2020-21**

Zn X Varieties Yield, q/ha

Udaipur

	No Zn	SA@12.5 kg/ha	SA@25.0 kg/ha	FA(2 sprays)	SA12.5 +FA	SA25.0 +FA	Mean
DWRB137	19.26	16.90	16.52	19.30	20.82	16.17	18.16
RD 2899	12.86	15.78	16.89	20.89	13.56	18.77	16.46
MEAN	16.06	16.34	16.70	20.09	17.19	17.47	17.31

		F. Test	S.E.m	C.D.	C.V.(%)
Zn	(A)	N.S.	0.94	2.97	13.3
Varieties	(B)	N.S.	0.65	2.01	16.0
B within A		*	1.60	4.94	
A within B			1.47	4.54	

*Poor yield

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

The trial was conducted in dry areas of NWPZ (Agra, Durgapura and Hisar) and Udaipur in split plot design having Irrigation levels (3 treatments) in main plot and Silicon doses (4 levels) in sub plot. Pooled results of NWPZ and Udaipur centre revealed that Irrigation levels and silicon doses significantly affected the productivity of barley (Table6 and 6a). The highest yield was obtained with three irrigation and 200 kg silicon per ha which is significantly superior to other treatment combinations. At Udaipur, two irrigations with 200 kg silicon and three irrigations with 150 kg silicon per ha were at par and superior to other treatment combinations.

Table 6 **NORTH WESTERN PLAIN ZONE** **POOLED** **2020-21**

Irrigation X Silicon Levels

Silicon	Irrigation levels				
	Zero	one	Two	Three	Mean
			Yield, q/ha		
Control	23.92	34.09	42.64	51.05	37.93
Silicon 100Kg ha-1	28.62	39.15	47.98	55.30	42.76
Silicon 150Kg ha-1	31.04	41.09	51.79	59.78	45.92
Silicon 200Kg ha-1	37.99	42.89	54.01	61.90	49.20
MEAN	30.39	39.31	49.11	57.01	43.95
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	279.0	310.4	329.2	354.7	318.3
Silicon 100Kg ha-1	292.3	322.7	341.4	367.6	331.0
Silicon 150Kg ha-1	300.9	334.9	351.8	380.8	342.1
Silicon 200Kg ha-1	304.0	336.8	355.3	385.7	345.5
MEAN	294.1	326.2	344.4	372.2	334.2
CD (0.05)	Irrigation((A) 4.64	Silicon (B) 1.88	B within A 3.76	A within B 5.65	
			Grains/Earhead		
Control	27.22	31.84	38.26	42.17	34.87
Silicon 100Kg ha-1	29.33	33.74	38.56	41.74	35.84
Silicon 150Kg ha-1	32.26	34.07	39.34	42.69	37.09
Silicon 200Kg ha-1	33.74	35.73	40.63	43.57	38.42
MEAN	30.64	33.84	39.20	54.17	36.56
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	38.61	42.53	42.78	44.00	41.98
Silicon 100Kg ha-1	39.90	43.39	44.71	45.43	43.35
Silicon 150Kg ha-1	40.36	44.15	45.15	45.94	43.90
Silicon 200Kg ha-1	41.27	44.57	45.67	46.46	44.49
MEAN	40.03	43.66	44.58	45.46	43.43
CD (0.05)	Irrigation((A) 0.72	Silicon (B) 0.72	B within A 1.45	A within B 1.44	

Table 6.1 **NORTH WESTERN PLAIN ZONE** **Agra** **2020-21**

Irrigation X Silicon Levels Yield, q/ha

Silicon	Irrigation levels				
	Zero	one	Two	Three	Mean
Control	24.82	35.03	43.03	50.85	38.43
Silicon 100Kg ha-1	27.17	38.83	45.10	53.25	41.09
Silicon 150Kg ha-1	30.22	40.80	47.55	55.50	43.52
Silicon 200Kg ha-1	32.10	42.16	49.60	57.08	45.24
MEAN	28.58	39.20	46.32	54.17	42.07
		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	**	0.60	2.07	4.92
Silicon	(B)	**	0.900	2.63	7.42
B within A		N.S.	1.800	5.26	
A within B			1.670	5.00	
		Hisar			
Control	39.34	50.58	51.46	53.24	48.65
Silicon 100Kg ha-1	47.33	56.79	60.04	60.64	56.20
Silicon 150Kg ha-1	47.62	57.97	66.84	67.14	59.89
Silicon 200Kg ha-1	66.25	60.04	69.80	70.39	66.62
MEAN	50.13417	56.34417	62.0375	62.85	57.84
		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	*	1.99	6.89	11.92
Silicon	(B)	**	1.86	5.44	11.16
B within A		N.S.	3.73	10.88	
A within B			3.79	11.64	
		Durgapura			
Control	7.60	16.67	33.43	49.07	26.69
Silicon 100Kg ha-1	11.37	21.83	38.80	52.00	31.00
Silicon 150Kg ha-1	15.27	24.50	40.97	56.70	34.36
Silicon 200Kg ha-1	15.63	26.47	42.63	58.23	35.74
MEAN	50.13	56.34	38.96	54.00	31.95
		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	**	0.90	3.13	9.80
Silicon	(B)	**	0.89	2.61	9.68
B within A		N.S.	1.79	5.21	
A within B			1.79	5.48	

Table 6a **Central ZONE** **Udaipur** **2020-21**

Irrigation X Silicon Levels **Yield, q/ha**

Silicon	Irrigation levels				
	Zero	one	Two	Three	Mean
Control	20.03	14.92	17.20	19.32	17.87
Silicon 100Kg ha-1	17.65	17.44	17.43	18.37	17.72
Silicon 150Kg ha-1	18.84	16.49	17.71	19.92	18.24
Silicon 200Kg ha-1	17.60	15.12	20.82	19.79	18.33
MEAN	18.53	15.99	18.29	19.35	18.04
		F. Test	S.E.m	C.D.	C.V.(%)
Irrigation	(A)	N.S.	0.85	2.93	16.3
Silicon	(B)	N.S.	0.66	1.92	12.6
B within A		N.S.	1.31	3.83	
A within B			1.42	4.41	

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, (%)	-	28.2	58.34	82.00	72	83.5	-	55	49.6	-	38.75
Silt, (%)	-	53.4	21.91	9.20	18.5	7.9	-	32	28.25	-	26.78
Clay , (%)	-	18.4	19.41	6.80	9.5	8.5	-	14	22.15	-	34.47
Bulk density, Mg m-3	1.52	1.54	-	1.49	1.4	1.48	-	-	1.4	-	1.46
Field capacity,(%)	33	-	18.61	10.33	-	-	-	-	19.5	-	
Permanent wilting point,(%)	13.5	-	9.56	3.12	-	-	-	-	5.55	-	
Organic carbon, (%)	0.80	0.62	0.34	0.24	0.38	0.285	0.54	0.40	0.45	-	0.54
Available N, Kg ha-1	434	378	183.70	182	142	-	166	-	202.03	-	278.1
Available P2O5,kg ha-1	45.5	28.5	27.79	31.60	17.3	45	8.8	18	22.02	-	23.34
Available K2O,kg ha-1	248	178	282.64	223	292	201.6	244	180	228.13	-	363.2
Ph (1:2)	5.3	6.4	8.42	8.1	7.8	6.8	8.1	7.5	7.42	-	7.89
Ec(1:2)	1.55	55	1.78	0.27	0.21	0.16	0.24	0.15	0.15	-	0.9

Meteorological Information

Bajaura *Latitude 31o 48' N Longitude 77 o 00' E Height above MSL 1090 m*								***Malan*** *Latitude 32o 1' N Longitude 76 o 2' E Height above MSL 950 m*							
Julian weeks	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*	*Julian weeks*	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*
	Max.	*Min.*	*Max.*	*Min.*	*mm*	*mm*			*Max.*	*Min.*	*Max.*	*Min.*	*mm*	*mm*	*hrs/day*
40 (01-07 Oct.)								*40 (01-07 Oct.)*	*12.7*	*31.2*	*75.0*	*80.4*	-		
41 (08-14 Oct.)								*41 (08-14 Oct.)*	*14.1*	*30.8*	*73.3*	*80.7*	-		
42 (15-21 Oct.)	*10.2*	*31*	*38*	*86*	-			*42 (15-21 Oct.)*	*12.1*	*29.8*	*68.6*	*76.0*	-		
43 (22-28 Oct)	*6.8*	*28.7*	*34*	*86*	-			*43 (22-28 Oct)*	*10.1*	*28.8*	*63.3*	*68.0*	-		
44 (29-04 Nov.)	*5.9*	*27.4*	*45*	*79*	-			*44 (29-04 Nov.)*	*9.4*	*28.1*	*59.9*	*63.6*	-		
45 (05-11 Nov.)	*3.2*	*26.3*	*36*	*85*	-			*45 (05-11 Nov.)*	*8.2*	*25.6*	*62.6*	*67.1*	-		
46 (12-18 Nov.)	*2.3*	*23.5*	*31*	*86*	*11.2*			*46 (12-18 Nov.)*	*6.9*	*25.2*	*64.9*	*71.9*	*19.9*		
47 (19-25 Nov.)	*0.2*	*18*	*48*	*90*	*4*			*47 (19-25 Nov.)*	*6.4*	*25.4*	*65.0*	*74.0*	-		
48 (26-02 Dec.)	*0.4*	*13.5*	*57*	*90*	*40.4*			*48 (26-02 Dec.)*	*6.3*	*25.4*	*66.7*	*74.0*	-		
49 (03-09 Dec.)	*0.4*	*21.3*	*27*	*89*	-			*49 (03-09 Dec.)*	*6.1*	*25.4*	*67.9*	*75.7*	-		
50 (10-16 Dec.)	*-1.1*	*17.2*	*27*	*90*	*14*			*50 (10-16 Dec.)*	*5.8*	*25.3*	*68.9*	*74.7*	*22.3*		
51 (17-23 Dec)	*-1.4*	*18.2*	*28*	*90*	-			*51 (17-23 Dec)*	*5.5*	*25.0*	*65.6*	*74.1*	-		
52 (24-31 Dec)	*-1.9*	*17.1*	*32*	*91*	-			*52 (24-31 Dec)*	*6.0*	*23.4*	*66.3*	*74.1*	-		
1 (01-07 Jan)	*1.3*	*16.3*	*35*	*91*	*21.5*			*1 (01-07 Jan)*	*6.1*	*23.1*	*70.0*	*74.3*	*22.8*		
2 (8-14 Jan)	*-1.8*	*17.8*	*30*	*91*	-			*2 (8-14 Jan)*	*6.9*	*23.8*	*71.8*	*76.4*	*7.3*		
3 (15-21 Jan)	*-0.6*	*15*	*32*	*90*	-			*3 (15-21 Jan)*	*8.0*	*25.1*	*69.6*	*76.3*	-		
4 (22-28 Jan)	*0*	*18.2*	*35*	*91*	-			*4 (22-28 Jan)*	*7.4*	*25.4*	*71.0*	*75.1*	*11.4*		
5 (29-04 Feb.)	*-0.3*	*18.9*	*44*	*87*	*5.4*			*5 (29-04 Feb.)*	*6.9*	*25.1*	*71.9*	*77.0*	-		
6 (05-11 Feb.)	*0.7*	*19.2*	*38*	*89*	*10.5*			*6 (05-11 Feb.)*	*7.8*	*27.0*	*72.9*	*77.3*	*5.2*		
7 (12-18 Feb.)	*1.9*	*23.2*	*33*	*90*	-			*7 (12-18 Feb.)*	*8.4*	*26.1*	*73.9*	*77.9*	-		
8 (19-25 Feb.)	*4.4*	*24.8*	*27*	*89*	-			*8 (19-25 Feb.)*	*10.3*	*27.4*	*74.4*	*78.8*	-		
9 (26-04 Mar.)	*4.1*	*24.3*	*27*	*89*	*1.8*			*9 (26-04 Mar.)*	*9.4*	*27.3*	*75.7*	*79.5*	-		
10 (05-11 Mar.)	*5.7*	*24.3*	*33*	*90*	*27.5*			*10 (05-11 Mar.)*	*10.5*	*27.1*	*75.4*	*79.9*	-		
11 (12-18 Mar.)	*5.6*	*24.6*	*42*	*87*	-			*11 (12-18 Mar.)*	*10.6*	*26.9*	*74.3*	*77.9*	-		
12 (19-25 Mar.)	*5.4*	*22.4*	*46*	*88*	*23.1*			*12 (19-25 Mar.)*	*12.0*	*27.7*	*75.3*	*79.9*	*23.8*		
13 (26-01 Apr.)	*6.8*	*27*	*29*	*88*	*6.8*			*13 (26-01 Apr.)*	*11.8*	*28.2*	*74.4*	*80.6*	*2.3*		
14 (02-08 Apr.)	*5.5*	*24.2*	*44*	*86*	*19.4*			*14 (02-08 Apr.)*	*11.7*	*28.8*	*75.3*	*80.4*	*19.4*		
15 (09-15 Apr.)	*5.4*	*28.6*	*36*	*82*	-			*15 (09-15 Apr.)*	*13.1*	*26.9*	*73.1*	*80.7*	-		
16 (16-22 Apr.)	*7.6*	*23.2*	*33*	*88*	*79*			*16 (16-22 Apr.)*	*15.1*	*28.6*	*72.7*	*80.0*	*31.5*		
17 (23-29 April)	*5.6*	*26.2*	*34*	*90*	*53.8*			*17 (23-29 April)*	*15.4*	*32.0*	*75.7*	*82.0*	*73.0*		
18(30-06 May)	*9.7*	*29.2*	*48*	*85*	*23.6*			*18(30-06 May)*	*15.3*	*29.9*	*73.9*	*81.0*	*26.0*		
19 (8-14 May, 19)	*11.2*	*26.2*	*61*	*87*	*26.8*			*19 (8-14 May, 19)*	*14.3*	*30.1*	*74.0*	*81.3*	*6.3*		
20 (15-21 May, 19)	*11.1*	*29.9*	*45*	*84*	*9.6*			*20 (15-21 May, 19)*	*15.3*	*30.5*	*74.7*	*81.0*	*47.8*		
21 (22-28 May, 19)								*21 (22-28 May, 19)*							

Agra Latitude 27o02' N Longitude 77 o 09' E Height above MSL 163.4 m								*Udaipur Latitude 24o35' N Longitude 73 o 42' E Height above MSL 582.17 m*							
Julian weeks	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*	*Julian weeks*	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*
	Max.	*Min.*	*Max.*	*Min.*	*mm*	*mm*			*Max.*	*Min.*	*Max.*	*Min.*	*mm*	*mm*	*hrs/day*
40 (01-07 Oct.)	*36.7*	*21.0*	*87.6*	*53.1*	-	*4.4*		*40 (01-07 Oct.)*	*33.3*	*17.1*	*75.9*	*36.0*	*10.8*	*5.8*	*8.2*
41 (08-14 Oct.)	*35.8*	*20.7*	*88.4*	*56.7*	-	*3.6*		*41 (08-14 Oct.)*	*33.3*	*15.8*	*64.7*	*28.0*	*0.0*	*5.9*	*9.2*
42 (15-21 Oct.)	*35.5*	*20.7*	*82.6*	*52.1*	-	*3.3*		*42 (15-21 Oct.)*	*32.5*	*21.5*	*77.1*	*57.2*	*10.6*	*5.0*	*5.0*
43 (22-28 Oct)	*33.9*	*18.4*	*91.0*	*35.4*	-	*3.1*		*43 (22-28 Oct)*	*32.1*	*13.4*	*63.7*	*22.7*	*0.0*	*4.8*	*9.1*
44 (29-04 Nov.)	*31.4*	*14.4*	*83.8*	*39.0*	-	*2.3*		*44 (29-04 Nov.)*	*30.1*	*10.3*	*67.0*	*21.4*	*0.0*	*4.6*	*8.6*
45 (05-11 Nov.)	*30.3*	*13.4*	*89.7*	*48.8-*	-	*2.1*		*45 (05-11 Nov.)*	*30.2*	*9.6*	*68.9*	*24.4*	*0.0*	*3.1*	*8.7*
46 (12-18 Nov.)	*29.0*	*14.5*	*91.4*	*64.8*	*9.0*	*1.8*		*46 (12-18 Nov.)*	*28.9*	*11.6*	*79.7*	*42.9*	*0.0*	*3.8*	*6.8*
47 (19-25 Nov.)	*25.0*	*10.7*	*89.1*	*60.1*	-	*1.3*		*47 (19-25 Nov.)*	*26.2*	*9.4*	*73.1*	*34.3*	*0.0*	*3.4*	*7.1*
48 (26-02 Dec.)	*25.4*	*11.0*	*89.0*	*59.7*	-	*1.4*		*48 (26-02 Dec.)*	*27.1*	*9.7*	*83.0*	*34.0*	*0.0*	*3.1*	*8.0*
49 (03-09 Dec.)	*28.0*	*12.3*	*89.3*	*51.1*	-	*1.8*		*49 (03-09 Dec.)*	*30.4*	*10.2*	*76.1*	*27.3*	*0.0*	*3.7*	*8.8*
50 (10-16 Dec.)	*22.6*	*13.2*	*89.0*	*75.8*	-	*1.3*		*50 (10-16 Dec.)*	*24.5*	*12.1*	*85.4*	*52.1*	*0.0*	*2.8*	*4.1*
51 (17-23 Dec)	*22.1*	*6.9*	*87.1*	*71.9*	-	*1.0*		*51 (17-23 Dec)*	*23.3*	*4.3*	*80.9*	*26.7*	*0.0*	*3.1*	*7.9*
52 (24-31 Dec)	*21.1*	*6.8*	*86.3*	*69.4*	-	*1.3*		*52 (24-31 Dec)*	*22.5*	*3.8*	*81.9*	*27.8*	*0.0*	*3.1*	*8.3*
1 (01-07 Jan)	*21.7*	*11.4*	*88.3*	*71.3*	-	*1.0*		*1 (01-07 Jan)*	*24.0*	*8.7*	*85.7*	*46.7*	*12.6*	*4.0*	*3.4*
2 (8-14 Jan)	*19.3*	*8.4*	*86.9*	*75.0*	-	*1.4*		*2 (8-14 Jan)*	*22.8*	*9.7*	*90.6*	*51.4*	*0.0*	*2.6*	*4.3*
3 (15-21 Jan)	*20.7*	*7.4*	*86.2*	*72.7*	-	*1.0*		*3 (15-21 Jan)*	*27.3*	*7.5*	*87.9*	*32.9*	*0.0*	*4.0*	*8.3*
4 (22-28 Jan)	*19.4*	*6.9*	*86.6*	*76.1*	-	*1.0*		*4 (22-28 Jan)*	*24.5*	*4.1*	*83.1*	*28.1*	*0.0*	*3.9*	*8.8*
5 (29-04 Feb.)	*25.0*	*8.1*	*87.4*	*64.1*	-	*1.4*		*5 (29-04 Feb.)*	*26.1*	*4.4*	*76.1*	*23.1*	*0.0*	*4.1*	*8.6*
6 (05-11 Feb.)	*26.1*	*10.2*	*87.6*	*68.6*	-	*1.8*		*6 (05-11 Feb.)*	*26.6*	*5.9*	*75.6*	*22.3*	*0.0*	*4.0*	*8.7*
7 (12-18 Feb.)	*28.2*	*11.9*	*89.0*	*67.7*	-	*1.7*		*7 (12-18 Feb.)*	*29.0*	*8.0*	*74.4*	*23.1*	*0.0*	*4.4*	*8.3*
8 (19-25 Feb.)	*30.69*	*13.4*	*89.7*	*63.3*	-	*3.0*		*8 (19-25 Feb.)*	*29.6*	*8.9*	*65.4*	*18.3*	*0.0*	*4.1*	*9.3*
9 (26-04 Mar.)	*32.9*	*15.3*	*86.1*	*49.9*	-	*3.1*		*9 (26-04 Mar.)*	*32.3*	*11.4*	*64.9*	*23.1*	*0.0*	*6.8*	*9.6*
10 (05-11 Mar.)	*32.9*	*16.7*	*89.3*	*52.1*	-	*3.1*		*10 (05-11 Mar.)*	*33.1*	*13.1*	*54.4*	*26.5*	*0.0*	*6.8*	*9.5*
11 (12-18 Mar.)	*33.8*	*18.0*	*91.0*	*57.8*	-	*3.3*		*11 (12-18 Mar.)*	*33.3*	*14.7*	*57.4*	*27.1*	*0.0*	*7.9*	*8.5*
12 (19-25 Mar.)	*35.5*	*19.4*	*91.4*	*37.8*	-	*4.0*		*12 (19-25 Mar.)*	*33.2*	*15.3*	*61.7*	*20.7*	*0.0*	*6.4*	*7.3*
13 (26-01 Apr.)	*37.5*	*20.1*	*91.4*	*33.3*	-	*7.1*		*13 (26-01 Apr.)*	*33.6*	*15.4*	*58.3*	*15.6*	*0.0*	*8.5*	*8.0*
14 (02-08 Apr.)	*39.7*	*19.2*	*88.6*	*25.6*	-	*5.6*		*14 (02-08 Apr.)*	*36.1*	*17.0*	*39.7*	*15.8*	*0.0*	*10.8*	*9.8*
15 (09-15 Apr.)	*40.5*	*20.9*	*84.6*	*31.4*	-	*6.8*		*15 (09-15 Apr.)*	*36.4*	*17.8*	*38.7*	*17.9*	*0.0*	*10.8*	*7.4*
16 (16-22 Apr.)	*39.6*	*22.7*	*75.7*	*30.4*	-	*6.2*		*16 (16-22 Apr.)*	*37.0*	*20.3*	*46.7*	*20.7*	*0.0*	*11.5*	*9.5*
17 (23-29 April)	*39.3*	*20.1*	*89.8*	*33.8*	-	*8.0*		*17 (23-29 April)*	*37.5*	*19.5*	*34.6*	*18.1*	*0.0*	*11.9*	*9.9*
18(30-06 May)	*41.2*	*25.6*	*91.5*	*30.8*	-	*7.8*		*18(30-06 May)*	*37.2*	*20.1*	*43.3*	*25.0*	*0.4*	*11.7*	*7.8*
19(07-13 May)	*40.2*	*24.2*	*82.0*	*33.1*	*4.1*	*6.0*			*38.1*	*22.9*	*42.3*	*26.3*	*0.0*	*13.4*	*9.8*
20(14-20 May)	*34.8*	*24.1*	*89.0*	*60.8*	*88.0*	*3.1*									

Kanpur Latitude 250 28' N Longitude 80 o 34' E Height above MSL 125.9 m								*Kumarganj Latitude 26o 47' N Longitude 82o 12' E Height above MSL 113 m*							
Julian weeks	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*	*Julian weeks*	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*
	Max.	*Min.*	*Max.*	*Min.*	*mm*	*mm*			*Max.*	*Min.*	*Max.*	*Min.*	*mm*	*mm*	*hrs/day*
40 (01-07 Oct.)								*40 (01-07 Oct.)*	*34.4*	*23.0*	*53.1*	*94.1*	*3*		*6.3*
41 (08-14 Oct.)								*41 (08-14 Oct.)*	*34.3*	*21.4*	*50.4*	*90.2*	*0*		*7.8*
42 (15-21 Oct.)								*42 (15-21 Oct.)*	*34.2*	*21.8*	*44.1*	*92.2*	*0*		*7.0*
43 (22-28 Oct)								*43 (22-28 Oct)*	*32.9*	*16.4*	*36.2*	*91.0*	*0*		*7.6*
44 (29-04 Nov.)								*44 (29-04 Nov.)*	*31.3*	*13.5*	*32.0*	*89.5*	*0*		*7.7*
45 (05-11 Nov.)								*45 (05-11 Nov.)*	*30.0*	*11.7*	*33.2*	*92.0*	*0*		*5.1*
46 (12-18 Nov.)								*46 (12-18 Nov.)*	*28.1*	*14.8*	*49.5*	*92.8*	*6.2*		*6.7*
47 (19-25 Nov.)								*47 (19-25 Nov.)*	*25.9*	*10.2*	*36.0*	*92.0*	*0*		*7.1*
48 (26-02 Dec.)								*48 (26-02 Dec.)*	*26.8*	*8.8*	*36.7*	*91.5*	*0*		*7.4*
49 (03-09 Dec.)								*49 (03-09 Dec.)*	*27.3*	*10.2*	*47.1*	*93.7*	*0*		*5.2*
50 (10-16 Dec.)								*50 (10-16 Dec.)*	*22.7*	*11.0*	*57.7*	*90.7*	*0*		*1.8*
51 (17-23 Dec)								*51 (17-23 Dec)*	*20.5*	*5.1*	*45.2*	*91.5*	*0*		*6.0*
52 (24-31 Dec)								*52 (24-31 Dec)*	*23.0*	*5.1*	*42.1*	*91.5*	*0*		*7.0*
1 (01-07 Jan)								*1 (01-07 Jan)*	*24.2*	*9.5*	*45.4*	*87.4*	*0.0*	*3.6*	*6.0*
2 (8-14 Jan)								*2 (8-14 Jan)*	*21.3*	*8.8*	*59.1*	*89.2*	*0.0*	*3.4*	*5.9*
3 (15-21 Jan)								*3 (15-21 Jan)*	*18.5*	*7.4*	*64.4*	*86.0*	*0.0*	*2.5*	*2.9*
4 (22-28 Jan)								*4 (22-28 Jan)*	*16.8*	*7.0*	*72.2*	*96.7*	*0.0*	*1.8*	*2.8*
5 (29-04 Feb.)								*5 (29-04 Feb.)*	*21.1*	*5.5*	*48.8*	*93.5*	*0.0*	*2.4*	*4.3*
6 (05-11 Feb.)								*6 (05-11 Feb.)*	*25.5*	*9.0*	*45.5*	*88.7*	*0.0*	*3.1*	*1.9*
7 (12-18 Feb.)								*7 (12-18 Feb.)*	*27.2*	*9.5*	*43.1*	*93.1*	*0.0*	*4.3*	*5.7*
8 (19-25 Feb.)								*8 (19-25 Feb.)*	*28.2*	*11.7*	*44.1*	*88.5*	*0.0*	*4.7*	*6.5*
9 (26-04 Mar.)								*9 (26-04 Mar.)*	*30.2*	*13.2*	*42.2*	*75.4*	*0.0*	*4.9*	*6.6*
10 (05-11 Mar.)								*10 (05-11 Mar.)*	*31.8*	*14.2*	*51.4*	*77.2*	*0.0*	*5.3*	*6.6*
11 (12-18 Mar.)								*11 (12-18 Mar.)*	*32.2*	*15.2*	*47.2*	*85.7*	*0.0*	*4.4*	*5.9*
12 (19-25 Mar.)								*12 (19-25 Mar.)*	*34.6*	*16.5*	*38.4*	*75.7*	*0.0*	*5.9*	*6.9*
13 (26-01 Apr.)								*13 (26-01 Apr.)*	*35.6*	*16.4*	*35.7*	*77.0*	*0.0*	*6.0*	*7.6*
14 (02-08 Apr.)								*14 (02-08 Apr.)*	*37.6*	*17.0*	*24.4*	*64.2*	*0.0*	*6.2*	*6.7*
15 (09-15 Apr.)								*15 (09-15 Apr.)*	*33.3*	*18.8*	*27.8*	*47.2*	*0.0*	*6.1*	*5.7*
16 (16-22 Apr.)								*16 (16-22 Apr.)*	*37.9*	*20.1*	*35.2*	*56.1*	*0.0*	*5.8*	*7.6*
17 (23-29 April)								*17 (23-29 April)*	*38.0*	*18.0*	*38.0*	*82.0*	*0.0*	*5.8*	*7.6*
18(30-06 May)								*18(30-06 May)*	*36.3*	*24.1*	*38.4*	*64.9*	*0.0*	*5.9*	*6.9*

Hisar Latitude 29o10' N Longitude 75 o 46' E Height above MSL 215.2 m								*Durgapura Latitude 26o 51' N Longitude 75 o 47' E Height above MSL 390 m*							
Julian weeks	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*	*Julian weeks*	*Temperature*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*
	Max.	*Min.*	*Max.*	*Min.*	*mm*	*mm*			*Max.*	*Min.*	*Max.*	*Min.*	*mm*	*mm*	*hrs/day*
40 (01-07 Oct.)	*31.8*	*21.0*	*92*	*50*	*2.6*	*3.7*	*5.5*	*40 (01-07 Oct.)*	*36.1*	*20.0*	*53*	*18*	*5.3*	*0.0*	*36.1*
41 (08-14 Oct.)	*32.7*	*17.6*	*90*	*38*	*0.0*	*3.9*	*7.5*	*41 (08-14 Oct.)*	*35.7*	*20.1*	*51*	*19*	*4.2*	*0.0*	*35.7*
42 (15-21 Oct.)	*34.1*	*18.4*	*79*	*34*	*0.0*	*4.0*	*7.3*	*42 (15-21 Oct.)*	*33.8*	*22.9*	*35*	*24*	*4.9*	*0.0*	*33.8*
43 (22-28 Oct)	*31.9*	*15.0*	*79*	*31*	*0.0*	*3.1*	*6.5*	*43 (22-28 Oct)*	*33.1*	*18.5*	*38*	*17*	*4.2*	*1.0*	*33.1*
44 (29-04 Nov.)	*30.7*	*16.3*	*90*	*40*	*0.0*	*1.8*	*1.8*	*44 (29-04 Nov.)*	*30.6*	*13.2*	*40*	*12*	*3.3*	*0.0*	*30.6*
45 (05-11 Nov.)	*28.4*	*12.7*	*85*	*36*	*0.3*	*2.8*	*6.6*	*45 (05-11 Nov.)*	*30.7*	*13.5*	*57*	*19*	*2.6*	*0.0*	*30.7*
46 (12-18 Nov.)	*26.8*	*12.7*	*87*	*40*	*0.0*	*2.0*	*3.0*	*46 (12-18 Nov.)*	*28.0*	*14.4*	*69*	*25*	*4.4*	*11.0*	*28.0*
47 (19-25 Nov.)	*26.7*	*10.9*	*87*	*45*	*0.0*	*2.3*	*5.0*	*47 (19-25 Nov.)*	*27.3*	*14.1*	*55*	*16*	*4.9*	*0.0*	*27.3*
48 (26-02 Dec.)	*22.6*	*12.1*	*94*	*63*	*12.0*	*1.5*	*2.8*	*48 (26-02 Dec.)*	*26.0*	*11.7*	*79*	*31*	*3.4*	*3.2*	*26.0*
49 (03-09 Dec.)	*23.1*	*6.0*	*88*	*47*	*0.0*	*1.3*	*6.2*	*49 (03-09 Dec.)*	*29.6*	*12.4*	*78*	*24*	*2.1*	*0.0*	*29.6*
50 (10-16 Dec.)	*19.2*	*8.3*	*95*	*73*	*4.5*	*1.2*	*2.2*	*50 (10-16 Dec.)*	*25.2*	*13.0*	*69*	*48*	*4.7*	*0.0*	*25.2*
51 (17-23 Dec)	*13.7*	*6.1*	*99*	*81*	*0.0*	*0.9*	*1.1*	*51 (17-23 Dec)*	*23.1*	*7.5*	*72*	*26*	*2.9*	*0.0*	*23.1*
52 (24-31 Dec)	*11.9*	*2.6*	*97*	*75*	*0.0*	*0.8*	*1.7*	*52 (24-31 Dec)*	*21.9*	*6.0*	*75*	*27*	*3.6*	*0.0*	*21.9*
1 (01-07 Jan)	*17.3*	*5.7*	*96*	*60*	*0.0*	*1.0*	*3.5*	*1 (01-07 Jan)*	*20.9*	*13*	*78*	*59*	*8*	*6.8*	*20.9*
2 (8-14 Jan)	*17.7*	*5.7*	*96*	*64*	*3.2*	*1.0*	*3.3*	*2 (8-14 Jan)*	*20.4*	*8.3*	*83*	*44*	*3.9*	*0*	*20.4*
3 (15-21 Jan)	*13.4*	*4.7*	*100*	*82*	*0.0*	*0.5*	*2.1*	*3 (15-21 Jan)*	*24*	*8.4*	*85*	*32*	*4*	*0*	*24*
4 (22-28 Jan)	*19.2*	*5.0*	*96*	*56*	*7.2*	*1.4*	*5.9*	*4 (22-28 Jan)*	*23*	*6.9*	*85*	*33*	*4.5*	*0*	*23*
5 (29-04 Feb.)	*18.8*	*3.9*	*98*	*61*	*0.0*	*1.3*	*6.3*	*5 (29-04 Feb.)*	*24.8*	*8.2*	*79*	*24*	*26*	*0*	*24.8*
6 (05-11 Feb.)	*20.1*	*2.8*	*92*	*46*	*0.0*	*1.7*	*7.2*	*6 (05-11 Feb.)*	*26.3*	*9*	*83*	*24*	*3.3*	*0*	*26.3*
7 (12-18 Feb.)	*24.7*	*4.8*	*36*	*16*	*0.0*	*0.0*	*2.2*	*7 (12-18 Feb.)*	*28.6*	*12.9*	*74*	*33*	*3.6*	*0*	*28.6*
8 (19-25 Feb.)	*23.8*	*10.5*	*61*	*7*	*10.9*	*1.6*	*2.6*	*8 (19-25 Feb.)*	*30.5*	*12.6*	*64*	*19*	*2.9*	*0*	*30.5*
9 (26-04 Mar.)	*25.8*	*12.2*	*55*	*7*	*0.2*	*0.0*	*2.3*	*9 (26-04 Mar.)*	*32.2*	*14.8*	*58*	*15*	*5*	*0*	*32.2*
10 (05-11 Mar.)	*23.5*	*11.2*	*64*	*12*	*61.8*	*8.8*	*2.8*	*10 (05-11 Mar.)*	*34.2*	*16.6*	*58*	*19*	*4.7*	*0*	*34.2*
11 (12-18 Mar.)	*23.5*	*10.5*	*56*	*8*	*11.6*	*1.7*	*2.6*	*11 (12-18 Mar.)*	*26.6*	*12.8*	*55*	*18*	*4.8*	*0*	*26.6*
12 (19-25 Mar.)	*28.8*	*13.8*	*92*	*50*	*0.0*	*3.3*	*6.8*	*12 (19-25 Mar.)*	*32.1*	*19.4*	*53*	*17*	*4.7*	*2.4*	*32.1*
13 (26-01 Apr.)	*27.9*	*15.2*	*92*	*55*	*21.6*	*4.0*	*5.4*	*13 (26-01 Apr.)*	*36.9*	*19.3*	*41*	*11*	*6.9*	*0.00*	*36.9*
14 (02-08 Apr.)	*30.6*	*13.4*	*84*	*42*	*0.5*	*4.0*	*7.4*	*14 (02-08 Apr.)*	*36.9*	*22.1*	*24*	*8*	*6.4*	*0.00*	*36.9*
15 (09-15 Apr.)	*33.9*	*16.4*	*76*	*26*	*0.0*	*4.8*	*7.4*	*15 (09-15 Apr.)*	*37.9*	*21.0*	*28*	*9*	*4.4*	*0.00*	*37.9*
16 (16-22 Apr.)	*36.9*	*19.6*	*67*	*24*	*0.8*	*6.3*	*7.5*	*16 (16-22 Apr.)*	*36.9*	*21.2*	*39*	*15*	*7.1*	*0.00*	*36.9*
17 (23-29 April)	*34.3*	*19.7*	*75*	*41*	*4.0*	*5.3*	*7.8*	*17 (23-29 April)*	*38.2*	*21.0*	*27*	*7*	*6.2*	*0.00*	*38.2*
18(30-06 May)	*37.4*	*22.1*	*69*	*32*	*18.2*	*7.0*	*8.8*	*18(30-06 May)*	*39.1*	*25.4*	*34*	*15*	*6.2*	*0.00*	*39.1*

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*		*RH %*		*Rainfall*	*Pan Evap.*	*Sun Shine*	*Julian weeks*	*Temperature*		*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.)*							
41 (08-14 Oct.)								*41 (08-14 Oct.)*							
42 (15-21 Oct.)								*42 (15-21 Oct.)*							
43 (22-28 Oct)								*43 (22-28 Oct)*	*31.1*	*13.3*	*85.0*	*23.0*	*0.0*	*19.8*	*6.2*
44 (29-04 Nov.)	*30.3*	*11.9*	*94.6*	*44.7*	*00.0*	*02.7*	*06.3*	*44 (29-04 Nov.)*	*29.1*	*11.2*	*88.0*	*23.0*	*0.0*	*17.8*	*6.0*
45 (05-11 Nov.)	*29.6*	*10.8*	*94.0*	*46.6*	*00.0*	*02.7*	*07.0*	*45 (05-11 Nov.)*	*28.5*	*10.2*	*92.0*	*26.0*	*0.0*	*13.0*	*6.0*
46 (12-18 Nov.)	*26.7*	*12.1*	*98.3*	*61.0*	*39.0*	*02.0*	*05.4*	*46 (12-18 Nov.)*	*24.8*	*10.9*	*88.0*	*43.0*	*14.6*	*10.2*	*4.4*
47 (19-25 Nov.)	*22.6*	*09.1*	*94.7*	*66.7*	*00.0*	*01.7*	*06.8*	*47 (19-25 Nov.)*	*21.5*	*7.9*	*89.0*	*39.0*	*1.0*	*12.2*	*5.2*
48 (26-02 Dec.)	*23.1*	*09.5*	*98.4*	*61.0*	*04.6*	*01.7*	*06.9*	*48 (26-02 Dec.)*	*24.2*	*8.8*	*93.0*	*34.0*	*0.0*	*10.8*	*8.3*
49 (03-09 Dec.)	*23.7*	*10.5*	*98.1*	*68.9*	*00.0*	*01.0*	*05.6*	*49 (03-09 Dec.)*	*24.6*	*11.4*	*89.0*	*47.0*	*0.0*	*10.6*	*4.6*
50 (10-16 Dec.)	*20.4*	*09.8*	*98.3*	*78.0*	*02.4*	*01.8*	*04.4*	*50 (10-16 Dec.)*	*17.4*	*9.3*	*90.0*	*64.0*	*4.2*	*9.2*	*3.8*
51 (17-23 Dec)	*17.9*	*04.0*	*100.0*	*65.0*	*00.0*	*01.2*	*06.1*	*51 (17-23 Dec)*	*18.6*	*3.5*	*91.0*	*39.0*	*0.0*	*7.2*	*7.2*
52 (24-31 Dec)	*17.6*	*03.5*	*94.9*	*76.4*	*00.0*	*01.0*	*05.2*	*52 (24-31 Dec)*	*15.8*	*4.2*	*96.0*	*63.0*	*18.0*	*8.2*	*4.1*
1 (01-07 Jan)	*17.1*	*10.2*	*95.0*	*90.6*	*36.4*	*01.0*	*01.3*	*1 (01-07 Jan)*	*17.6*	*10.0*	*91.0*	*75.0*	*11.0*	*7.4*	*0.5*
2 (8-14 Jan)	*14.9*	*07.0*	*98.7*	*91.3*	*00.0*	*00.9*	*02.7*	*2 (8-14 Jan)*	*14.0*	*6.8*	*93.0*	*71.0*	*0.0*	*6.4*	*1.8*
3 (15-21 Jan)	*16.7*	*07.7*	*99.6*	*88.1*	*00.0*	*00.7*	*03.1*	*3 (15-21 Jan)*	*16.6*	*6.9*	*96.0*	*70.0*	*0.0*	*4.4*	*3.0*
4 (22-28 Jan)	*17.4*	*06.2*	*100.0*	*92.4*	*00.0*	*01.1*	*04.5*	*4 (22-28 Jan)*	*17.9*	*6.4*	*93.0*	*55.0*	*0.0*	*8.4*	*4.6*
5 (29-04 Feb.)	*20.1*	*06.0*	*97.4*	*62.3*	*14.0*	*01.4*	*06.4*	*5 (29-04 Feb.)*	*20.6*	*6.3*	*89.0*	*39.0*	*17.0*	*12.4*	*6.5*
6 (05-11 Feb.)	*20.7*	*06.5*	*100.0*	*68.0*	*05.4*	*02.0*	*07.2*	*6 (05-11 Feb.)*	*21.3*	*7.3*	*95.0*	*58.0*	*0.0*	*11.4*	*7.4*
7 (12-18 Feb.)	*22.7*	*09.1*	*100.0*	*69.7*	*00.0*	*01.2*	*05.5*	*7 (12-18 Feb.)*	*22.5*	*10.8*	*96.0*	*69.0*	*0.0*	*7.2*	*5.4*
8 (19-25 Feb.)	*25.4*	*10.8*	*100.0*	*69.7*	*00.0*	*02.1*	*06.9*	*8 (19-25 Feb.)*	*26.8*	*11.6*	*96.0*	*47.0*	*0.0*	*14.8*	*14.8*
9 (26-04 Mar.)	*27.7*	*12.0*	*95.0*	*73.4*	*04.4*	*03.7*	*09.1*	*9 (26-04 Mar.)*	*27.8*	*11.9*	*90.0*	*38.0*	*0.0*	*24.3*	*9.8*
10 (05-11 Mar.)	*29.2*	*14.0*	*97.9*	*64.4*	*02.0*	*03.6*	*07.7*	*10 (05-11 Mar.)*	*29.7*	*15.3*	*80.0*	*42.0*	*0.0*	*25.4*	*7.5*
11 (12-18 Mar.)	*29.6*	*13.2*	*94.6*	*59.0*	*01.0*	*03.8*	*06.7*	*11 (12-18 Mar.)*	*28.6*	*15.2*	*81.0*	*39.0*	*0*	*23.0*	*4.2*
12 (19-25 Mar.)	*29.3*	*14.7*	*89.4*	*63.3*	*01.0*	*03.9*	*06.1*	*12 (19-25 Mar.)*	*29.1*	*15.2*	*84.0*	*35.0*	*5.0*	*28.6*	*6.1*
13 (26-01 Apr.)	*32.7*	*14.3*	*84.3*	*35.0*	*00.0*	*05.4*	*07.9*	*13 (26-01 Apr.)*	*32.2*	*15.6*	*73.0*	*25.0*	*0.0*	*34.6*	*9.7*
14 (02-08 Apr.)	*34.8*	*14.2*	*56.7*	*21.9*	*00.0*	*07.0*	*07.8*	*14 (02-08 Apr.)*	*32.2*	*14.6*	*55.0*	*16.0*	*3.0*	*41.6*	*8.1*
15 (09-15 Apr.)	*37.8*	*16.6*	*50.4*	*20.7*	*00.0*	*08.0*	*08.9*	*15 (09-15 Apr.)*	*36.0*	*17.5*	*49.0*	*11.0*	*0.0*	*50.8*	*9.5*
16 (16-22 Apr.)	*35.9*	*17.1*	*62.7*	*29.0*	*01.0*	*08.1*	*07.3*	*16 (16-22 Apr.)*	*32.0*	*12.9*	*64.0*	*31.0*	*6.0*	*41.4*	*5.7*
17 (23-29 April)	*35.9*	*17.8*	*60.4*	*23.6*	*01.8*	*08.0*	*09.5*	*17 (23-29 April)*							
18(30-06 May)								*18(30-06 May)*							
								19(07-13 May)							

Cooperating centers and Scientists 2020-21

SN	Centre	Cooperating Scientist Address
NORTHERN HILL ZONE		
1.	Bajaura	Dr Gurudev Singh, Assistant Agronomist, CSKHPKV, HAREC, Bajaura-175 125 (HP). *Email: gdevsaandil@rediffmail.com, Mobile: 09418479856*
2.	Palampur/ Malan	Dr. AD Bindra, Agronomist, Rice-wheat research station, CSK HPKV, Malan, District Kangra, HP.176047 Email: adbindra03@yahoo.co.in; Mobile: 094181 49795
3.	Almora	Dr, Dibakar Mahanta, Scientist Agronomy, VPKAS, Almora-263 601 (Uttarakhand). *Email:* dibakar_mahanta@yahoo.com, *Mobile: 09456108508*
NORTH WESTERN PLAIN ZONE		
4.	Karnal	Dr Ajit Singh Kharub, Principal Scientist, PB NO. 158, ICAR-IIWBR, Karnal -132 001 *Email: Ajit.kharub@icar.gov.in, Mobile 09416158272*
5.	Ludhiana	Dr Hari Ram Saharan, Principal Agronomist, Deptt. of Plant Breeding & Genetics, PAU Ludhiana-141 004 *Email: hr_saharan@yahoo.com, Mobile:09501002967* Dr Maninder Kaur, Agronomist, Plant Breeding & Genetics, PAU Ludhiana-141 004 *Email:* mkrandhawa@pau.edu, *Mobile:09815098390*
6.	Agra	Dr SB Singh, Head, Department of Agronomy, RBS College, Bichpuri, Agra, UP-283105. *Email: singhsbrbs28@rediffmail.com, Mobile: 9451113256, 8077332948*
7.	Hisar	Dr Shweta Malik Assistant Scientist, Department of Agronomy, CCS HAU, Hisar (Haryana)-125 004 *Email:* malik.shweta54@gmail.com, *Mobile:* 8901009488
8.	Durgapura	Dr Malu Ram Yadav, Agronomist, RARI, Durgapura, Jaipur (Rajasthan) *Email:* mryadavrari@gmail.com, *Mobile:7027930165*
NORTH EASTERN PLAINS ZONE		
9.	Kanpur	Dr Ram Ashish Yadav, Professor (Agronomy), Section of EB (Rabi Cereales), CSAUA&T, Kanpur (UP)- 208 002 Email: ramashish94@yahoo.in; Mobile: 09450129685.
10.	Varanasi	Dr RK Singh, Sr. agronomist (AICWIP), Institute of Agricultural Sciences, BHU, Varanasi (UP)- 221 005 *Email: rks1660bhu@gmail.com, Mobile: 09450533438*
11.	Kumarganj	Dr Ashok Kumar Singh, Asstt. Wheat Agronomist, Department of Agronomy, NDUA&T, Kumarganj, Ayodhya (UP)- 224 229 Email: aksdla@gmail.com, wbnduat@gmail.com Mobile: 09451714193, 07607513884
CENTRAL ZONE		
12.	Udaipur	Dr. R.S. Choudhary, Agronomist, Department of Agronomy, College of Agriculture, Udaipur, Rajasthan-313 001. Email: *agroudr@gmail.com* , *aicrp.wheat.udaipur@gmail.com* , Mobile No.- 9352241145, 7976497470

MALTING QUALITY EVALUATION

The Barley Improvement Unit took up the malting quality evaluation of grain samples of Initial Varietal Trial (IVT) on malt barley received from various test sites at its central facility. The grain samples (500gm) were received from nine locations (Hisar, Karnal, Bawal, Ludhiana, Bathinda, Durgapura and Pantnagar). This year a total of 168 samples were received. There were 16 test entries in which were analyzed with five checks.

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

State	Location	Trial	No. of Samples
Timely Sown			
Haryana	Hisar	IVT	21
	Karnal	IVT	21
	Bawal	IVT	21
Punjab	Ludhiana	IVT	21
	Bathinda	IVT	21
Rajasthan	Durgapura	IVT	21
	Sri Ganganagar*	IVT	21
Uttarakhand	Pantnagar	IVT	21
Total			**168**

**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 (%)
- Germinative Energy (at 72 hrs) (%)	- Hot Water extract % (F.g.d.b.)
- Husk Content (%)	- Diastatic Power (^{0}L)
- Protein Content (%)	- Wort Filtration rate (ml/hr)
- B- 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 four stages (wet stage for 8 hours at 25^{o}C; air rest for 17 hours at 18^{o}C; wet stage for 6 hours at 18^{o}C and air rest for 10 hours at 18^{o}C)

in a total duration of 36 hours. Germination was done in three stages (24 hours at 18ºC, 24 hours at 17ºC and 12 hours at 16ºC) in total of 60 hours. Kilning was done in a total of 10 stages for 30 hours starting from 30ºC and increasing 5ºC incrementally after each duration of 3 hours with final temperature of 75ºC.

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 and Wort β- glucan content was done in samples of Karnal location only.*
- *Husk content analysis was done by Sodium hypo-chlorite method (dry basis) as per EBC procedure.*
- *The steeping temperature during wet stages has been kept at 25^{o}C in first stage.*
- *The wort was filtered through Whatman folded filter papers (2555 1/2, (dia 320 mm) to determine filtration rate and subsequent analysis of wort.*
- *The diastatic power was done by the method as described above results should be inferred under this light.*
- *Hot water extract and other malt quality values should be interpreted in the light that only 100g sample was micro-malted for each genotype and each location. This gives a relative picture in comparison to checks only and therefore industrial values for bulk processing, may differ.*
- *The kilning time was 30 hours starting from 30^{o}C to preserve polysaccharide degradative activity to the maximum.*

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	31.05.2021	Karnal and Hisar
2	07.06.2021	Ludhiana, Durgapura and Bhatinda
3	21.06.2021	Pantnagar and Bawal

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 IVT entries for grain and malt quality traits is given in Tables 4a and 4b. The location wise data for each physical and biochemical grain/malt quality parameter are given in Annexure 2. 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 5). 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 221, PL 930
Bold Grains	RD 3028, BH 1036, DWRB 218
Protein content	PL 930, RD 3028, UPB 1097, DWRB 218, PL 931, BH 1036, BH 1034, BH 1035, RD 3029
Husk Content	DWRB 221
Hot water extract	DWRB 220, UPB 1098, PL 930
Filtration Rate	PL 930, RD 3027
Diastatic Power	RD 3029, RD 3030, PL 930, BH 1034, RD 3027
FAN Content	RD 3030, UPB 1098, RD 3028, PL 930, RD 3027, RD 3029, DWRB 218
Kolbach Index	RD 3027, DWRB 220, RD 3028
Wort β- glucan	None
Over all MQ	DWRB 221

**Better or at par to the best check*

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

S.N.	Genotype	Test wt (kg/hl)#	Bold (%)	Thin (%)	1000GW (g)	GER (%)	Protein (%)	Husk (%)	BG (%)*
1	BH 1034	62.2 (57.1-66.1)	91.8 (88.8-97.9)	1.3 (0.5-1.9)	51.6 (45.4-58.9)	99 (94-100)	12.7 (10.3-16.2)	12.0 (9.8-14.4)	4.4
2	BH 1035	62.4 (55.9-68.6)	77.2 (61.5-85.0)	3.9 (2.2-7.0)	42.9 (36.3-52.9)	99 (98-100)	12.5 (11.1-14.3)	10.9 (9.6-13.0)	6.5
3	BH 1036	63.5 (59.5-67.6)	93.9 (88.0-98.7)	1.2 (0.3-2.8)	52.4 (47.8-56.0)	99 (97-100)	12.8 (9.8-15.9)	11.9 (9.8-14.2)	6.0
4	DWRB 218	64.8 (55.9-70.7)	92.8 (81.2-98.9)	1.0 (0.1-2.3)	51.8 (46.2-58.6)	99 (96-100)	13.1 (10.8-15.8)	11.0 (9.2-12.5)	6.0
5	DWRB 219	63.6 (58.0-68.2)	87.6 (79.7-96.8)	2.5 (0.6-4.9)	48.2 (44.3-55.3)	99 (96-100)	11.5 (9.3-14.0)	11.4 (10.4-13.1)	5.3
6	DWRB 220	64.6 (58.7-70.5)	89.3 (79.4-98.1)	1.6 (0.3-3.8)	50.1 (43.8-56.8)	99 (96-100)	11.4 (9.1-14.8)	11.3 (9.3-13.0)	5.1
7	DWRB 221	65.9 (60.7-71.0)	88.1 (66.3-98.1)	2.4 (0.2-9.8)	45.5 (35.6-51.2)	99 (96-100)	11.6 (9.6-14.4)	10.5 (9.2-11.8)	5.6
8	PL 926	63.8 (57.8-68.8)	91.5 (87.3-97.2)	1.3 (0.2-2.3)	50.9 (46.9-57.1)	97 (95-100)	12.2 (10.1-14.9)	12.4 (10.4-14.1)	4.6
9	PL 930	65.7 (59.3-70.1)	56.3 (40.2-83.0)	7.2 (1.5-11.9)	40.9 (37.9-45.1)	99 (97-100)	13.3 (11.7-15.8)	10.8 (8.8-14.4)	6.6
10	PL 931	64.6 (59.8-68.1)	64.6 (42.7-93.1)	5.1 (0.6-11.6)	45.0 (39.4-50.4)	99 (97-100)	13.0 (10.5-15.7)	11.1 (9.8-12.9)	6.0
11	RD 3027	62.9 (58.5-68.0)	87.1 (83.3-97.8)	2.1 (0.5-3.1)	51.2 (48.2-57.2)	99 (97-100)	12.4 (10.2-15.9)	10.9 (9.9-12.3)	5.6
12	RD 3028	64.0 (59.0-68.2)	94.7 (88.1-98.7)	0.7 (0.4-1.3)	57.3 (52.2-62.6)	99 (94-100)	13.2 (10.7-15.2)	11.1 (9.6-12.7)	6.1
13	RD 3029	61.8 (56.8-67.7)	83.1 (62.7-97.4)	1.5 (0.4-4.0)	51.4 (44.2-56.3)	99 (96-100)	12.4 (10.1-14.7)	11.3 (9.5-13.4)	5.5
14	RD 3030	64.4 (58.1-68.9)	91.2 (83.1-98.0)	1.4 (0.3-3.3)	50.6 (46.4-56.8)	99 (98-100)	13.9 (11.7-16.5)	11.6 (10.6-13.3)	6.5
15	UPB 1097	63.8 (59.1-69.0)	72.7 (50.0-93.2)	5.6 (0.8-18.1)	48.8 (40.1-54.8)	99 (97-100)	13.1 (11.4-14.9)	12.1 (10.3-14.2)	6.8
16	UPB 1098	63.6 (58.1-67.2)	91.8 (79.9-97.8)	2.1 (0.2-7.8)	56.6 (47.4-63.5)	99 (95-100)	12.3 (10.8-14.0)	10.7 (9.4-12.6)	5.6
17	BH 946 ©**	59.9 (55.6-65.8)	85.6 (69.7-93.9)	2.5 (0.8-7.0)	42.8 (34.4-50.1)	99 (97-100)	11.5 (8.8-14.6)	12.5 (10.3-14.7)	4.5
18	DWRB 160 ©	63.0 (57.4-67.8)	92.5 (75.6-98.4)	1.6 (0.2-6.6)	58.6 (48.7-65.5)	95 (80-100)	11.5 (9.7-14.8)	11.3 (10.2-12.8)	6.9
19	DWRB 182 ©	63.4 (59.9-68.7)	79.4 (65.3-92.0)	4.3 (0.8-12.2)	43.6 (36.4-48.3)	99 (98-100)	12.4 (9.6-15.1)	11.8 (10.1-13.3)	4.4
20	DWRUB 52 ©	65.9 (60.5-70.8)	81.5 (60.9-92.6)	3.8 (0.9-15.7)	45.8 (38.2-49.7)	99 (97-100)	12.1 (10.4-14.8)	11.2 (10.4-12.1)	4.2
21	RD 2849 ©	66.1 (61.3-71.0)	82.0 (63.4-95.4)	2.6 (0.6-9.8)	45.5 (38.6-50.9)	99 (98-100)	11.2 (9.4-15.0)	10.7 (9.2-12.7)	4.5

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

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

S.N.	Genotype	Malt yield (%)	Friability (%)	Homogeneity (%)	FR (ml/hr)	HWE (%fgdb)	DP (^{0}L)*	KI (%)	WBG ppm	FAN
1	BH 1034	86.9 (83.6-90.2)	62 (53-69)	91 (88-94)	236 (165-305)	77.6 (72.6-80.5)	101 (81-109)	39.0 (34.9-42.2)	371	153 (139-178)
2	BH 1035	87.1 (83.3-90.3)	56 (42-65)	90 (82-95)	193 (95-285)	78.4 (74.9-82.3)	94 (81-109)	39.0 (34.6-41.7)	639	151 (126-169)
3	BH 1036	87.0 (83.4-90.7)	52 (42-60)	87 (85-89)	202 (95-320)	76.9 (71.6-83.8)	94 (85-101)	39.0 (35.5-42.9)	651	138 (112-182)
4	DWRB 218	86.7 (83.4-92.6)	61 (49-69)	95 (94-97)	244 (130-325)	78.5 (72.4-82.3)	95 (83-109)	38.4 (32.6-41.0)	834	163 (149-177)
5	DWRB 219	88.5 (86.1-92.9)	58 (50-62)	87 (83-91)	220 (145-330)	78.2 (74.8-79.6)	90 (70-108)	39.1 (33.3-46.0)	655	133 (116-144)
6	DWRB 220	86.3 (81.1-91.2)	62 (52-67)	93 (90-95)	241 (145-325)	79.9 (76.9-81.7)	95 (79-110)	40.5 (36.8-43.3)	695	150 (135-164)
7	DWRB 221	88.2 (85.9-91.3)	61 (56-65)	92 (88-95)	234 (170-325)	79.4 (76.6-84.2)	88 (76-106)	39.6 (35.5-42.3)	602	156 (137-187)
8	PL 926	90.4 (87.5-93.2)	56 (45-63)	69 (54-90)	243 (145-320)	75.7 (72.1-80.9)	94 (83-108)	36.2 (30.8-39.1)	430	112 (96-123)
9	PL 930	85.8 (82.6-90.5)	62 (55-71)	92 (90-93)	267 (195-310)	79.7 (75.6-83.9)	101 (83-109)	37.6 (32.8-40.0)	665	170 (140-219)
10	PL 931	85.6 (81.7-89.4)	58 (49-68)	89 (85-93)	249 (175-310)	78.1 (73.8-81.7)	94 (83-119)	38.9 (35.6-40.5)	782	156 (133-190)
11	RD 3027	85.6 (80.8-90.1)	58 (52-63)	91 (88-93)	254 (215-305)	79.3 (75.0-83.3)	100 (89-118)	39.3 (33.3-42.3)	600	168 (155-189)
12	RD 3028	85.1 (79.8-91.1)	54 (48-62)	91 (89-93)	204 (115-305)	77.9 (74.2-82.7)	97 (81-119)	41.3 (38.1-43.7)	562	172 (149-200)
13	RD 3029	86.7 (83.8-91.5)	59 (50-64)	88 (82-92)	179 (105-265)	78.2 (73.8-82.8)	105 (98-108)	40.3 (34.3-45.0)	550	165 (139-201)
14	RD 3030	86.8 (82.7-92.3)	50 (40-65)	85 (81-88)	204 (160-315)	76.9 (71.8-82.2)	103 (88-119)	37.9 (35.4-40.0)	735	175 (148-222)
15	UPB 1097	87.8 (85.5-92.0)	52 (45-63)	88 (80-93)	179 (75-300)	76.0 (74.3-78.6)	95 (80-108)	38.1 (34.4-41.0)	773	150 (122-184)
16	UPB 1098	88.9 (84.5-91.3)	60 (53-69)	93 (90-95)	199 (115-310)	79.8 (77.8-81.7)	96 (80-109)	38.8 (33.1-43.1)	683	174 (157-200)
17	BH 946 ©**	85.6 (79.3-91.0)	61 (60-62)	87 (79-92)	213 (80-260)	76.4 (72.1-81.1)	99 (88-110)	39.3 (36.8-41.9)	443	149 (121-174)
18	DWRB 160 ©	87.8 (84.0-91.3)	60 (53-68)	92 (86-97)	223 (155-310)	77.5 (74.0-83.5)	100 (89-119)	40.3 (38.2-42.9)	738	128 (113-148)
19	DWRB 182 ©	86.7 (81.5-90.4)	68 (61-72)	91 (88-96)	254 (185-305)	78.3 (73.3-83.1)	99 (83-119)	38.4 (34.1-41.7)	352	149 (136-161)
20	DWRUB 52 ©	88.3 (86.0-91.6)	64 (56-70)	91 (88-93)	242 (155-325)	78.9 (75.7-81.6)	90 (83-98)	38.6 (33.6-40.6)	395	159 (141-181)
21	RD 2849 ©	88.4 (85.8-91.6)	64 (56-70)	92 (88-95)	228 (155-320)	80.1 (77.5-82.4)	90 (76-102)	39.3 (36.1-42.9)	283	162 (141-197)

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

Table 5.5: Weighted performances of IVT entries for malting quality*

S. No.	Genotype	TW	Bol	Hus	Pro	BG	Fria	HW	FR	DP	KI	FAN	WBG	Total (36)
1	BH 1034	1	3	1	3	2	1	1	2	3	2	3	1	23
2	BH 1035	1	0	2	3	0	0	1	1	3	2	3	0	16
3	BH 1036	1	3	1	3	0	0	1	2	3	2	2	0	18
4	DWRB 218	2	3	2	3	0	1	2	2	3	2	3	0	23
5	DWRB 219	2	2	2	2	0	0	1	2	2	2	2	0	17
6	DWRB 220	2	2	2	2	0	1	2	2	3	3	3	0	22
7	DWRB 221	3	2	3	3	0	1	2	2	2	3	3	0	24
8	PL 926	2	3	1	3	1	0	1	2	3	1	1	0	18
9	PL 930	3	0	2	3	0	1	2	3	3	2	3	0	22
10	PL 931	2	0	2	3	0	0	1	2	3	2	3	0	18
11	RD 3027	1	1	2	3	0	0	2	3	3	2	3	0	20
12	RD 3028	2	3	2	3	0	0	1	2	3	3	3	0	22
13	RD 3029	1	0	2	3	0	0	1	1	3	3	3	0	17
14	RD 3030	2	3	1	1	0	0	1	2	3	2	3	0	18
15	UPB 1097	2	0	1	3	0	0	1	1	3	2	2	0	15
16	UPB 1098	2	3	2	3	0	1	2	1	3	2	3	0	22
17	BH 946 ©*	0	3	1	3	2	1	1	2	3	2	2	0	20
18	DWRB 160 ©	1	3	2	3	0	1	1	2	3	3	2	0	21
19	DWRB 182 ©	1	0	1	3	2	2	2	3	3	2	2	1	22
20	DWRUB 52 ©	3	0	2	3	2	1	2	2	2	2	3	1	23
21	RD 2849 ©	3	0	2	2	2	1	2	2	2	2	3	3	24

*= six- row barleys

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

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

** 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 - 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}L)	>90	>90
15.	Wort β--glucan	<300 ppm	<300 ppm
16.	FAN	>150 ppm	>150 ppm

Annexure 2: IVT-TS-MALT BARLEY

GRAIN PARAMETERS

Table 2.1: Thousand grain weight (g) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	45.4	53.3	50.3	50.4	56.3	58.9	46.3	**51.6**
2	**BH 1035**	39.4	44.7	40.0	52.9	44.9	42.4	36.3	**42.9**
3	**BH 1036**	47.8	54.4	52.0	48.1	56.0	55.2	53.5	**52.4**
4	**DWRB 218**	50.4	55.0	47.1	46.2	55.9	58.6	49.3	**51.8**
5	**DWRB 219**	46.7	50.5	44.9	44.3	ND	55.3	47.5	**48.2**
6	**DWRB 220**	44.2	54.9	45.4	43.8	56.8	54.1	51.2	**50.1**
7	**DWRB 221**	47.3	50.4	44.2	39.5	50.3	51.2	35.6	**45.5**
8	**PL 926**	47.0	54.3	49.1	46.9	50.2	57.1	51.5	**50.9**
9	**PL 930**	38.7	42.7	40.8	39.5	41.5	45.1	37.9	**40.9**
10	**PL 931**	39.4	47.1	44.2	40.3	47.9	50.4	45.9	**45.0**
11	**RD 3027**	48.3	53.7	50.5	49.2	ND	57.2	48.2	**51.2**
12	**RD 3028**	55.6	59.4	55.1	55.1	61.0	62.6	52.2	**57.3**
13	**RD 3029**	49.8	54.4	44.2	48.3	55.8	56.3	51.2	**51.4**
14	**RD 3030**	48.0	54.8	47.7	46.4	52.8	56.8	48.0	**50.6**
15	**UPB 1097**	43.8	49.1	48.9	40.1	54.3	54.8	50.8	**48.8**
16	**UPB 1098**	53.6	59.0	55.3	47.4	60.2	63.5	57.2	**56.6**
17	**BH 946 ©***	37.9	41.4	50.1	34.4	48.9	43.1	43.8	**42.8**
18	**DWRB 160 ©**	59.3	62.1	56.3	48.7	65.0	65.5	53.1	**58.6**
19	**DWRB 182 ©**	41.5	44.0	43.9	36.4	47.2	48.3	43.8	**43.6**
20	**DWRUB 52 ©**	47.5	48.1	44.8	38.2	48.2	49.7	44.3	**45.8**
21	**RD 2849 ©**	43.9	47.3	42.6	38.6	48.6	50.9	46.7	**45.5**
	Mean	**46.5**	**51.5**	**47.5**	**44.5**	**52.7**	**54.1**	**47.3**	

**= 6 row barley*

Table 2.2: Test weight (kg/hl) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	58.9	64.6	57.1	65.5	66.1	62.2	61.4	**62.2**
2	**BH 1035**	61.7	68.6	55.9	65.2	68.4	61.0	56.1	**62.4**
3	**BH 1036**	61.4	66.5	59.5	65.1	67.6	64.4	59.7	**63.5**
4	**DWRB 218**	65.6	69.2	55.9	67.4	70.7	64.1	60.6	**64.8**
5	**DWRB 219**	63.8	68.2	58.6	67.8	ND	65.2	58.0	**63.6**
6	**DWRB 220**	62.6	69.4	58.7	65.0	70.5	65.0	61.2	**64.6**
7	**DWRB 221**	66.2	70.6	63.2	65.6	71.0	64.3	60.7	**65.9**
8	**PL 926**	62.0	66.1	57.8	68.8	68.0	62.9	61.0	**63.8**
9	**PL 930**	64.3	70.1	61.8	67.4	69.3	67.7	59.3	**65.7**
10	**PL 931**	62.6	68.1	59.8	65.7	67.9	67.5	60.3	**64.6**
11	**RD 3027**	63.3	68.0	58.6	66.0	ND	63.0	58.5	**62.9**
12	**RD 3028**	63.6	68.2	59.0	67.2	67.1	62.5	60.1	**64.0**
13	**RD 3029**	58.4	65.4	56.8	65.5	67.7	60.0	59.1	**61.8**
14	**RD 3030**	63.7	68.9	58.1	67.4	67.0	65.5	60.5	**64.4**
15	**UPB 1097**	61.7	67.2	60.3	63.3	69.0	65.7	59.1	**63.8**
16	**UPB 1098**	63.2	67.1	61.0	64.8	67.2	63.6	58.1	**63.6**
17	**BH 946 ©***	58.9	62.1	60.3	59.5	65.8	57.2	55.6	**59.9**
18	**DWRB 160 ©**	62.2	66.7	57.4	65.0	67.8	63.5	58.2	**63.0**
19	**DWRB 182 ©**	61.7	67.0	59.9	63.5	68.7	61.7	61.4	**63.4**
20	**DWRUB 52 ©**	66.3	69.9	60.5	64.6	70.8	68.3	60.8	**65.9**
21	**RD 2849 ©**	64.0	70.1	61.3	65.1	71.0	68.7	62.8	**66.1**
	Mean	**62.7**	**67.7**	**59.1**	**65.5**	**68.5**	**64.0**	**59.6**	

*= 6 row barley

Table 2.3: Proportion of bold grains (%) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	88.8	90.2	92.4	89.6	93.4	97.9	90.6	**91.8**
2	**BH 1035**	61.5	76.7	78.3	84.6	83.6	85.0	70.9	**77.2**
3	**BH 1036**	90.2	95.0	91.0	88.0	98.1	98.7	96.0	**93.9**
4	**DWRB 218**	93.8	97.4	81.2	87.6	98.9	98.7	92.0	**92.8**
5	**DWRB 219**	83.5	88.1	84.7	79.7	ND	96.8	92.8	**87.6**
6	**DWRB 220**	81.7	95.2	79.4	80.8	94.9	98.1	94.9	**89.3**
7	**DWRB 221**	90.2	91.6	82.3	66.3	96.3	98.1	91.7	**88.1**
8	**PL 926**	87.3	89.4	89.8	89.2	92.7	97.2	95.2	**91.5**
9	**PL 930**	40.2	48.3	58.0	54.7	59.5	83.0	50.3	**56.3**
10	**PL 931**	42.7	61.4	63.6	50.3	72.8	93.1	68.7	**64.6**
11	**RD 3027**	83.5	83.3	84.5	84.0	ND	97.8	89.3	**87.1**
12	**RD 3028**	93.8	97.0	93.9	88.1	96.4	98.7	95.3	**94.7**
13	**RD 3029**	83.5	81.0	89.1	77.6	90.4	97.4	62.7	**83.1**
14	**RD 3030**	90.1	95.0	87.4	83.1	89.8	98.0	94.9	**91.2**
15	**UPB 1097**	50.0	74.3	73.6	52.8	93.2	86.1	78.8	**72.7**
16	**UPB 1098**	89.9	90.7	93.4	79.9	95.1	97.8	95.7	**91.8**
17	**BH 946 ©***	77.4	84.5	93.7	69.7	93.9	91.7	88.7	**85.6**
18	**DWRB 160 ©**	95.3	96.3	95.9	75.6	98.4	97.5	88.6	**92.5**
19	**DWRB 182 ©**	73.3	71.0	80.1	65.3	91.9	92.0	82.3	**79.4**
20	**DWRUB 52 ©**	79.9	83.4	80.8	60.9	89.4	92.6	83.5	**81.5**
21	**RD 2849 ©**	74.3	79.3	78.0	63.4	93.8	95.4	90.0	**82.0**
	Mean	**78.6**	**84.2**	**83.4**	**74.8**	**90.6**	**94.8**	**85.4**	

*= 6 row barley

Table 2.4: Proportion of thin grains (%) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	1.8	1.3	0.7	1.6	1.1	0.5	1.9	1.3
2	**BH 1035**	7.0	3.3	4.7	2.2	2.2	2.2	5.9	3.9
3	**BH 1036**	1.8	1.0	0.9	2.8	0.5	0.3	1.0	1.2
4	**DWRB 218**	1.1	0.2	1.6	2.3	0.1	0.3	1.3	1.0
5	**DWRB 219**	4.0	2.3	2.0	4.9	ND	0.6	1.0	2.5
6	**DWRB 220**	2.6	0.5	2.3	3.8	1.0	0.3	0.8	1.6
7	**DWRB 221**	1.2	1.4	2.4	9.8	0.4	0.2	1.0	2.4
8	**PL 926**	2.3	1.3	0.9	2.1	1.4	0.2	1.1	1.3
9	**PL 930**	11.9	5.9	5.9	10.5	5.8	1.5	8.7	7.2
10	**PL 931**	11.6	3.6	4.2	10.8	3.4	0.6	1.6	5.1
11	**RD 3027**	2.9	3.1	1.4	2.6	ND	0.5	2.0	2.1
12	**RD 3028**	0.8	0.6	0.4	1.3	0.6	0.4	0.9	0.7
13	**RD 3029**	1.0	1.3	1.5	4.0	1.6	0.4	0.9	1.5
14	**RD 3030**	1.4	0.6	1.2	2.2	3.3	0.3	0.9	1.4
15	**UPB 1097**	8.8	3.8	3.6	18.1	0.8	1.5	2.8	5.6
16	**UPB 1098**	1.4	2.4	0.5	7.8	0.9	0.2	1.3	2.1
17	**BH 946 ©***	3.6	2.2	0.8	7.0	1.1	1.0	1.6	2.5
18	**DWRB 160 ©**	0.9	0.6	0.5	6.6	0.3	0.2	2.0	1.6
19	**DWRB 182 ©**	5.6	5.9	2.6	12.2	1.1	0.8	2.0	4.3
20	**DWRUB 52 ©**	2.7	1.8	2.4	15.7	1.1	0.9	2.2	3.8
21	**RD 2849 ©**	3.4	0.6	2.0	9.8	0.6	0.6	0.9	2.6
	Mean	**3.7**	**2.1**	**2.0**	**6.6**	**1.4**	**0.6**	**2.0**	

*= 6 row barley

Table 2.5: Germinative energy (% 72hrs) of IVT (TS-MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	99	99	100	100	100	94	99	**99**
2	**BH 1035**	100	100	98	100	100	100	98	**99**
3	**BH 1036**	100	100	98	99	99	97	99	**99**
4	**DWRB 218**	100	100	96	100	100	99	99	**99**
5	**DWRB 219**	98	100	99	100	100	97	96	**99**
6	**DWRB 220**	99	100	100	98	100	96	100	**99**
7	**DWRB 221**	100	100	100	98	100	97	96	**99**
8	**PL 926**	95	95	96	97	99	97	100	**97**
9	**PL 930**	100	100	100	97	100	100	98	**99**
10	**PL 931**	100	99	100	100	99	97	100	**99**
11	**RD 3027**	100	100	100	99	100	98	97	**99**
12	**RD 3028**	97	100	100	100	100	100	94	**99**
13	**RD 3029**	100	100	100	96	100	96	100	**99**
14	**RD 3030**	98	100	100	100	99	98	99	**99**
15	**UPB 1097**	100	100	97	99	100	97	100	**99**
16	**UPB 1098**	99	99	99	100	100	95	100	**99**
17	**BH 946 ©***	100	98	100	97	100	98	97	**99**
18	**DWRB 160 ©**	97	100	98	93	95	80	100	**95**
19	**DWRB 182 ©**	100	99	100	100	100	98	99	**99**
20	**DWRUB 52 ©**	98	100	100	100	98	98	97	**99**
21	**RD 2849 ©**	100	99	98	99	99	98	100	**99**
	Mean	**99**	**99**	**99**	**99**	**99**	**97**	**98**	

*= 6 row barley

Table 2.6: Protein content (%) # of IVT (TS-MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	13.2	12.6	16.2	12.2	13.0	10.3	11.5	**12.7**
2	**BH 1035**	12.0	13.4	12.3	14.3	12.3	11.1	12.3	**12.5**
3	**BH 1036**	12.5	13.0	15.9	13.6	13.2	9.8	11.4	**12.8**
4	**DWRB 218**	13.1	13.1	15.8	15.3	12	10.8	11.5	**13.1**
5	**DWRB 219**	11.1	12.3	12.0	14.0	NA	9.3	10.2	**11.5**
6	**DWRB 220**	11.0	12.2	14.8	11.6	11.1	9.1	10.3	**11.4**
7	**DWRB 221**	11.1	12.1	12.9	14.4	10.7	9.6	10.3	**11.6**
8	**PL 926**	12.1	12.3	14.9	13.7	11.4	10.9	10.1	**12.2**
9	**PL 930**	13.7	13.3	15.8	13.9	12.8	12.1	11.7	**13.3**
10	**PL 931**	13.5	12.5	15.1	15.7	12.9	10.5	10.6	**13.0**
11	**RD 3027**	11.5	13.6	15.9	11.9	NA	10.2	11.4	**12.4**
12	**RD 3028**	13.8	13.7	15.2	14.3	12.1	10.7	12.6	**13.2**
13	**RD 3029**	11.6	13.0	10.1	14.7	14.3	11.4	12.0	**12.4**
14	**RD 3030**	13.2	14.0	16.5	15.5	14.6	11.7	11.9	**13.9**
15	**UPB 1097**	12.8	13.8	14.7	14.9	12.4	11.8	11.4	**13.1**
16	**UPB 1098**	11.9	12.6	12.4	14.0	13.1	11.0	10.8	**12.3**
17	**BH 946 ©***	10.6	11.3	14.6	12.3	12.4	8.8	10.6	**11.5**
18	**DWRB 160 ©**	10.7	11.0	12.8	14.8	10.9	9.7	10.6	**11.5**
19	**DWRB 182 ©**	12.3	14.4	13.4	15.1	11.4	9.6	10.8	**12.4**
20	**DWRUB 52 ©**	11.6	11.4	14.8	14.4	10.4	10.9	11.5	**12.1**
21	**RD 2849 ©**	11.1	11.2	15.0	11.0	11.5	9.4	9.5	**11.2**
	Mean	**12.1**	**12.7**	**14.3**	**13.9**	**12.2**	**10.4**	**11.1**	

*= 6 row barley # Predicted values through NIR

Table 2.7: Husk content (%) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	14.4	12.5	12.5	11.8	10.9	12.3	9.8	**12.0**
2	**BH 1035**	12.8	10.4	13.0	9.7	9.6	10.9	10.2	**10.9**
3	**BH 1036**	14.2	12.1	12.8	11.8	11.1	9.8	11.7	**11.9**
4	**DWRB 218**	12.3	11.1	12.5	11.0	9.9	11.2	9.2	**11.0**
5	**DWRB 219**	13.1	11.4	10.4	11.0	NA	12.0	10.4	**11.4**
6	**DWRB 220**	13.0	11.5	11.9	12.2	9.3	11.2	9.7	**11.3**
7	**DWRB 221**	11.8	10.2	11.2	10.1	9.2	10.7	10.5	**10.5**
8	**PL 926**	14.1	13.5	13.9	10.4	11.7	12.0	11.1	**12.4**
9	**PL 930**	14.4	10.9	10.1	10.7	8.8	10.2	10.1	**10.8**
10	**PL 931**	12.9	10.4	12.5	10.8	9.8	11.1	9.9	**11.1**
11	**RD 3027**	11.4	9.9	12.3	10.5	NA	10.7	10.5	**10.9**
12	**RD 3028**	12.7	11.6	11.4	11.0	9.6	11.9	9.9	**11.1**
13	**RD 3029**	13.3	11.6	13.4	10.9	9.5	10.5	10.0	**11.3**
14	**RD 3030**	13.3	12.2	11.5	10.6	10.7	12.2	10.9	**11.6**
15	**UPB 1097**	14.2	12.8	12.4	12.5	10.3	12.4	10.3	**12.1**
16	**UPB 1098**	12.6	11.2	10.1	11.4	9.4	10.2	10.2	**10.7**
17	**BH 946 ©***	14.7	13.0	12.6	12.4	10.3	13.5	10.9	**12.5**
18	**DWRB 160 ©**	12.8	11.5	11.6	10.2	10.9	11.0	10.9	**11.3**
19	**DWRB 182 ©**	13.3	12.0	12.3	12.4	11.5	11.2	10.1	**11.8**
20	**DWRUB 52 ©**	12.1	11.0	11.4	11.4	11.9	10.4	10.6	**11.2**
21	**RD 2849 ©**	12.7	10.9	11.3	10.7	9.2	10.3	9.6	**10.7**
	Mean	**13.1**	**11.5**	**11.9**	**11.1**	**10.2**	**11.2**	**10.3**	

*= 6 row barley

Table 2.8: β--Glucan Content (% d.b.) of IVT (MB) entries at Karnal location

S.N.	Genotype	Grain (%)	Wort (ppm)
1	**BH 1034**	4.4	371.2
2	**BH 1035**	6.5	639.7
3	**BH 1036**	6.0	651.5
4	**DWRB 218**	6.0	834.6
5	**DWRB 219**	5.3	655.4
6	**DWRB 220**	5.1	695.4
7	**DWRB 221**	5.6	602.9
8	**PL 926**	4.6	430.8
9	**PL 930**	6.6	665.2
10	**PL 931**	6.0	782.0
11	**RD 3027**	5.6	600.9
12	**RD 3028**	6.1	562.1
13	**RD 3029**	5.5	550.4
14	**RD 3030**	6.5	735.8
15	**UPB 1097**	6.8	773.0
16	**UPB 1098**	5.6	683.6
17	**BH 946 ©***	4.5	443.0
18	**DWRB 160 ©**	6.9	738.1
19	**DWRB 182 ©**	4.4	352.4
20	**DWRUB 52 ©**	4.2	395.5
21	**RD 2849 ©**	4.5	283.0

*= 6 row barley

Table 2.9: Moisture content in grains (%) # of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	8.9	8.9	7.7	8.6	8.3	11.1	8.9	**8.9**
2	**BH 1035**	9.4	9.2	7.7	9.0	7.7	11.1	9.1	**9.0**
3	**BH 1036**	8.7	9.0	9	9.0	7.9	11.1	11.0	**9.4**
4	**DWRB 218**	9.1	9.1	7.5	8.7	7.9	11.1	9.4	**9.0**
5	**DWRB 219**	8.6	8.9	8.3	8.7	NA	11.2	9.1	**9.1**
6	**DWRB 220**	9.1	9.0	7.9	8.7	7.3	11.1	9.8	**9.0**
7	**DWRB 221**	9.0	9.0	7.6	9.0	7.7	11.0	9.3	**8.9**
8	**PL 926**	9.0	9.2	7.7	8.8	8.6	11.1	9.0	**9.1**
9	**PL 930**	8.9	9.1	7.1	8.6	7.4	10.9	9.8	**8.8**
10	**PL 931**	8.8	9.3	7.8	8.9	8.7	11.1	9.3	**9.1**
11	**RD 3027**	8.9	9.2	7.4	8.9	NA	11.0	9.6	**9.2**
12	**RD 3028**	9.0	9.4	9.7	8.8	8.4	11.1	9.2	**9.4**
13	**RD 3029**	9.2	9.0	7.6	8.9	8.0	11.4	9.2	**9.0**
14	**RD 3030**	9.1	9.1	8.6	9.1	7.9	11.2	9.3	**9.2**
15	**UPB 1097**	8.9	8.9	7.6	8.9	8.3	11.0	9.6	**9.0**
16	**UPB 1098**	9.2	9.1	8.3	8.8	8.3	11.2	9.8	**9.2**
17	**BH 946 ©***	8.8	9.0	8	8.6	8.2	11.0	9.8	**9.1**
18	**DWRB 160 ©**	8.9	9.1	7.6	8.6	8.1	11.2	10.0	**9.1**
19	**DWRB 182 ©**	9.1	8.9	7.4	8.7	7.4	11.2	9.4	**8.9**
20	**DWRUB 52 ©**	9.0	9.1	7.6	8.5	8.0	10.8	9.3	**8.9**
21	**RD 2849 ©**	9.2	9.0	8.7	8.9	7.4	10.9	9.4	**9.1**
	Mean	**9.0**	**9.1**	**7.9**	**8.8**	**8.0**	**11.1**	**9.5**	

*= 6 row barley # Predicted values through NIR

Table 2.10: Starch content in grains (%dwt basis) # of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	59.8	62.0	58.7	63.6	62.5	61.4	61.1	**61.3**
2	**BH 1035**	61.4	62.7	59.2	60.9	63.9	61.5	60.0	**61.4**
3	**BH 1036**	60.7	61.5	58.8	61.5	61.3	62.6	60.2	**60.9**
4	**DWRB 218**	61.4	61.7	58.5	61.5	63.6	61.3	60.7	**61.2**
5	**DWRB 219**	61.1	62.3	59.9	61.2	NA	63.1	61.1	**61.5**
6	**DWRB 220**	61.3	62.8	59.2	62.4	65.1	62.8	60.9	**62.1**
7	**DWRB 221**	61.8	62.8	61.5	61.1	64.8	62.7	61.3	**62.3**
8	**PL 926**	61.1	62.2	58.4	61.5	62.0	60.9	61.0	**61.0**
9	**PL 930**	61.2	63.2	59.5	61.5	65.0	62.3	60.5	**61.9**
10	**PL 931**	61.3	63.3	59.6	61.4	62.2	63.8	62.1	**62.0**
11	**RD 3027**	60.8	61.4	59.0	62.9	NA	61.8	60.5	**61.1**
12	**RD 3028**	60.5	60.9	58.2	61.3	65.6	61.1	59.5	**61.0**
13	**RD 3029**	61.0	62.2	60.9	60.7	61.5	61.3	60.9	**61.2**
14	**RD 3030**	60.3	62.2	57.9	60.1	61.3	61.2	60.1	**60.4**
15	**UPB 1097**	60.3	61.3	59.5	60.1	62.5	61.3	60.0	**60.7**
16	**UPB 1098**	61.6	63.2	60.6	61.9	62.0	61.7	60.9	**61.7**
17	**BH 946 ©***	61.5	62.3	59.2	60.9	62.4	61.8	59.5	**61.1**
18	**DWRB 160 ©**	62.1	61.4	60.2	61.1	63.8	62.7	60.5	**61.7**
19	**DWRB 182 ©**	60.9	61.5	60.3	60.4	64.7	62.7	61.5	**61.7**
20	**DWRUB 52 ©**	61.3	63.1	59.5	61.1	65.2	62.6	60.7	**61.9**
21	**RD 2849 ©**	61.8	64.2	58.8	61.5	64.7	63.5	61.6	**62.3**
	Mean	**61.1**	**62.3**	**59.4**	**61.4**	**63.4**	**62.1**	**60.7**	

*= 6 row barley # Predicted values through NIR

MALT PARAMETERS

Table 2.11: Malt yield of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	88.8	90.2	85.8	83.6	88.4	84.9	86.4	**86.9**
2	**BH 1035**	90.0	90.3	87.7	86.0	88.9	83.3	83.6	**87.1**
3	**BH 1036**	90.7	90.5	86.1	83.4	87.4	84.8	86.5	**87.0**
4	**DWRB 218**	88.5	92.6	83.4	85.7	87.2	83.6	85.8	**86.7**
5	**DWRB 219**	91.3	92.9	87.1	87.1	NA	86.1	86.5	**88.5**
6	**DWRB 220**	89.0	91.2	84.3	83.9	89.8	81.1	85.0	**86.3**
7	**DWRB 221**	91.1	91.3	85.9	86.6	88.5	86.9	87.3	**88.2**
8	**PL 926**	93.2	93.2	90.4	88.5	92.0	87.5	87.8	**90.4**
9	**PL 930**	88.7	90.5	83.9	82.6	85.8	84.3	85.0	**85.8**
10	**PL 931**	88.0	89.4	84.4	81.7	87.8	83.0	85.3	**85.6**
11	**RD 3027**	90.1	89.6	85.1	80.8	NA	83.1	84.9	**85.6**
12	**RD 3028**	91.1	90.8	84.9	80.2	83.8	79.8	84.9	**85.1**
13	**RD 3029**	89.0	91.5	87.8	84.0	86.9	83.8	84.1	**86.7**
14	**RD 3030**	90.8	92.3	86.5	84.5	82.7	85.4	85.3	**86.8**
15	**UPB 1097**	90.4	92.0	87.0	86.4	87.7	85.9	85.5	**87.8**
16	**UPB 1098**	91.3	91.1	90.5	88.2	89.6	87.0	84.5	**88.9**
17	**BH 946 ©***	89.8	91.0	86.6	79.3	87.5	80.8	84.4	**85.6**
18	**DWRB 160 ©**	91.3	90.9	86.8	84.0	90.0	86.8	85.2	**87.8**
19	**DWRB 182 ©**	90.4	88.2	88.3	81.5	88.7	84.4	85.5	**86.7**
20	**DWRUB 52 ©**	91.0	91.6	86.0	87.6	88.3	87.6	86.0	**88.3**
21	**RD 2849 ©**	90.3	91.6	87.9	85.8	90.1	86.9	86.6	**88.4**
	Mean	**90.2**	**91.1**	**86.5**	**84.3**	**87.9**	**84.6**	**85.5**	

*= 6 row barley

Table 2.12: Malt friability (%) of IVT (MB) entries from different locations

S.N.	Genotype	Bathinda	Durgapura	Bawal	Average
1	**BH 1034**	52.6	69.0	63.8	**61.8**
2	**BH 1035**	42.2	64.7	60.0	**55.6**
3	**BH 1036**	42.2	54.0	60.1	**52.1**
4	**DWRB 218**	49.2	65.8	69.0	**61.3**
5	**DWRB 219**	49.5	62.0	61.0	**57.5**
6	**DWRB 220**	52.1	66.4	67.1	**61.9**
7	**DWRB 221**	55.8	61.7	65.0	**60.8**
8	**PL 926**	45.0	60.0	63.3	**56.1**
9	**PL 930**	54.5	61.4	71.5	**62.5**
10	**PL 931**	49.4	56.0	68.0	**57.8**
11	**RD 3027**	51.7	60.0	62.8	**58.2**
12	**RD 3028**	48.1	52.7	61.5	**54.1**
13	**RD 3029**	49.6	64.0	63.3	**58.9**
14	**RD 3030**	40.2	44.5	65.1	**49.9**
15	**UPB 1097**	45.1	47.1	62.5	**51.6**
16	**UPB 1098**	52.5	60.0	68.8	**60.5**
17	**BH 946 ©***	59.5	62.0	61.7	**61.1**
18	**DWRB 160 ©**	52.6	60.0	68.5	**60.4**
19	**DWRB 182 ©**	61.5	70.9	72.3	**68.2**
20	**DWRUB 52 ©**	56.0	66.0	70.0	**64.0**
21	**RD 2849 ©**	55.6	66.0	70.3	**64.0**
	Mean	**50.7**	**60.7**	**65.5**	

*= 6 row barley

Table 2.13: Malt homogeneity (%) of IVT (MB) entries from different locations

S.N.	Genotype	Bathinda	Durgapura	Bawal	Average
1	**BH 1034**	91.5	93.7	88.0	**91.1**
2	**BH 1035**	82.2	91.5	94.9	**89.5**
3	**BH 1036**	85.5	85.2	89.2	**86.6**
4	**DWRB 218**	96.5	94.8	94.0	**95.1**
5	**DWRB 219**	90.9	82.9	88.0	**87.3**
6	**DWRB 220**	90.1	94.2	95.2	**93.2**
7	**DWRB 221**	87.8	95.2	91.5	**91.5**
8	**PL 926**	64.1	53.9	90.3	**69.4**
9	**PL 930**	89.6	93.5	93.3	**92.1**
10	**PL 931**	85.4	88.8	93.4	**89.2**
11	**RD 3027**	92.4	88.3	93.0	**91.2**
12	**RD 3028**	89.2	92.0	92.8	**91.3**
13	**RD 3029**	82.3	88.2	92.2	**87.6**
14	**RD 3030**	84.8	81.1	87.8	**84.6**
15	**UPB 1097**	80.1	92.9	92.1	**88.3**
16	**UPB 1098**	93.2	89.6	95.1	**92.6**
17	**BH 946 ©***	92.2	79.4	89.7	**87.1**
18	**DWRB 160 ©**	86.3	92.4	96.5	**91.7**
19	**DWRB 182 ©**	89.8	96.1	87.9	**91.3**
20	**DWRUB 52 ©**	90.6	88.3	93.4	**90.8**
21	**RD 2849 ©**	88.4	95.0	93.2	**92.2**
	Mean	**87.3**	**88.4**	**92.0**	

*= 6 row barley

Table 2.14: Hot water extract (% fgdb) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	80.5	79.1	75.9	77.8	78.8	72.6	78.3	**77.6**
2	**BH 1035**	80.1	74.9	76.3	80.5	82.3	78.8	75.6	**78.4**
3	**BH 1036**	73.9	76.9	71.6	80.4	83.8	74.7	76.9	**76.9**
4	**DWRB 218**	81.5	79.3	77.4	82.3	79.7	78.4	77.0	**79.4**
5	**DWRB 219**	79.6	76.9	76.8	79.1	NA	77.7	79.1	**78.2**
6	**DWRB 220**	80.1	80.7	76.9	80.5	81.7	79.7	79.4	**79.9**
7	**DWRB 221**	79.8	77.6	76.6	78.5	84.2	80.5	79.0	**79.4**
8	**PL 926**	77.1	76.4	74.8	72.1	76.3	72.2	80.9	**75.7**
9	**PL 930**	75.9	81.2	75.6	83.4	79.0	79.1	83.9	**79.7**
10	**PL 931**	81.7	78.6	75.6	80.9	79.0	73.8	77.4	**78.1**
11	**RD 3027**	77.9	80.5	75.0	83.3	NA	80.0	79.3	**79.3**
12	**RD 3028**	77.3	82.7	74.2	80.2	76.2	78.2	76.5	**77.9**
13	**RD 3029**	82.8	77.6	75.9	80.7	73.8	77.1	79.8	**78.2**
14	**RD 3030**	71.8	78.8	76.2	78.8	78.5	71.8	82.2	**76.9**
15	**UPB 1097**	74.3	77.1	74.5	75.2	78.6	74.4	78.2	**76.0**
16	**UPB 1098**	81.6	80.3	77.8	80.2	78.5	78.6	81.7	**79.8**
17	**BH 946 ©***	72.1	75.7	74.6	78.7	81.1	76.6	76.3	**76.4**
18	**DWRB 160 ©**	76.0	76.5	74.0	74.8	83.5	76.7	81.0	**77.5**
19	**DWRB 182 ©**	80.2	75.5	73.3	83.1	82.6	74.7	80.3	**78.5**
20	**DWRUB 52 ©**	80.3	77.1	75.7	80.3	81.6	78.1	79.5	**78.9**
21	**RD 2849 ©**	82.4	78.6	77.5	81.9	79.4	79.3	81.4	**80.1**
	Mean	**78.4**	**78.2**	**75.4**	**79.7**	**79.9**	**76.5**	**79.2**	

*= 6 row barley

Table 2.15: Wort filtration rate (ml/hr) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	305	285	265	180	165	290	165	**236**
2	**BH 1035**	205	180	185	125	95	285	275	**193**
3	**BH 1036**	320	310	145	105	95	210	230	**202**
4	**DWRB 218**	325	300	160	170	130	305	315	**244**
5	**DWRB 219**	330	305	145	195	NA	195	150	**220**
6	**DWRB 220**	250	325	205	220	280	260	145	**241**
7	**DWRB 221**	325	320	170	180	200	225	220	**234**
8	**PL 926**	295	155	315	305	145	320	165	**243**
9	**PL 930**	295	310	305	225	250	290	195	**267**
10	**PL 931**	310	305	175	180	190	270	310	**249**
11	**RD 3027**	260	250	215	230	NA	305	265	**254**
12	**RD 3028**	235	245	175	200	115	305	155	**204**
13	**RD 3029**	250	140	190	130	105	265	170	**179**
14	**RD 3030**	200	315	160	175	175	230	175	**204**
15	**UPB 1097**	205	300	190	75	120	175	185	**179**
16	**UPB 1098**	310	295	185	115	120	205	165	**199**
17	**BH 946 ©***	250	255	240	80	155	260	250	**213**
18	**DWRB 160 ©**	300	310	170	155	295	170	160	**223**
19	**DWRB 182 ©**	305	295	215	185	255	280	240	**254**
20	**DWRUB 52 ©**	320	325	185	185	155	240	285	**242**
21	**RD 2849 ©**	315	320	215	180	155	230	180	**228**
	Mean	**281**	**278**	**200**	**171**	**168**	**253**	**210**	

*= 6 row barley

Table 2.16: Diastatic power (^{0}L) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	108.7	105.3	106.4	80.6	99.0	96.2	107.5	**101**
2	**BH 1035**	80.6	86.2	92.6	94.3	108.7	95.2	97.1	**94**
3	**BH 1036**	87.0	99.0	101.0	84.7	96.2	90.1	98.0	**94**
4	**DWRB 218**	104.2	82.6	101.0	94.3	88.5	108.7	88.5	**95**
5	**DWRB 219**	107.5	80.6	95.2	86.2	NA	70.4	99.0	**90**
6	**DWRB 220**	79.4	93.5	96.2	106.4	87.7	109.9	89.3	**95**
7	**DWRB 221**	84.7	84.7	94.3	86.2	80.6	75.8	106.4	**88**
8	**PL 926**	86.2	92.6	98.0	92.6	82.6	97.1	107.5	**94**
9	**PL 930**	98.0	89.3	108.7	82.6	108.7	108.7	108.7	**101**
10	**PL 931**	97.1	87.0	87.7	89.3	98.0	82.6	119.0	**94**
11	**RD 3027**	108.7	95.2	117.6	98.0	NA	89.3	89.3	**100**
12	**RD 3028**	98.0	80.6	99.0	105.3	119.0	86.2	89.3	**97**
13	**RD 3029**	106.4	98.0	104.2	104.2	106.4	107.5	106.4	**105**
14	**RD 3030**	106.4	106.4	98.0	87.7	119.0	116.3	90.1	**103**
15	**UPB 1097**	87.7	80.0	104.2	89.3	107.5	98.0	98.0	**95**
16	**UPB 1098**	99.0	94.3	104.2	80.0	89.3	108.7	96.2	**96**
17	**BH 946 ©***	89.3	100.0	98.0	87.7	109.9	98.0	109.9	**99**
18	**DWRB 160 ©**	89.3	90.1	94.3	98.0	109.9	119.0	97.1	**100**
19	**DWRB 182 ©**	96.2	105.3	88.5	82.6	106.4	96.2	119.0	**99**
20	**DWRUB 52 ©**	86.2	82.6	87.7	89.3	98.0	89.3	96.2	**90**
21	**RD 2849 ©**	89.3	84.0	102.0	94.3	75.8	82.0	102.0	**90**
	Mean	**95**	**91**	**99**	**91**	**100**	**96**	**101**	

*= 6 row barley

Table 2.17: Saccharification rate (minutes) of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	5	10	5	5	10	10	5	**7.1**
2	**BH 1035**	10	5	5	5	5	10	5	**6.4**
3	**BH 1036**	5	5	10	5	5	5	10	**6.4**
4	**DWRB 218**	5	5	5	5	10	5	5	**5.7**
5	**DWRB 219**	10	5	5	5	5	10	5	**6.4**
6	**DWRB 220**	5	5	5	5	5	5	10	**5.7**
7	**DWRB 221**	5	5	5	10	5	5	5	**5.7**
8	**PL 926**	10	10	5	5	5	5	5	**6.4**
9	**PL 930**	10	5	10	5	10	5	5	**7.1**
10	**PL 931**	5	5	5	5	10	5	5	**5.7**
11	**RD 3027**	5	10	10	5	5	10	5	**7.1**
12	**RD 3028**	5	5	5	5	5	5	5	**5.0**
13	**RD 3029**	10	5	10	10	5	5	5	**7.1**
14	**RD 3030**	5	5	10	10	5	5	5	**6.4**
15	**UPB 1097**	10	5	5	5	5	5	10	**6.4**
16	**UPB 1098**	10	5	10	10	10	5	5	**7.9**
17	**BH 946 ©***	5	5	10	10	5	5	10	**7.1**
18	**DWRB 160 ©**	5	10	5	10	5	5	5	**6.4**
19	**DWRB 182 ©**	5	5	5	5	10	10	10	**7.1**
20	**DWRUB 52 ©**	5	5	5	10	5	5	5	**5.7**
21	**RD 2849 ©**	5	10	5	5	5	5	5	**5.7**
	Mean	**6.7**	**6.2**	**6.7**	**6.7**	**6.4**	**6.2**	**6.2**	

*= 6 row barley

Table 2.18: Wort pH of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	6.5	6.4	6.4	6.1	6.4	6.5	6.6	**6.4**
2	**BH 1035**	6.5	6.4	6.6	6.2	6.5	6.6	6.6	**6.5**
3	**BH 1036**	6.4	6.3	6.3	6.2	6.4	6.6	6.6	**6.4**
4	**DWRB 218**	6.4	6.2	6.2	6.1	6.3	6.5	6.6	**6.3**
5	**DWRB 219**	6.4	6.2	6.5	6.3	NA	6.6	6.6	**6.4**
6	**DWRB 220**	6.6	6.5	6.5	6.3	6.5	6.6	6.6	**6.5**
7	**DWRB 221**	6.4	6.3	6.4	6.3	6.4	6.6	6.6	**6.4**
8	**PL 926**	6.4	6.4	6.4	6.3	6.4	6.6	6.6	**6.4**
9	**PL 930**	6.5	6.5	6.3	6.2	6.4	6.6	6.7	**6.4**
10	**PL 931**	6.5	6.5	6.3	6.1	6.4	6.6	6.7	**6.4**
11	**RD 3027**	6.5	6.4	6.3	6.0	NA	6.5	6.6	**6.4**
12	**RD 3028**	6.4	6.3	6.3	5.9	6.2	6.5	6.6	**6.3**
13	**RD 3029**	6.4	6.4	6.4	6.1	6.3	6.5	6.5	**6.4**
14	**RD 3030**	6.4	6.3	6.3	6.2	6.2	6.6	6.6	**6.4**
15	**UPB 1097**	6.4	6.3	6.4	6.3	6.4	6.6	6.6	**6.4**
16	**UPB 1098**	6.3	6.2	6.4	6.2	6.3	6.5	6.5	**6.3**
17	**BH 946 ©***	6.5	6.6	6.3	6.2	6.5	6.5	6.7	**6.5**
18	**DWRB 160 ©**	6.6	6.5	6.4	6.1	6.5	6.6	6.6	**6.5**
19	**DWRB 182 ©**	6.5	6.5	6.4	6.2	6.6	6.6	6.7	**6.5**
20	**DWRUB 52 ©**	6.4	6.4	6.3	6.3	6.4	6.5	6.6	**6.4**
21	**RD 2849 ©**	6.4	6.4	6.4	6.3	6.4	6.6	6.6	**6.4**
	Mean	**6.4**	**6.4**	**6.4**	**6.2**	**6.4**	**6.6**	**6.6**	

*= 6 row barley

Table 2.19: Kolbach Index (KI) # of IVT (MB) entries from different locations

S.N.	Genotype	Hisar	Karnal	Bathinda	Ludhiana	Durgapura	Pantnagar	Bawal	Average
1	**BH 1034**	37.4	34.9	39.0	42.2	38.1	40.6	40.6	**39**
2	**BH 1035**	38.8	34.6	40.4	38.5	39.5	39.6	41.7	**39**
3	**BH 1036**	37.1	35.5	37.8	40.4	39.7	39.8	42.9	**39**
4	**DWRB 218**	39.0	32.6	39.0	39.5	41.0	38.9	39.1	**38**
5	**DWRB 219**	38.2	33.3	39.3	37.6	NA	40.4	46.0	**39**
6	**DWRB 220**	38.4	39.1	36.8	42.1	43.3	43.0	40.9	**41**
7	**DWRB 221**	39.4	35.5	39.3	40.5	42.3	41.2	38.8	**40**
8	**PL 926**	35.9	30.8	36.9	37.8	33.9	38.9	39.1	**36**
9	**PL 930**	35.4	32.8	38.5	40.0	38.8	38.1	39.4	**38**
10	**PL 931**	37.9	35.6	38.7	39.0	40.5	40.4	40.2	**39**
11	**RD 3027**	39.4	33.3	38.1	42.3	40.7	41.2	39.8	**39**
12	**RD 3028**	42.1	38.1	40.7	42.9	NA	43.7	40.6	**41**
13	**RD 3029**	38.5	34.3	38.8	43.2	42.6	45.0	39.6	**40**
14	**RD 3030**	40.0	35.4	39.4	36.2	37.6	38.1	38.5	**38**
15	**UPB 1097**	36.8	34.4	36.8	39.7	39.0	41.0	39.3	**38**
16	**UPB 1098**	37.9	33.1	37.8	38.7	43.1	38.3	43.0	**39**
17	**BH 946 ©***	40.2	36.8	38.4	39.5	39.3	39.3	41.9	**39**
18	**DWRB 160 ©**	40.2	38.2	39.5	39.3	40.7	41.1	42.9	**40**
19	**DWRB 182 ©**	35.3	34.1	38.0	41.7	39.8	39.2	40.5	**38**
20	**DWRUB 52 ©**	38.0	33.6	39.8	39.1	40.6	40.4	38.4	**39**
21	**RD 2849 ©**	36.3	36.1	37.6	41.1	40.0	42.9	41.1	**39**
	Mean	**38**	**35**	**39**	**40**	**40**	**41**	**41**	

*= 6 row barley #NIR predicted values

Table 2.20: Wort FAN content (ppm) of IVT (MB) entries from different locations

S.N.	Genotype	Karnal	Durgapura	Pantnagar	Average
1	**BH 1034**	138.7	141.2	178.3	**152.7**
2	**BH 1035**	168.9	126.0	156.6	**150.5**
3	**BH 1036**	121.7	111.6	181.8	**138.4**
4	**DWRB 218**	149.5	161.6	177.4	**162.8**
5	**DWRB 219**	116.4	139.6	143.6	**133.2**
6	**DWRB 220**	135.0	151.2	164.0	**150.1**
7	**DWRB 221**	143.7	136.8	187.4	**156.0**
8	**PL 926**	96.1	116.8	122.8	**111.9**
9	**PL 930**	152.4	139.6	219.1	**170.4**
10	**PL 931**	146.2	133.2	190.0	**156.5**
11	**RD 3027**	154.9	188.8	160.1	**167.9**
12	**RD 3028**	149.1	166.4	200.0	**171.8**
13	**RD 3029**	138.7	153.6	201.3	**164.5**
14	**RD 3030**	147.8	156.0	221.7	**175.2**
15	**UPB 1097**	144.9	122.4	183.5	**150.3**
16	**UPB 1098**	166.0	156.8	200.4	**174.4**
17	**BH 946 ©***	121.3	151.6	173.5	**148.8**
18	**DWRB 160 ©**	113.0	122.4	148.4	**127.9**
19	**DWRB 182 ©**	149.5	135.6	160.5	**148.5**
20	**DWRUB 52 ©**	140.8	156.0	181.3	**159.4**
21	**RD 2849 ©**	147.8	140.8	196.5	**161.7**
	Mean	**140.1**	**143.2**	**178.5**	

*= 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 three categories i.e. hulless barley, malt barley and general germplasm evaluation. Besides this one set of 7 entries was sent of genotypes developed through MAS (molecular biology).

HULLESS BARLEY NURSERY

Table 1. Promising sources for different traits*

Traits	Promising entries
Thousand grain weight	DWRFB-58
Bold grains	DWRFB 40, DWRNB 14, DWRFB 58
Protein content	BCU 8028, BCU 8032, BCU8041, BCU 8038
Starch content	DWRNB 25, DWRB 204, DWRB 217

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

Table 2: Beta glucan content (%db) of few genotypes from different locations

Genotype	Hisar	Karnal	Ludhiana	Durgapura	Kanpur	Pantnagar	Average
BCU 8028	6.9	7.6	6.4	7.0	6.2	7.9	**7.0**
DWRFB-40	5.8	4.0	7.2	7.4	5.2	6.5	**6.0**
DWRFB-58	5.6	5.4	5.9	5.2	6.0	5.7	**5.6**
Dolma (c)	6.6	6.1	6.3	7.7	6.2	5.7	**6.4**
NDB 943 (c)	5.2	5.7	5.2	6.7	5.1	NA	**5.6**
Karan 16 (c)	5.3	5.5	5.3	6.3	6.0	5.4	**5.6**
BHS 352 (c)	7.2	8.1	8.0	7.6	7.1	8.0	**7.7**
Geetanjali (c)	5.9	5.8	3.8	6.2	3.9	5.7	**5.2**
HBL 276 (c)	6.6	7.8	6.6	6.7	6.1	6.5	**6.7**
PL 891 (c)	6.3	5.7	6.3	6.8	5.2	5.9	**6.0**
Average	**6.1**	**6.2**	**6.1**	**6.8**	**5.7**	**6.4**	

Table 3: Hectoliter weight (Test weight in kg/hl) of genotypes from different locations

Code	Genotype	Durgapura	Pantnagar	Kanpur	Hisar	Karnal	Ludhiana	Average
H-1	**BCU 7998**	76.3	61.3	59.3	51.4	71.8	70.4	**65.1**
H-2	**BCU 8023**	72.4	NA	73.6	NA	74.5	NA	**73.5**
H-3	**BCU 8028**	73.1	72.9	74.4	NA	66.8	67.7	**71.0**
H-4	**BCU 8032**	73.6	NA	74.5	NA	NA	65.9	**71.3**
H-5	**BCU 8038**	71.4	NA	75.0	NA	72.7	NA	**73.1**
H-6	**BCU8041**	58.7	59.4	NA	NA	63.9	58.8	**60.2**
H-7	**DWR 62**	78.3	76.3	70.1	56.6	69.9	76.0	**71.2**
H-8	**DWR 80**	78.9	59.8	68.7	53.9	75.6	73.8	**68.4**
H-9	**Dolma (c)**	77.4	70.7	71.9	63.5	74.3	70.6	**71.4**
H-10	**NDB 943 (c)**	78.4	NA	66.1	57.5	73.2	69.0	**68.8**
H-11	**Karan 16 (c)**	78.0	60.2	71.3	59.3	75.8	66.7	**68.6**
H-12	**BHS 352 (c)**	74.3	69.0	71.2	64.8	74.3	NA	**70.7**
H-13	**Geetanjali (c)**	76.3	68.7	74.5	NA	77.8	68.7	**73.2**
H-14	**HBL 276 (c)**	77.1	72.0	71.9	64.3	77.1	68.8	**71.9**
H-15	**ATAHULAPA ©**	74.8	61.7	59.3	54.8	66.1	68.0	**64.1**
H-16	**PL 891 (c)**	75.5	62.7	71.9	65.9	71.4	NA	**69.5**
H-17	**DWRNB 05**	74.9	68.9	73.3	65.6	75.1	72.1	**71.6**
H-18	**DWRNB 14**	75.0	62.4	65.4	62.3	67.5	66.3	**66.5**
H-19	**DWRNB 17**	71.2	57.9	52.3	48.8	67.4	69.9	**61.2**
H-20	**DWRNB 20**	73.6	64.8	64.1	64.2	54.8	62.9	**64.1**
H-21	**DWRNB 23**	77.5	65.6	68.0	56.6	77.2	75.2	**70.0**
H-22	**DWRNB 25**	79.1	70.6	76.2	69.9	77.8	74.7	**74.7**
H-23	**DWRNB 28**	71.6	NA	62.3	69.3	66.2	69.0	**67.7**
H-24	**INBON- HI-(2017)-88**	76.1	57.1	65.0	55.1	76.4	69.5	**66.5**
H-25	**K 1155 ©**	64.5	59.8	58.4	52.9	58.2	57.2	**58.5**
H-26	**Falcon Bar ©**	70.7	65.3	66.7	60.5	65.7	63.8	**65.5**
H-27	**Peregrine ©**	78.4	67.4	66.0	71.2	75.2	67.8	**71.0**
H-28	**DWRB 204**	78.6	58.6	75.1	58.0	61.7	67.3	**66.5**
H-29	**DWRB 216**	67.5	52.7	72.0	54.7	64.4	67.0	**63.0**
H-30	**DWRB-217**	75.7	71.4	72.4	68.1	73.1	72.9	**72.3**
H-31	**DWRFB-40**	78.2	62.4	70.4	70.2	78.9	77.2	**72.9**
H-32	**DWRFB-58**	73.9	75.1	NA	70.4	75.3	74.9	**73.9**
	Average	**74.4**	**65.0**	**68.7**	**61.1**	**71.1**	**69.0**	

Table 4: 1000 gw of genotypes from different locations

Code	Genotype	Durgapura	Pantnagar	Kanpur	Hisar	Karnal	Ludhiana	Average
H-1	**BCU 7998**	44.6	38.1	36.9	38.3	35.6	35.2	**38.1**
H-2	**BCU 8023**	37.9	15.3	38.3	33.1	35.3	28.3	**31.4**
H-3	**BCU 8028**	36.6	35.3	36.2	35.4	35.4	31.4	**35.1**
H-4	**BCU 8032**	37.1	33.4	40.5	30.6	34.4	32.0	**34.7**
H-5	**BCU 8038**	36.9	34.4	43.5	39.6	42.1	29.6	**37.7**
H-6	**BCU8041**	39.6	32.4	NA	38.8	42.8	34.0	**37.5**
H-7	**DWR 62**	38.7	34.6	33.7	35.0	33.0	33.4	**34.7**
H-8	**DWR 80**	40.4	34.1	33.2	31.6	37.6	33.9	**35.1**
H-9	**Dolma (c)**	32.1	26.4	28.7	23.1	31.3	26.1	**28.0**
H-10	**NDB 943 (c)**	37.5	NA	30.8	30.2	32.4	27.7	**31.7**
H-11	**Karan 16 (c)**	38.2	31.2	30.1	26.9	29.5	25.9	**30.3**
H-12	**BHS 352 (c)**	34.3	28.2	28.9	24.5	32.0	22.8	**28.5**
H-13	**Geetanjali (c)**	35.7	30.5	34.7	25.6	32.5	23.8	**30.5**
H-14	**HBL 276 (c)**	36.1	32.1	29.7	28.4	34.6	26.0	**31.1**
H-15	**ATAHULAPA (c)**	49.9	43.9	38.6	43.2	46.2	39.6	**43.6**
H-16	**PL 891 (c)**	49.7	44.6	39.0	44.4	46.6	38.7	**43.9**
H-17	**DWRNB 05**	45.1	36.0	37.6	36.1	39.2	31.6	**37.6**
H-18	**DWRNB 14**	43.4	38.5	37.2	39.9	42.1	31.1	**38.7**
H-19	**DWRNB 17**	38.7	29.8	32.8	25.0	29.5	29.3	**30.9**
H-20	**DWRNB 20**	39.6	36.2	36.1	40.2	38.6	27.8	**36.4**
H-21	**DWRNB 23**	39.2	34.0	33.6	23.3	32.9	31.8	**32.5**
H-22	**DWRNB 25**	39.9	35.4	35.9	26.8	35.4	32.4	**34.3**
H-23	**DWRNB 28**	38.5	41.3	36.7	39.2	36.9	32.0	**37.4**
H-24	**INBON- HI-(2017)-88**	38.9	36.4	34.1	33.2	38.2	27.0	**34.6**
H-25	**K 1155 ©**	47.4	44.6	43.3	40.5	43.0	33.3	**42.0**
H-26	**Falcon Bar ©**	42.3	36.4	33.7	35.1	37.2	27.3	**35.3**
H-27	**Peregrin ©**	35.3	27.0	28.0	24.3	29.3	21.3	**27.5**
H-28	**DWRB 204**	38.9	40.4	33.9	33.3	33.0	35.3	**35.8**
H-29	**DWRB 216**	41.5	33.6	30.6	33.1	31.9	29.5	**33.4**
H-30	**DWRB-217**	40.4	36.8	34.6	32.1	27.7	29.3	**33.5**
H-31	**DWRFB-40**	49.7	43.2	42.5	39.4	45.2	39.0	**43.2**
H-32	**DWRFB-58**	51.5	44.9	40.6	35.9	45.6	42.7	**43.5**
	Average	**40.5**	**35.1**	**35.3**	**33.3**	**36.5**	**30.9**	

Table 5: Bold grain percentage of genotypes from different locations

Code	Genotype	Durgapura	Pantnagar	Kanpur	Hisar	Karnal	Ludhiana	Average
H-1	**BCU 7998**	65.3	49.1	50.4	70.5	26.7	29.9	**48.6**
H-2	**BCU 8023**	40.2	NA	24.7	NA	14.2	NA	**26.3**
H-3	**BCU 8028**	34.6	43.2	49.5	NA	42.1	18.7	**37.6**
H-4	**BCU 8032**	34.9	14.3	24.5	NA	8.5	9.3	**18.3**
H-5	**BCU 8038**	26.8	38.6	37.6	NA	28.9	11.0	**28.6**
H-6	**BCU8041**	44.3	35.7	NA	NA	54.7	21.6	**39.1**
H-7	**DWR 62**	65.2	45.2	49.8	73.7	44.5	50.2	**54.8**
H-8	**DWR 80**	73.7	53.6	27.3	47.4	37.8	48.1	**48.0**
H-9	**Dolma (c)**	25.9	13.8	7.1	3.8	13.4	19.6	**13.9**
H-10	**NDB 943 (c)**	31.5	NA	36.0	38.2	26.5	21.6	**30.8**
H-11	**Karan 16 (c)**	33.5	32.8	18.9	19.4	7.9	19.4	**22.0**
H-12	**BHS 352 (c)**	20.0	3.5	6.5	2.0	8.6	2.9	**7.2**
H-13	**Geetanjali (c)**	39.3	16.8	26.9	6.9	29.8	11.5	**21.9**
H-14	**HBL 276 (c)**	34.8	13.6	13.4	5.5	24.7	14.7	**17.8**
H-15	**ATAHULAPA (c)**	74.5	51.7	41.7	52.9	27.0	36.8	**47.4**
H-16	**PL 891 (c)**	72.7	46.8	11.5	48.1	35.8	23.4	**39.7**
H-17	**DWRNB 05**	37.5	12.2	9.9	9.6	7.6	6.8	**13.9**
H-18	**DWRNB 14**	85.8	62.8	55.4	63.3	73.7	45.6	**64.4**
H-19	**DWRNB 17**	63.1	31.2	55.1	15.1	19.9	22.7	**34.5**
H-20	**DWRNB 20**	29.2	43.3	52.5	57.0	43.6	14.2	**39.9**
H-21	**DWRNB 23**	73.9	35.7	31.5	10.6	12.4	23.7	**31.3**
H-22	**DWRNB 25**	81.4	35.9	37.4	11.0	37.8	38.3	**40.3**
H-23	**DWRNB 28**	29.0	53.8	36.6	49.6	27.0	23.8	**36.6**
H-24	**INBON- HI-(2017)-88**	75.2	64.4	56.1	60.0	63.0	28.6	**57.9**
H-25	**K 1155 ©**	87.3	73.4	64.7	51.5	66.8	25.6	**61.5**
H-26	**Falcon Bar ©**	69.2	55.4	38.0	38.8	45.0	22.5	**44.8**
H-27	**Peregrine ©**	38.1	20.4	27.4	5.9	14.9	9.6	**19.4**
H-28	**DWRB 204**	66.0	75.2	34.5	49.9	39.2	51.8	**52.8**
H-29	**DWRB 216**	72.2	58.9	10.2	40.0	33.4	26.6	**40.2**
H-30	**DWRB-217**	80.2	47.4	31.9	19.4	31.2	37.4	**41.3**
H-31	**DWRFB-40**	92.7	82.9	76.8	61.14	82.2	64.7	**76.7**
H-32	**DWRFB-58**	87.1	67.5	63.2	19.38	73.6	68.2	**63.2**
	Average	**55.8**	**42.6**	**35.7**	**34.5**	**34.4**	**27.4**	

Table 6: Thin grain percentage of genotypes from different locations

Code	Genotype	Durgapura	Pantnagar	Kanpur	Hisar	Karnal	Ludhiana	Average
H-1	**BCU 7998**	6.5	13.9	16.3	3.9	23.1	24.27	**14.7**
H-2	**BCU 8023**	24.9	NA	26.3	NA	35.5	NA	**28.9**
H-3	**BCU 8028**	29.0	20.4	15.5	NA	22.2	28.74	**23.2**
H-4	**BCU 8032**	28.8	44.2	25.2	NA	52.2	43.52	**38.8**
H-5	**BCU 8038**	36.5	25.4	14.7	NA	25.1	39.14	**28.2**
H-6	**BCU8041**	18.8	23.2	NA	NA	16.3	22.56	**20.2**
H-7	**DWR 62**	2.5	10.6	10.6	5.0	14.2	10.74	**9.0**
H-8	**DWR 80**	3.8	10.7	20.4	14.2	TBD	11.61	**12.1**
H-9	**Dolma (c)**	30.2	48.3	59.1	75.0	44.7	46.09	**50.6**
H-10	**NDB 943 (c)**	10.1	NA	23.5	19.0	19.8	35.16	**21.5**
H-11	**Karan 16 (c)**	13.8	26.4	38.5	42.5	47.0	43.12	**35.2**
H-12	**BHS 352 (c)**	39.7	76.2	61.1	83.3	55.2	66.32	**63.6**
H-13	**Geetanjali (c)**	15.8	39.0	22.4	52.6	28.5	61.2	**36.6**
H-14	**HBL 276 (c)**	23.6	43.4	44.7	56.9	27.3	51.88	**41.3**
H-15	**ATAHULAPA (c)**	1.8	6.9	20.0	9.3	10.6	14.46	**10.5**
H-16	**PL 891 (c)**	2.2	8.7	28.4	8.7	15.2	14.36	**12.9**
H-17	**DWRNB 05**	12.1	35.7	45.8	40.1	39.3	55.08	**38.0**
H-18	**DWRNB 14**	1.9	6.2	11.5	4.4	5.5	21.07	**8.4**
H-19	**DWRNB 17**	4.4	25.7	10.1	49.7	40.6	28.58	**26.5**
H-20	**DWRNB 20**	18.1	18.3	15.8	11.0	16.3	53.89	**22.2**
H-21	**DWRNB 23**	7.3	21.0	20.8	58.6	38.6	34.5	**30.1**
H-22	**DWRNB 25**	1.7	17.0	14.8	36.5	18.4	24.06	**18.7**
H-23	**DWRNB 28**	25.0	12.8	25.9	15.4	28.7	36.61	**24.1**
H-24	**INBON- HI-(2017)-88**	2.3	8.3	9.1	6.8	4.7	25.21	**9.4**
H-25	**K 1155 ©**	3.9	6.2	6.7	10.0	7.0	34.38	**11.4**
H-26	**Falcon Bar ©**	4.4	11.5	18.7	19.0	22.5	42.84	**19.8**
H-27	**Peregrin ©**	9.6	33.0	21.7	59.2	41.0	60.31	**37.4**
H-28	**DWRB 204**	3.5	3.3	17.9	12.9	11.5	13.4	**10.4**
H-29	**DWRB 216**	1.9	12.0	43.1	22.3	27.4	30.6	**22.9**
H-30	**DWRB-217**	2.7	10.4	16.1	29.6	20.8	25.36	**17.5**
H-31	**DWRFB-40**	1.4	3.5	6.4	9.4	3.7	11.07	**5.9**
H-32	**DWRFB-58**	4.0	4.1	8.4	19.3	4.0	9.3	**8.2**
	Average	**12.3**	**20.9**	**23.2**	**28.7**	**24.7**	**32.9**	

Table 7: Protein content (%db) of genotypes from different locations#

Code	Genotype	Durgapura	Pantnagar	Kanpur	Hisar	Karnal	Ludhiana	Average
H-1	**BCU 7998**	15.3	13.9	13.5	13.0	17.7	16.8	**15.0**
H-2	**BCU 8023**	14.9	NA	13.2	NA	16.6	NA	**14.9**
H-3	**BCU 8028**	16.4	18.7	15.6	NA	20.4	19.8	**18.2**
H-4	**BCU 8032**	16.0	20.2	13.6	NA	17.3	20.4	**17.5**
H-5	**BCU 8038**	16.7	18.1	14.5	NA	16.0	NA	**16.3**
H-6	**BCU8041**	15.7	17.4	NA	NA	16.6	16.3	**16.5**
H-7	**DWR 62**	14.5	14.9	12.4	12.7	15.2	16.8	**14.4**
H-8	**DWR 80**	14.0	16.6	11.4	14.7	14.8	15.4	**14.5**
H-9	**Dolma (c)**	14.2	17.4	12.8	16.2	15.6	16.9	**15.5**
H-10	**NDB 943 (c)**	14.5	NA	12.4	15.3	13.9	16.3	**14.5**
H-11	**Karan 16 (c)**	12.2	13.7	11.9	14.3	13.8	14.7	**13.4**
H-12	**BHS 352 (c)**	13.8	16.3	11.8	14.6	14.4	15.4	**14.4**
H-13	**Geetanjali (c)**	14.4	14.0	10.6	NA	13.5	18.2	**14.1**
H-14	**HBL 276 (c)**	13.0	11.5	11.8	15.4	12.9	16.4	**13.5**
H-15	**ATAHULAPA (c)**	15.2	15.9	12.9	16.0	15.2	18.4	**15.6**
H-16	**PL 891 (c)**	14.1	15.0	13.9	15.4	16.2	15.2	**15.0**
H-17	**DWRNB 05**	14.2	15.0	13.7	12.9	13.8	15.0	**14.1**
H-18	**DWRNB 14**	11.3	10.8	11.8	10.9	12.9	14.3	**12.0**
H-19	**DWRNB 17**	13.8	13.2	11.1	13.6	13.7	16.3	**13.6**
H-20	**DWRNB 20**	12.9	15.0	11.0	13.2	12.9	20.5	**14.3**
H-21	**DWRNB 23**	12.6	13.1	12.1	14.4	13.2	16.2	**13.6**
H-22	**DWRNB 25**	13.0	13.9	11.9	12.9	14.2	16.3	**13.7**
H-23	**DWRNB 28**	13.6	NA	12.7	12.2	15.8	18.2	**14.5**
H-24	**INBON- HI-(2017)-88**	12.9	10.4	12.4	13.0	13.3	16.9	**13.2**
H-25	**K 1155 ©**	13.5	10.1	10.1	12.4	12.0	14.9	**12.2**
H-26	**Falcon Bar ©**	13.0	10.2	10.9	12.4	13.4	16.2	**12.7**
H-27	**Peregrine ©**	12.5	11.9	10.8	11.8	14.1	17.3	**13.1**
H-28	**DWRB 204**	11.4	11.7	11.1	12.8	13.2	14.5	**12.5**
H-29	**DWRB 216**	13.7	10.7	13.2	14.0	14.4	16.6	**13.8**
H-30	**DWRB-217**	13.5	11.3	11.8	13.4	14.7	17.0	**13.6**
H-31	**DWRFB-40**	13.2	11.1	12.8	13.3	13.8	15.3	**13.3**
H-32	**DWRFB-58**	16.1	11.4	12.7	15.5	15.7	16.5	**14.7**
	Average	**13.9**	**13.9**	**12.3**	**13.7**	**14.5**	**16.6**	

#Predicted values through NIR

Table 8: Starch content (%db) of genotypes from different locations#

Code	Genotype	Durgapura	Pantnagar	Kanpur	Hisar	Karnal	Ludhiana	Average
H-1	**BCU 7998**	64.1	60.1	60.5	59.0	59.7	60.4	**60.6**
H-2	**BCU 8023**	62.8	NA	62.6	NA	61.3	NA	**62.2**
H-3	**BCU 8028**	60.5	58.4	61.0	NA	57.3	58.4	**59.1**
H-4	**BCU 8032**	60.4	57.0	61.2	NA	59.4	57.7	**59.1**
H-5	**BCU 8038**	59.9	58.3	60.6	NA	60.5	NA	**59.8**
H-6	**BCU8041**	59.5	58.8	NA	NA	60.2	59.6	**59.5**
H-7	**DWR 62**	65.7	62.6	64.1	61.6	62.1	61.5	**62.9**
H-8	**DWR 80**	64.6	59.4	63.5	59.5	63.1	61.8	**62.0**
H-9	**Dolma (c)**	64.7	60.1	63.1	60.7	61.8	60.1	**61.8**
H-10	**NDB 943 (c)**	65.1	NA	62.8	59.8	63.6	60.9	**62.4**
H-11	**Karan 16 (c)**	65.8	60.2	63.8	60.1	63.4	61.3	**62.4**
H-12	**BHS 352 (c)**	63.8	59.7	63.7	61.5	62.1	61.4	**62.0**
H-13	**Geetanjali (c)**	63.5	61.3	65.5	NA	64.5	59.4	**62.8**
H-14	**HBL 276 (c)**	65.5	63.9	63.8	61.1	65.6	60.7	**63.4**
H-15	**ATAHULAPA (c)**	61.8	58.9	60.8	58.3	61.0	59.0	**60.0**
H-16	**PL 891 (c)**	63.0	59.8	61.7	60.0	61.4	62.0	**61.3**
H-17	**DWRNB 05**	63.7	61.1	63.0	62.8	63.6	62.6	**62.8**
H-18	**DWRNB 14**	66.9	61.8	63.3	61.6	64.0	62.8	**63.4**
H-19	**DWRNB 17**	64.4	61.0	60.6	58.6	63.1	61.3	**61.5**
H-20	**DWRNB 20**	65.6	59.8	63.5	60.4	60.0	57.3	**61.1**
H-21	**DWRNB 23**	66.6	62.2	61.9	60.4	65.0	61.7	**63.0**
H-22	**DWRNB 25**	66.7	63.1	65.8	63.1	64.5	62.5	**64.3**
H-23	**DWRNB 28**	64.3	NA	61.2	61.4	60.8	59.2	**61.4**
H-24	**INBON- HI-(2017)-88**	64.5	61.2	62.2	58.8	63.6	59.7	**61.7**
H-25	**K 1155 ©**	59.9	61.0	61.0	58.9	60.3	59.6	**60.1**
H-26	**Falcon Bar ©**	63.9	62.9	64.3	60.1	61.7	59.7	**62.1**
H-27	**Peregrine ©**	67.8	63.8	64.4	64.0	65.0	60.0	**64.2**
H-28	**DWRB 204**	68.7	62.6	66.2	60.4	63.1	61.7	**63.8**
H-29	**DWRB 216**	63.5	60.9	63.5	60.0	61.7	59.8	**61.6**
H-30	**DWRB-217**	65.6	64.5	65.0	61.5	64.3	61.0	**63.7**
H-31	**DWRFB-40**	65.6	61.7	63.6	61.7	64.3	62.6	**63.3**
H-32	**DWRFB-58**	61.4	64.3	62.6	61.0	61.4	60.7	**61.9**
	Average	**64.1**	**61.0**	**62.9**	**60.6**	**62.3**	**60.5**	

#Predicted values through NIR

MALT BARLEY NURSERY

Table 1. Promising sources for different traits*

Trait	Promising entries
Hectoliter weight	BCU-4966
Thousand grain weight (40-46 g)	ICARDA-12, ICARDA-18, ICARDA-9, BK 306, ICARDA-28, ICARDA-1, ICARDA-19
Protein content (12-13% dwb)	BCU-4966, DWRB211, ICARDA-26, ICARDA-5, PL912, ICARDA-9, ICARDA-18, RD3025, BK 316, ICARDA-17, ICARDA-11, ICARDA-28, K-647
Starch content	ICARDA-1
Beta glucan content	ICARDA-5, ICARDA-9

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

Table 2: Beta glucan content (%db) of few genotypes from different locations

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
M-6	**ICARDA-5**	3.6	3.9	4.3	4.1	3.3	3.8	**3.8**
M-8	**ICARDA-9**	3.7	3.0	4.2	4.3	3.7	4.4	**3.8**
M-9	**ICARDA-11**	4.3	4.4	4.1	4.2	4.0	4.1	**4.2**
M-17	**DWRUB 52 (c)**	5.4	4.2	4.4	5.2	5.1	5.3	**4.9**
M-18	**DWRB 101 (c)**	5.4	4.4	5.9	5.0	5.1	5.0	**5.1**
M-23	**DWRB-182 (c)**	4.2	4.2	4.4	4.7	4.0	4.0	**4.2**
M-27	**BK 306**	3.8	4.3	4.4	4.7	4.5	4.5	**4.4**
M-33	**DWRB 197**	6.3	6.4	6.6	6.4	6.5	5.9	**6.4**
M-44	**DWR 37**	4.8	4.4	4.8	5.0	5.4	4.8	**4.9**
M-46	**DWR 39**	4.6	2.9	NA	NA	4.4	4.2	**4.0**
Average		**4.6**	**4.2**	**4.8**	**4.8**	**4.6**	**4.6**	

Table 3: Protein content (%db) of genotypes from different locations#

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
M-1	**BCU 2030**	10.0	12.8	14.2	13.3	7.9	9.9	**11.4**
M-2	**BK-1127**	13.0	15.1	15.4	15.1	10.4	13.6	**13.8**
M-3	**BCU-4966**	13.1	14.0	14.4	14.7	10.5	NA	**13.3**
M-4	**ICARDA-1***	9.8	12.9	11.3	13.6	9.2	12.4	**11.5**
M-5	**ICARDA-4***	11.5	12.3	11.9	13.1	9.4	11.7	**11.7**
M-6	**ICARDA-5***	13.9	12.9	13.9	14.0	12.0	11.4	**13.0**
M-7	**ICARDA-8***	15.1	14.1	13.6	14.9	13.1	13.2	**14.0**
M-8	**ICARDA-9***	13.1	13.6	14.2	12.9	12.1	11.7	**12.9**
M-9	**ICARDA-11***	12.5	13.5	14.5	12.1	11.5	11.4	**12.6**
M-10	**ICARDA-12***	10.9	12.3	13.3	13.1	11.4	10.9	**12.0**
M-11	**ICARDA-17***	13.9	12.4	13.3	12.8	11.7	11.4	**12.6**
M-12	**ICARDA-18***	13.5	11.9	13.1	13.1	14.3	10.9	**12.8**
M-13	**ICARDA-19***	10.9	13.2	15	13.2	11.3	11.3	**12.5**
M-14	**ICARDA-26***	11.2	13.3	15.3	15.0	12.5	11.6	**13.2**
M-15	**ICARDA-27***	12.7	13.8	14.5	15.1	12.9	12.5	**13.6**
M-16	**ICARDA-28***	11.6	12.2	12.8	13.1	NA	13.2	**12.6**
M-17	**DWRUB 52 (c)**	12.0	11.6	14.5	12.0	9.7	12.5	**12.1**
M-18	**DWRB 101 (c)**	12.1	11.7	12.8	11.7	9.6	11.1	**11.5**
M-19	**DWRB 123 (c)**	12.5	12.1	12.6	11.6	9.4	10.1	**11.4**
M-20	**DWRB 92 (c)**	12.5	14.1	13.5	11.9	10.7	12.7	**12.6**
M-21	**DWRB 91 (c)**	11.7	12.1	13.4	12.0	10.3	10.3	**11.6**
M-22	**DWRB-160 (c)**	11.8	12.2	12.4	11.3	10.9	10.3	**11.5**
M-23	**DWRB-182 (c)**	12.2	11.6	14.2	13.2	12.1	10.4	**12.3**
M-24	**K-647**	12.5	14.3	13.8	13.5	12.6	12.5	**13.2**
M-25	**DWRB-184**	11.3	13.0	13.3	11.7	11.1	9.9	**11.7**
M-26	**BCU 2241**	13.0	15.4	15.6	12.9	12.4	11	**13.4**
M-27	**BK 306**	12.5	13.7	13.8	11.5	11.5	11.4	**12.4**
M-28	**DWR 49**	14.1	15.4	15.3	14.0	13.2	11.9	**14.0**
M-29	**BK 303**	13.5	15.0	14.9	13.5	13.8	11.4	**13.7**
M-30	**BK 316**	12.6	13.5	13.1	12.7	12.8	11.4	**12.7**
M-31	**BH 1026**	14.3	16.5	13.5	13.2	15	12.4	**14.2**
M-32	**BH 1027**	15.2	15.2	12.2	13.0	14.1	13.3	**13.8**
M-33	**DWRB 197**	12.8	13.6	11.4	13.0	13	9.9	**12.3**
M-34	**DWRB209**	13.3	15.4	10.7	12.8	12.8	9.7	**12.5**
M-35	**DWRB211**	13.8	14.8	11.5	14.3	13.3	11.5	**13.2**
M-36	**RD3025**	13.4	14.1	12.3	12.9	12.9	11.2	**12.8**
M-37	**PL912**	13.7	14.2	12.5	12.7	13.8	11	**13.0**
M-38	**PL919**	12.8	14.8	12.5	11.7	12.5	10.5	**12.5**
M-39	**PL916**	12.3	14.4	12.8	11.9	10.1	10.5	**12.0**
M-40	**RD3024**	12.8	13.2	10.5	12.1	10.5	10.4	**11.6**
M-41	**UPB 1090**	13.9	13.7	12	12.4	11.8	11.3	**12.5**
M-42	**DWRB 137 (c)**	11.6	12.2	11.1	10.4	11.2	9.5	**11.0**
M-43	**RD2849 (C)**	12.8	13.5	12.9	11.2	14.6	10.2	**12.5**
M-44	**DWR 37**	14.6	16.3	12.9	12.8	15.5	13.2	**14.2**
M-45	**DWR 38**	14.2	16.0	13.4	15.0	14.1	15.2	**14.7**
M-46	**DWR 39**	15.8	16.6	NA	NA	NA	NA	**16.2**
M-47	**DWR-51**	13.9	15.2	12.4	14.0	14.7	15.2	**14.2**
M-48	**Kasota**	11.7	14.8	10.5	12.3	12.2	14.2	**12.6**
Average		**12.8**	**13.8**	**13.2**	**12.9**	**12.0**	**11.6**	

*#Predicted values through NIR **Details given in table 7*

Table 4: Hectoliter weight (Test weight in kg/hl) of genotypes from different locations

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
M-1	**BCU 2030**	51.9	58.1	51.5	63.7	58.5	57.0	**56.8**
M-2	**BK-1127**	59.9	65.9	63.4	66.8	62.7	58.8	**62.9**
M-3	**BCU-4966**	63.4	70.9	66.2	69.9	68.4	NA	**67.8**
M-4	**ICARDA-1**	55.8	66.2	63.0	69.2	63.0	59.1	**62.7**
M-5	**ICARDA-4**	53.0	60.8	59.9	64.5	61.0	54.1	**58.9**
M-6	**ICARDA-5**	55.5	68.5	62.5	66.6	66.3	60.8	**63.4**
M-7	**ICARDA-8**	52.7	66.0	58.3	67.3	60.6	55.0	**60.0**
M-8	**ICARDA-9**	57.8	64.0	63.4	68.8	63.4	61.9	**63.2**
M-9	**ICARDA-11**	52.0	62.0	57.5	62.6	60.3	57.7	**58.7**
M-10	**ICARDA-12**	56.5	65.2	61.6	68.1	64.3	59.3	**62.5**
M-11	**ICARDA-17**	55.3	63.8	58.6	64.5	60.3	59.2	**60.3**
M-12	**ICARDA-18**	54.1	64.1	56.9	66.1	56.5	60.0	**59.6**
M-13	**ICARDA-19**	56.1	64.8	56.5	65.8	64.1	59.3	**61.1**
M-14	**ICARDA-26**	53.4	63.3	54.9	65.2	58.4	57.4	**58.8**
M-15	**ICARDA-27**	54.4	63.2	59.2	65.2	58.4	60.2	**60.1**
M-16	**ICARDA-28**	53.3	60.9	59.1	66.0	NA	58.3	**59.5**
M-17	**DWRUB 52 (c)**	61.3	68.7	57.9	70.8	64.5	62.3	**64.3**
M-18	**DWRB 101 (c)**	59.8	66.3	65.3	70.7	67.7	64.7	**65.8**
M-19	**DWRB 123 (c)**	60.1	67.0	63.7	69.3	67.3	57.5	**64.2**
M-20	**DWRB 92 (c)**	57.5	66.0	61.7	67.1	65.1	59.8	**62.9**
M-21	**DWRB 91 (c)**	58.3	66.4	61.8	69.2	65.1	62.5	**63.8**
M-22	**DWRB-160 (c)**	52.6	62.5	58.5	67.6	63.8	57.4	**60.4**
M-23	**DWRB-182 (c)**	54.1	59.8	55.6	69.2	63.2	56.1	**59.6**
M-24	**K-647**	58.0	62.3	59.5	63.4	59.4	NA	**60.5**
M-25	**DWRB-184**	58.1	66.4	63.2	67.7	66.2	62.2	**64.0**
M-26	**BCU 2241**	58.1	67.7	61.4	66.6	66.6	56.0	**62.7**
M-27	**BK 306**	58.8	68.8	61.8	66.1	66.5	56.3	**63.1**
M-28	**DWR 49**	59.0	68.0	63.2	69.1	69.0	61.1	**64.9**
M-29	**BK 303**	57.7	67.9	61.8	66.8	64.5	55.0	**62.3**
M-30	**BK 316**	56.8	67.0	66.5	68.9	67.5	60.4	**64.5**
M-31	**BH 1026**	58.9	65.9	62.7	69.0	64.5	58.2	**63.2**
M-32	**BH 1027**	59.1	67.9	64.3	68.5	66.4	58.6	**64.1**
M-33	**DWRB 197**	57.9	67.6	63.8	67.6	64.8	59.4	**63.5**
M-34	**DWRB209**	55.2	66.3	61.4	67.6	64.0	58.1	**62.1**
M-35	**DWRB211**	56.7	65.7	63.7	69.3	66.1	61.4	**63.8**
M-36	**RD3025**	55.0	61.5	60.8	67.6	63.9	60.1	**61.5**
M-37	**PL912**	55.1	66.2	61.0	68.4	63.6	58.1	**62.1**
M-38	**PL919**	55.0	65.8	64.0	68.5	63.7	59.7	**62.8**
M-39	**PL916**	55.9	67.7	60.8	67.2	67.0	64.1	**63.8**
M-40	**RD3024**	57.4	65.4	58.6	67.2	64.3	60.0	**62.1**
M-41	**UPB 1090**	58.2	63.7	61.5	65.9	63.4	62.1	**62.4**
M-42	**DWRB 137 (c)**	54.8	63.5	59.5	65.3	61.4	57.2	**60.3**
M-43	**RD2849 (C)**	60.4	69.7	63.8	68.6	65.4	64.3	**65.4**
M-44	**DWR 37**	56.6	63.4	62.5	63.4	61.4	56.5	**60.6**
M-45	**DWR 38**	52.1	63.7	64.8	65.6	65.2	62.0	**62.2**
M-46	**DWR 39**	NA	62.1	NA	NA	NA	NA	**62.1**
M-47	**DWR-51**	54.0	66.0	61.7	66.3	64.5	59.9	**62.1**
M-48	**Kasota**	50.8	57.8	56.4	63.5	60.2	56.3	**57.5**
Average		**56.3**	**65.0**	**61.0**	**67.1**	**63.7**	**59.2**	

Table 5: 1000 gw of genotypes from different locations

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
M-1	**BCU 2030**	47.9	50.1	42.0	53.5	49.6	51.7	**49.1**
M-2	**BK-1127**	60.6	67.9	64.2	70.3	66.4	62.4	**65.3**
M-3	**BCU-4966**	49.9	54.0	57.0	55.4	56.8	NA	**54.6**
M-4	**ICARDA-1**	38.5	42.0	41.9	52.1	41.1	40.7	**42.7**
M-5	**ICARDA-4**	33.2	39.9	38.5	44.2	37.7	41.9	**39.2**
M-6	**ICARDA-5**	50.3	55.8	58.4	55.9	53.6	50.5	**54.1**
M-7	**ICARDA-8**	28.6	43.5	35.7	45.3	37.5	30.9	**36.9**
M-8	**ICARDA-9**	46.4	41.0	42.7	50.2	41.3	45.2	**44.5**
M-9	**ICARDA-11**	37.2	39.0	32.8	39.8	34.4	38.3	**36.9**
M-10	**ICARDA-12**	44.6	48.2	43.9	54.1	44.2	40.8	**46.0**
M-11	**ICARDA-17**	48.4	46.0	47.2	53.1	42.7	45.6	**47.2**
M-12	**ICARDA-18**	46.4	46.5	41.5	53.0	36.3	45.3	**44.8**
M-13	**ICARDA-19**	41.7	41.0	31.4	46.9	38.1	40.6	**40.0**
M-14	**ICARDA-26**	38.1	39.9	31.7	46.3	34.6	39.1	**38.3**
M-15	**ICARDA-27**	33.8	41.8	35.4	44.0	33.2	38.8	**37.8**
M-16	**ICARDA-28**	42.2	43.2	42.9	46.0	NA	40.7	**43.0**
M-17	**DWRUB 52 (c)**	49.3	48.4	33.8	51.4	45.2	41.1	**44.9**
M-18	**DWRB 101 (c)**	49.0	55.5	49.6	51.3	43.1	45.0	**48.9**
M-19	**DWRB 123 (c)**	52.9	51.5	51.2	57.2	48.4	44.9	**51.0**
M-20	**DWRB 92 (c)**	53.4	60.3	48.0	63.1	57.9	54.0	**56.1**
M-21	**DWRB 91 (c)**	60.9	64.1	49.9	68.8	63.5	51.7	**59.8**
M-22	**DWRB-160 (c)**	56.8	52.4	54.9	69.6	60.4	55.1	**58.2**
M-23	**DWRB-182 (c)**	43.9	44.2	41.1	49.9	39.9	42.8	**43.6**
M-24	**K-647**	58.9	55.3	57.4	63.2	59.4	57.1	**58.6**
M-25	**DWRB-184**	50.0	52.0	47.6	55.5	52.6	48.7	**51.1**
M-26	**BCU 2241**	55.9	61.0	53.4	64.4	58.4	51.2	**57.4**
M-27	**BK 306**	42.0	45.2	40.1	48.1	47.1	41.1	**43.9**
M-28	**DWR 49**	50.1	49.3	47.0	54.5	53.5	47.6	**50.3**
M-29	**BK 303**	55.8	59.0	52.3	61.5	58.4	46.7	**55.6**
M-30	**BK 316**	42.3	50.6	46.8	53.5	46.6	42.2	**47.0**
M-31	**BH 1026**	55.4	51.7	55.2	60.4	56.2	48.9	**54.6**
M-32	**BH 1027**	52.2	52.7	52.2	58.3	55.2	45.7	**52.7**
M-33	**DWRB 197**	46.5	51.6	50.4	54.7	47.5	44.9	**49.3**
M-34	**DWRB209**	48.3	49.6	45.3	58.0	46.8	45.9	**49.0**
M-35	**DWRB211**	43.6	48.9	49.7	56.9	51.6	46.0	**49.4**
M-36	**RD3025**	48.3	48.1	49.0	60.5	50.7	52.0	**51.4**
M-37	**PL912**	50.2	54.0	53.4	58.6	50.0	45.0	**51.8**
M-38	**PL919**	46.1	49.5	46.0	53.0	46.1	43.6	**47.4**
M-39	**PL916**	44.6	48.9	46.3	52.5	48.1	45.8	**47.7**
M-40	**RD3024**	58.3	54.8	52.6	65.5	56.0	51.5	**56.5**
M-41	**UPB 1090**	56.7	49.9	52.2	62.0	57.3	52.0	**55.0**
M-42	**DWRB 137 (c)**	47.5	44.3	46.8	52.9	57.6	41.3	**48.4**
M-43	**RD2849 (C)**	51.8	45.9	48.5	53.4	41.2	44.9	**47.6**
M-44	**DWR 37**	47.7	50.7	52.9	52.8	47.7	50.6	**50.4**
M-45	**DWR 38**	45.1	50.3	51.8	45.2	50.6	46.5	**48.3**
M-46	**DWR 39**	24.6	44.7	NA	NA	44.2	33.4	**36.7**
M-47	**DWR-51**	51.5	55.8	56.1	57.1	54.9	49.7	**54.2**
M-48	**Kasota**	35.1	28.1	25.7	35.0	28.8	26.7	**29.9**
Average		**47.1**	**49.3**	**46.7**	**54.4**	**48.3**	**45.5**	

Table 6: Bold grain percentage of genotypes from different locations

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
M-1	**BCU 2030**	56.8	69.4	58.1	89.5	88.5	84.8	**74.5**
M-2	**BK-1127**	96.3	97.6	95.5	99.1	96.9	89.1	**95.7**
M-3	**BCU-4966**	89.1	96.9	97.0	98.2	97.5	NA	**95.7**
M-4	**ICARDA-1**	63.8	64.7	73.9	96.7	73.4	75.4	**74.7**
M-5	**ICARDA-4**	44.4	74.5	74.1	94.3	62.1	83.1	**72.1**
M-6	**ICARDA-5**	80.9	86.7	94.2	96.2	85.0	89.6	**88.7**
M-7	**ICARDA-8**	35.5	69.2	53.5	88.6	58.0	66.6	**61.9**
M-8	**ICARDA-9**	72.7	62.1	74.5	93.6	62.8	80.9	**74.4**
M-9	**ICARDA-11**	65.7	71.4	67.0	81.8	70.5	74.1	**71.7**
M-10	**ICARDA-12**	77.1	84.8	78.9	98.6	75.6	72.6	**81.3**
M-11	**ICARDA-17**	87.8	62.1	83.1	97.1	77.1	87.4	**82.4**
M-12	**ICARDA-18**	87.7	85.9	75.7	96.3	59.0	89.1	**82.3**
M-13	**ICARDA-19**	55.1	70.1	39.2	91.2	57.5	72.8	**64.3**
M-14	**ICARDA-26**	46.7	53.7	51.7	86.7	47.3	69.3	**59.2**
M-15	**ICARDA-27**	50.8	85.5	31.4	86.1	50.5	72.7	**62.8**
M-16	**ICARDA-28**	87.3	84.3	75.0	94.2	NA	82.0	**84.5**
M-17	**DWRUB 52 (c)**	89.3	81.0	46.5	93.6	75.0	61.0	**74.4**
M-18	**DWRB 101 (c)**	91.9	87.0	87.5	96.6	73.2	77.9	**85.7**
M-19	**DWRB 123 (c)**	92.8	91.2	88.5	96.4	88.0	78.8	**89.3**
M-20	**DWRB 92 (c)**	98.0	98.3	91.3	98.7	98.2	94.7	**96.5**
M-21	**DWRB 91 (c)**	94.8	97.4	75.6	98.4	96.4	70.5	**88.8**
M-22	**DWRB-160 (c)**	94.9	83.8	85.4	98.4	96.1	92.5	**91.9**
M-23	**DWRB-182 (c)**	70.6	74.9	63.2	93.3	67.0	73.3	**73.7**
M-24	**K-647**	93.8	92.8	88.8	95.0	94.4	NA	**93.0**
M-25	**DWRB-184**	94.6	93.5	87.1	97.9	96.3	94.8	**94.0**
M-26	**BCU 2241**	95.4	96.3	87.2	98.7	97.1	96.3	**95.2**
M-27	**BK 306**	93.0	93.0	78.4	97.5	96.1	89.3	**91.2**
M-28	**DWR 49**	83.3	75.2	72.0	94.6	92.2	78.2	**82.6**
M-29	**BK 303**	95.7	97.2	91.8	98.4	95.9	91.6	**95.1**
M-30	**BK 316**	84.9	94.0	93.0	98.2	91.7	84.6	**91.1**
M-31	**BH 1026**	97.5	92.2	96.0	97.5	95.8	89.2	**94.7**
M-32	**BH 1027**	95.9	92.7	96.2	97.5	94.6	82.9	**93.3**
M-33	**DWRB 197**	82.6	94.1	94.0	98.3	87.3	85.1	**90.2**
M-34	**DWRB209**	80.7	90.2	82.9	98.7	84.6	83.2	**86.7**
M-35	**DWRB211**	56.3	61.1	84.0	98.7	85.9	78.0	**77.4**
M-36	**RD3025**	85.8	78.2	88.0	99.0	90.3	90.7	**88.7**
M-37	**PL912**	61.1	56.7	85.1	92.4	80.9	55.8	**72.0**
M-38	**PL919**	63.1	74.2	72.3	91.2	66.7	80.5	**74.7**
M-39	**PL916**	56.6	74.6	66.4	91.0	75.7	72.0	**72.7**
M-40	**RD3024**	94.1	87.9	82.4	97.9	95.3	91.9	**91.6**
M-41	**UPB 1090**	93.4	74.2	81.5	98.3	97.6	90.4	**89.2**
M-42	**DWRB 137 (c)**	88.9	86.1	82.6	96.0	87.6	83.4	**87.4**
M-43	**RD2849 (C)**	84.5	74.8	79.8	95.1	64.2	79.0	**79.6**
M-44	**DWR 37**	86.1	90.9	95.3	96.9	85.8	93.9	**91.5**
M-45	**DWR 38**	92.4	92.9	95.8	92.9	96.7	94.1	**94.1**
M-46	**DWR 39**	73.1	68.4	NA	NA	NA	NA	**70.7**
M-47	**DWR-51**	90.9	91.2	96.9	95.1	92.3	87.7	**92.3**
M-48	**Kasota**	9.5	13.5	17.8	59.0	14.1	21.6	**22.6**
Average		**78.4**	**80.6**	**77.8**	**94.5**	**80.7**	**80.7**	

Table 7: Starch content (%db) of genotypes from different locations#

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
M-1	**BCU 2030**	59.6	60.4	58.3	60.3	61.7	60.3	**60.1**
M-2	**BK-1127**	59.6	59.4	59.6	60.5	62.2	58.9	**60.0**
M-3	**BCU-4966**	60.7	63.3	60.9	61.4	62.7	NA	**61.8**
M-4	**ICARDA-1**	61.0	62.9	61.7	62.3	63.6	60.5	**62.0**
M-5	**ICARDA-4**	59.7	62.3	61.1	61.6	62.0	60.3	**61.2**
M-6	**ICARDA-5**	58.2	62.3	60.3	60.4	61.6	61.4	**60.7**
M-7	**ICARDA-8**	58.6	62.3	60.1	61.0	60.7	60	**60.5**
M-8	**ICARDA-9**	59.9	61.3	60.8	62.4	61.8	62.8	**61.5**
M-9	**ICARDA-11**	59.3	61.8	59.8	61.8	61.3	61	**60.8**
M-10	**ICARDA-12**	60.2	61.4	59.8	60.7	61.8	60.5	**60.7**
M-11	**ICARDA-17**	58.9	61.8	59.9	61.0	61.1	61	**60.6**
M-12	**ICARDA-18**	58.3	61.2	59.5	60.9	58.2	61.2	**59.9**
M-13	**ICARDA-19**	59.8	61.5	58.5	61.6	62.0	61.1	**60.8**
M-14	**ICARDA-26**	59.6	61.8	58.4	59.5	59.6	60.1	**59.8**
M-15	**ICARDA-27**	58.9	60.7	59.1	59.1	60.0	61.1	**59.8**
M-16	**ICARDA-28**	59.6	60.8	59.8	61.2	NA	59.2	**60.1**
M-17	**DWRUB 52 (c)**	61.0	63.2	58.9	63.2	62.7	61.3	**61.7**
M-18	**DWRB 101 (c)**	60.1	62.2	60.9	63.5	62.7	62.5	**62.0**
M-19	**DWRB 123 (c)**	59.8	61.6	61.5	62.2	62.7	61.5	**61.6**
M-20	**DWRB 92 (c)**	59.9	61.6	60.5	64.0	62.4	60.2	**61.4**
M-21	**DWRB 91 (c)**	60.7	63.2	61.0	62.3	60.7	62.5	**61.7**
M-22	**DWRB-160 (c)**	59.5	61.8	60.5	64.0	62.1	60.9	**61.5**
M-23	**DWRB-182 (c)**	60.0	61.4	58.8	62.4	61.6	61.7	**61.0**
M-24	**K-647**	59.6	60.7	60.2	59.7	59.9	60.4	**60.1**
M-25	**DWRB-184**	60.4	61.6	60.3	63.4	61.8	61.1	**61.4**
M-26	**BCU 2241**	59.4	60.0	59.4	61.6	61.3	59.7	**60.2**
M-27	**BK 306**	59.8	62.9	60.8	62.8	62.3	60.4	**61.5**
M-28	**DWR 49**	59.3	61.0	59.8	62.4	61.7	60.9	**60.9**
M-29	**BK 303**	58.7	60.7	59.5	62.2	60.8	59.2	**60.2**
M-30	**BK 316**	59.3	61.9	62.3	62.2	62.1	61.2	**61.5**
M-31	**BH 1026**	59.1	59.2	60.5	62.6	60.3	60.2	**60.3**
M-32	**BH 1027**	58.8	60.7	61.2	61.2	60.7	59.7	**60.4**
M-33	**DWRB 197**	59.5	61.5	61.6	61.6	61.0	61.4	**61.1**
M-34	**DWRB209**	59.4	60.8	62.0	62.7	61.9	62.5	**61.6**
M-35	**DWRB211**	58.5	60.1	61.3	61.2	61.1	60.9	**60.5**
M-36	**RD3025**	58.6	60.4	60.4	61.4	61.5	61.7	**60.7**
M-37	**PL912**	58.7	61.0	60.7	61.4	60.1	61.3	**60.5**
M-38	**PL919**	59.2	60.2	61.7	62.3	60.5	61.4	**60.9**
M-39	**PL916**	60.0	61.4	61.0	60.5	63.0	62.3	**61.4**
M-40	**RD3024**	59.2	61.5	60.9	62.2	63.0	61.2	**61.3**
M-41	**UPB 1090**	59.0	61.0	61.0	61.3	61.2	61.4	**60.8**
M-42	**DWRB 137 (c)**	59.8	62.0	60.7	62.9	60.3	61.6	**61.2**
M-43	**RD2849 (C)**	59.6	62.3	61.0	62.8	60.2	63.3	**61.5**
M-44	**DWR 37**	58.4	60.2	59.6	61.2	59.2	59.8	**59.7**
M-45	**DWR 38**	58.0	58.5	61.0	59.6	59.8	59.7	**59.4**
M-46	**DWR 39**	58.7	59.2	NA	NA	NA	NA	**59.0**
M-47	**DWR-51**	58.2	60.6	60.6	60.1	59.9	58.5	**59.7**
M-48	**Kasota**	59.4	60.2	60.8	61.3	60.5	59.5	**60.3**
Average		**59.4**	**61.2**	**60.4**	**61.7**	**61.3**	**60.9**	

#Predicted values through NIR

Table 8: Details of ICARDA genotypes

S. No.	Cross	Row Type	Source(ICARDA)
ICARDA # 1	G09107 F3 10/030601	2	**PYT-15**
ICARDA # 5	LEGACY/4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI/5/ARUPO/K8755//MORA	2	**PYT-15**
ICARDA # 8	J01042/J01039	2	**PYT-15**
ICARDA # 9	J09049 F3 10/030552	2	**PYT-15**
ICARDA # 11	SEN/5/LEGACY/4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI	6	**PYT-15**
ICARDA # 12	Alanda-01//CAPUL/CABUYA	6	**HIBYT-15-1**
ICARDA # 17	LEGACY/4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI/5/6B89.2027/CHAMICO	6	**6R-SBYT2-15**
ICARDA # 18	LEGACY/4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI/5/LEGACY/CHAMICO	6	**6R-SBYT2-15**
ICARDA # 19	BREA/DL70//3*TOCTE/5/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	6	**6R-SBYT2-15**
ICARDA # 26	BISON 217//ATAH92/GOB	6	**6R-SBYT2-15**
ICARDA # 27	BISON 217//ATAH92/GOB	6	**6R-SBYT2-15**
ICARDA # 28	U.Sask.1766/Api//Cel/3/Weeah/4/Giza121/Pue	6	**6R-SBYT3-15**

ADVANCED BREEDING LINES EVALUATION FOR QUALITY COMPONENTS

Table 1: Details of the advanced breeding lines under evaluation.

Code	Genotype	Pedigree	Row Type
R-10	RMB-10	DWR30/Shebac	2
R-11	RMB -11	DWR30/Shebac	2
R-12	RMB -12	SLOOP VICB 9953/DWRB101	2
R-13	RMB -13	SLOOP VICB 9953/DWRB101	2
R-14	RMB -14	BK306/DWRB101	2
R-15	RMB -15	BK306/DWRB101	2

Table 2: Protein content (%db) of genotypes from different locations#

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
R-10	RMB-10	11.9	15.2	12.9	12.8	13.4	12.3	**13.1**
R-11	RMB -11	12.0	15.5	13.0	12.7	12.6	13.1	**13.2**
R-12	RMB -12	12.1	16.2	13.3	12.9	13.3	14.2	**13.7**
R-13	RMB -13	13.0	13.3	11.9	12.6	12.8	12.0	**12.6**
R-14	RMB -14	12.4	12.9	12.2	12.6	12.7	11.0	**12.3**
R-15	RMB -15	11.5	13.2	11.3	12.1	13.1	10.6	**12.0**
R-16	RMB -16	12.3	15.0	11.9	12.6	13.7	10.1	**12.6**
M-17	**DWRUB52 (c)**	12.0	11.6	14.5	12.0	9.7	12.5	**12.1**
M-18	**DWRB101 (c)**	12.1	11.7	12.8	11.7	9.6	11.1	**11.5**
M-19	**DWRB123 (c)**	12.5	12.1	12.6	11.6	9.4	10.1	**11.4**
M-20	**DWRB92 (c)**	12.5	14.1	13.5	11.9	10.7	12.7	**12.6**
M-21	**DWRB91 (c)**	11.7	12.1	13.4	12.0	10.3	10.3	**11.6**
M-22	**DWRB160 (c)**	11.8	12.2	12.4	11.3	10.9	10.3	**11.5**
M-23	**DWRB182 (c)**	12.2	11.6	14.2	13.2	12.1	10.4	**12.3**
M-2	**BK1127**	13.0	15.1	15.4	15.1	10.4	13.6	**13.8**
M-27	**BK 306**	12.5	13.7	13.8	11.5	11.5	11.4	**12.4**

#Predicted values through NIR

Table 3: Starch content (%db) of genotypes from different locations#

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
R-10	RMB-10	59.6	60.1	60.8	61.2	61.6	60.5	**60.6**
R-11	RMB -11	59.7	59.8	60.9	61.9	61.9	60.4	**60.8**
R-12	RMB -12	58.5	58.5	59.2	61.0	60.4	58.7	**59.4**
R-13	RMB -13	60.0	61.6	61.3	61.8	60.5	62.0	**61.2**
R-14	RMB -14	59.6	61.4	60.6	62.0	61.4	62.6	**61.3**
R-15	RMB -15	60.1	63.0	62.0	62.6	61.5	62.3	**61.9**
R-16	RMB -16	59.9	60.2	60.2	62.2	60.5	62.6	**60.9**
M-17	**DWRUB52 (c)**	61.0	63.2	58.9	63.2	62.7	61.3	**61.7**
M-18	**DWRB 101 (c)**	60.1	62.2	60.9	63.5	62.7	62.5	**62.0**
M-19	**DWRB 123 (c)**	59.8	61.6	61.5	62.2	62.7	61.5	**61.6**
M-20	**DWRB 92 (c)**	59.9	61.6	60.5	64.0	62.4	60.2	**61.4**
M-21	**DWRB 91 (c)**	60.7	63.2	61.0	62.3	60.7	62.5	**61.7**
M-22	**DWRB-160 (c)**	59.5	61.8	60.5	64.0	62.1	60.9	**61.5**
M-23	**DWRB-182 (c)**	60.0	61.4	58.8	62.4	61.6	61.7	**61.0**

#Predicted values through NIR

Table 4: Table 7: Beta glucan content (%db) of few genotypes from different locations

Code	Genotype	Hisar	Karnal	Ludhiana	Durgapura	Pantnagar	Kanpur	Average
R-10	RMB-10	8.9	4.7	6.8	7.1	7.7	7.9	**7.2**
R-11	RMB -11	7.7	5.5	6.9	8.8	7.6	8.3	**7.5**
R-12	RMB -12	8.3	6.1	5.3	8.3	6.1	8.6	**7.1**
R-13	RMB -13	5.4	5.3	5.3	6.8	4.9	4.2	**5.3**
R-14	RMB -14	4.2	5.4	3.6	4.3	4.8	6.0	**4.7**
R-15	RMB -15	5.6	5.1	3.7	5.1	4.8	5.6	**5.0**
R-16	RMB -16	4.9	4.8	4.4	4.8	4.5	4.9	**4.7**
M-17	**DWRUB52 (c)**	5.4	4.2	4.4	5.2	5.1	5.3	**4.9**
M-18	**DWRB101 (c)**	5.4	4.4	5.9	5.0	5.1	5.0	**5.1**
M-23	**DWRB182 (c)**	4.2	4.2	4.4	4.7	4.0	4.0	**4.2**
M-27	**BK 306**	3.8	4.3	4.4	4.7	4.5	4.5	**4.4**
M-33	**DWRB 197**	6.3	6.4	6.6	6.4	6.5	5.9	**6.4**
M-44	**DWR 37**	4.8	4.4	4.8	5.0	5.4	4.8	**4.9**
M-46	**DWR 39**	4.6	2.9	NA	NA	4.4	4.2	**4.0**
	DWRB 160 ©	-	6.9	-	-	-	--	

GERMPLASM NURSERY FOR QUALITY

Table 1: Protein content (%db) of genotypes from different locations#

Code	Germplasm	Hisar	Ludhiana	Pantnagar	Karnal	Durgapura	Kanpur	Average
G-1	**BCU 2860**	11.0	10.1	11.0	12.7	11.5	8.1	**10.7**
G-2	**BCU 2878**	12.9	13.0	13.9	13.9	16.9	12.1	**13.8**
G-3	**BCU 2899**	12.5	NA	14.6	13.2	17.9	13.2	**14.3**
G-4	**BCU 2911***	NA	NA	NA	NA	NA	NA	**NA**
G-5	**BCU 2943****	16.1	13.4	NA	15.9	16.8	12.7	**15.0**
G-6	**BCU 2967**	12.2	10.1	11.6	14.4	14.8	11.0	**12.4**
G-7	**BCU 2971**	14.9	13.1	10.6	17.4	14.8	13.1	**14.0**
G-8	**BCU 2975****	12.7	10.5	NA	14.0	14.3	10.2	**12.3**
G-9	**BCU 2977**	12.2	10.6	12.6	15.2	13.9	NA	**12.9**
G-10	**BCU 2991**	12.0	12.3	11.1	13.9	13.5	10.5	**12.2**
Average		**12.9**	**11.6**	**12.2**	**14.5**	**14.9**	**11.4**	

**Black grain **Hulless #Predicted values through NIR*

Table 2: Starch content (%db) of genotypes from different locations#

Code	Genotype	Hisar	Ludhiana	Pantnagar	Karnal	Durgapura	Kanpur	Average
G-1	**BCU 2860**	58.4	61.3	58.5	59.1	61.6	62.5	**60.2**
G-2	**BCU 2878**	58.0	59.8	58.1	60.1	56.3	59.4	**58.6**
G-3	**BCU 2899**	58.4	NA	58.1	59.5	55.4	58.9	**58.1**
G-4	**BCU 2911***	NA	NA	NA	NA	NA	NA	**NA**
G-5	**BCU 2943****	59.3	63.6	NA	61.2	60.5	63.8	**61.7**
G-6	**BCU 2967**	59.4	62.2	58	61.3	60.7	62.2	**60.6**
G-7	**BCU 2971**	58.8	60.5	59.7	58.4	58.9	60.0	**59.4**
G-8	**BCU 2975****	60.0	65.5	NA	65.0	63.7	68.9	**64.6**
G-9	**BCU 2977**	59.6	62.5	59.2	60.1	61.4	NA	**60.6**
G-10	**BCU 2991**	59.6	60.3	58.6	60.4	59.5	60.8	**59.9**
Average		**59.1**	**62.0**	**58.6**	**60.6**	**59.8**	**62.1**	

**Black grain **Hulless #Predicted values through NIR*

Table 3: Hectoliter weight (Test weight in kg/hl) of genotypes from different locations

Code	Genotype	Hisar	Ludhiana	Pantnagar	Karnal	Durgapura	Kanpur	Average
G-1	**BCU 2860**	46.9	57.4	50.0	53.6	59.7	57.1	54.1
G-2	**BCU 2878**	49.7	59.6	54.6	58.6	56.1	56.7	55.9
G-3	**BCU 2899**	54.5	NA	49.0	56.5	51.2	53.4	52.9
G-4	**BCU 2911***	54.0	64.6	55.1	67.5	62.1	60.5	60.6
G-5	**BCU 2943****	59.8	72.5	NA	76.9	74.5	71.8	71.1
G-6	**BCU 2967**	56.2	61.6	53.7	64.4	63.2	57.5	59.4
G-7	**BCU 2971**	58.2	59.8	54.2	63.6	61.1	ND	59.4
G-8	**BCU 2975****	56.5	68.3	NA	78.9	76.8	76.5	71.4
G-9	**BCU 2977**	55.8	63.2	55.7	64.6	63.7	ND	60.6
G-10	**BCU 2991**	56.1	NA	56.5	63.2	60.9	58.7	59.1
Average		54.8	63.4	53.6	64.8	62.9	61.5	

Table 4: 1000 gw of genotypes from different locations

Code	Genotype	Hisar	Ludhiana	Pantnagar	Karnal	Durgapura	Kanpur	Average
G-1	**BCU 2860**	34.7	38.0	42.8	40.0	42.1	41.2	**39.8**
G-2	**BCU 2878**	39.8	47.8	54.6	46.2	39.3	42.9	**45.1**
G-3	**BCU 2899**	48.3	NA	32.1	37.1	31.8	43.6	**38.6**
G-4	**BCU 2911***	33.7	33.7	41.1	36.1	34.2	34.4	**35.5**
G-5	**BCU 2943****	39.6	35.8	NA	38.4	48.3	39.5	**40.3**
G-6	**BCU 2967**	35.6	31.0	42.5	41.6	39.7	35.8	**37.7**
G-7	**BCU 2971**	44.4	32.2	39.6	44.7	38.2	34.0	**38.9**
G-8	**BCU 2975****	27.4	23.4	NA	28.9	34.1	32.1	**29.2**
G-9	**BCU 2977**	37.6	35.9	42.7	42.2	40.2	30.8	**38.2**
G-10	**BCU 2991**	44.3	39.8	42.9	40.2	42.8	41.3	**41.9**
Average		**38.6**	**35.3**	**42.3**	**39.5**	**39.1**	**37.6**	

**Black grain **Hulless*

Table 5: Bold grain percentage of genotypes from different locations

Code	Genotype	Hisar	Ludhiana	Pantnagar	Karnal	Durgapura	Kanpur	Average
G-1	**BCU 2860**	39.7	63.9	76.1	42.7	58.0	60.5	**56.8**
G-2	**BCU 2878**	57.1	82.1	96.5	72.6	47.5	70.3	**71.0**
G-3	**BCU 2899**	84.4	NA	93.1	53.8	63.9	68.3	**72.7**
G-4	**BCU 2911**	20.0	36.8	61.3	40.1	17.2	29.3	**34.1**
G-5	**BCU 2943**	52.4	48.9	NA	39.7	76.3	53.5	**54.2**
G-6	**BCU 2967**	51.2	48.9	93.8	68.2	67.3	64.3	**65.6**
G-7	**BCU 2971**	65.9	38.7	90.1	73.1	51.9	58.4	**63.0**
G-8	**BCU 2975**	20.8	7.6	NA	8.1	34.0	14.5	**17.0**
G-9	**BCU 2977**	59.9	63.6	92.9	76.7	66.2	NA	**71.8**
G-10	**BCU 2991**	55.3	59.3	81.7	52.0	57.3	50.1	**59.3**
Average		**50.7**	**50.0**	**85.7**	**52.7**	**53.9**	**52.1**	

**Black grain **Hulless*

Table 6: Thin grain percentage of genotypes from different locations

Code	Genotype	Hisar	Ludhiana	Pantnagar	Karnal	Durgapura	Kanpur	Average
G-1	**BCU 2860**	23.7	7.3	3.8	14.0	10.0	8.2	11.2
G-2	**BCU 2878**	13.7	3.4	0.3	5.3	11.2	8.1	7.0
G-3	**BCU 2899**	2.5	NA	3.3	8.8	13.1	7.8	7.1
G-4	**BCU 2911**	36.3	24.1	6.6	21.0	36.9	25.3	25.0
G-5	**BCU 2943**	7.9	14.0	NA	11.3	2.4	5.2	8.1
G-6	**BCU 2967**	2.2	17.5	0.6	6.1	7.4	3.2	6.2
G-7	**BCU 2971**	7.5	22.8	0.9	7.3	14.4	6.2	9.8
G-8	**BCU 2975**	38.8	68.9	NA	48.4	27.5	38.0	44.3
G-9	**BCU 2977**	9.1	9.8	1.1	4.1	8.9	NA	6.6
G-10	**BCU 2991**	9.1	14.5	2.8	10.9	12.1	9.9	9.9
Average		**15.1**	**20.3**	**2.4**	**13.7**	**14.4**	**12.4**	

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-1 Details of grain samples analyzed for quality

Trial	Zone	Locations	Total No. of Samples
AVT (RF)	NHZ	Bajaura, Malan	46
IVT (IR)	NWPZ	Karnal, Hisar, Durgapura, Pantnagar, Ludhiana	120
IVT (IR)	NEPZ	Sabour, Kanpur	48
IVT (IR)	CZ	Gwalior, Vijapur, Udaipur	72
IVT (RF)	NEPZ	Kanpur, Saini Farm, Sabour	36
AVT (SST)	All Zones	Kanpur, Hisar, Fatehpur	45
		TOTAL	**367**

Hectolitre weight (test weight) was measured with ICAR-IIWBR Hectolitre 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 starch content have been listed in table no.2.

Table 2. Entries having highest test weight, thousand grain weight, bold grain percentage and lowest thin grain percentage in respective trials

No.	Trial	Zone	Thousand grain weight	Protein content (% dwb)	Starch content (% dwb)
1	AVT (RF)	NHZ	VLB174, UPB1093, BHS484, HBL870	HBL871, VLB171, VLB170, VLB173, BHS485, BHS483, UPB1091	BHS352 ©, BHS485
2	IVT (IR)	NWPZ	BH 902 ©	KB1946, HUB277	NDB1756, KB1912, PL929, RD3034
3	IVT (IR)	NEPZ	HUB277, RD3033	KB1946, KB1916	PL927, HUB277, PL932, KB1912, DWRB222
4	IVT (IR)	CZ	RD3032, RD3031, HUB277	RD3033, HUB279, PL932, NDB1756, BH1038, RD3034	PL927, KB1946, RD3031
5	IVT (RF)	NEPZ	RD3037, RD3035, RD3036, HUB276	HUB276, RD3037	K603©
6	AVT (SST)	All Zones	KB1911, RD3040, RD3016, KB1822	RD2907©	RD3039, BH1039, RD3041

Annexure -1

AVT-RF-NHZ

Table 1: Thousand grain weight (g), Protein content (% dry weight) and Starch content (% dry weight) of different entries

Genotype	Thousand grain weight			Protein content (% dry weight)			Starch content (% dry weight)		
	Bajaura	Malan	Average	Bajaura	Malan	Average	Bajaura	Malan	Average
BHS483	35.1	32.6	**33.9**	9.5	10.4	**10.0**	62.4	64.6	**63.5**
BHS484	43.8	43.9	**43.8**	10.9	8.1	**9.5**	60.1	62.5	**61.3**
BHS485	32.2	31.0	**31.6**	9.6	11.0	**10.3**	64.4	64.2	**64.3**
BHS486	37.5	35.0	**36.3**	9.8	9.1	**9.5**	60.3	59.8	**60.1**
BHS487	42.8	40.5	**41.7**	11.1	8.2	**9.7**	60.1	60.7	**60.4**
HBL869	34.8	36.3	**35.5**	9.0	8.4	**8.7**	60.7	60.9	**60.8**
HBL870	42.4	44.4	**43.4**	8.8	8.7	**8.8**	60.3	61.7	**61.0**
HBL871	40.6	39.0	**39.8**	10.9	11.3	**11.1**	59.2	59.9	**59.6**
HBL872	43.7	40.6	**42.1**	9.7	9.1	**9.4**	59.1	60.5	**59.8**
HBL873	36.4	35.2	**35.8**	9.2	8.4	**8.8**	60.6	61.3	**61.0**
UPB1091	40.4	37.1	**38.7**	11.4	8.1	**9.8**	60.2	60.6	**60.4**
UPB1092	40.7	34.8	**37.8**	9.7	9.1	**9.4**	60.5	59.4	**60.0**
UPB1093	44.8	42.9	**43.9**	8.8	8.4	**8.6**	60.2	60.8	**60.5**
VLB170	33.2	36.6	**34.9**	10.4	10.6	**10.5**	61.8	63.8	**62.8**
VLB171	41.3	40.4	**40.9**	11.7	9.5	**10.6**	59.9	60.9	**60.4**
VLB172	37.1	38.0	**37.5**	8.7	9.5	**9.1**	63.3	63.8	**63.6**
VLB173	35.5	35.7	**35.6**	10.9	9.9	**10.4**	59.0	60.1	**59.6**
VLB174	47.9	48.4	**48.2**	9.6	9.7	**9.7**	60.0	60.8	**60.4**
BHS352 ©	33.0	35.3	**34.2**	9.8	9.5	**9.7**	64.2	64.9	**64.6**
BHS380 ©	36.0	39.8	**37.9**	8.9	10.3	**9.6**	60.1	61.7	**60.9**
BHS400 ©	44.2	41.9	**43.1**	10.0	8.6	**9.3**	59.7	61.1	**60.4**
HBL113 ©	38.6	39.4	**39.0**	7.9	10.1	**9.0**	62.3	62.2	**62.3**
VLB118 ©	43.3	42.7	**43.0**	9.6	8.9	**9.3**	60.4	60.5	**60.5**
Mean	**39.4**	**38.8**		**9.8**	**9.3**		**60.8**	**61.6**	

IVT-IR-FB

North Western Plain Zone

Table 1: Thousand grain weight (g) of different entries

Genotype	Karnal	Ludhiana	Durgapura	Pantnagar	Hisar	Average	Range
BH1037	43.0	33.6	50.8	38.5	37.2	**40.6**	**33.6-50.8**
BH1038	42.2	30.5	44.0	44.6	37.3	**39.7**	**30.5-44.6**
DWRB222	41.0	38.6	39.2	41.7	37.1	**39.5**	**37.1-41.7**
HUB277	45.2	34.4	47.7	44.1	40.5	**42.4**	**34.4-47.1**
HUB279	43.8	36.3	47.3	44.6	38.7	**42.1**	**36.3-47.3**
KB1912	40.6	30.3	45.7	42.6	39.5	**39.8**	**30.3-45.7**
KB1916	44.8	40.1	43.3	46.1	36.6	**42.2**	**36.6-46.1**
KB1946	43.8	38.9	36.9	50.0	37.0	**41.3**	**36.9-50.0**
NDB1756	47.9	36.9	48.2	46.3	41.3	**44.1**	**36.9-48.2**
PL927	43.0	36.2	50.3	46.9	39.2	**43.1**	**36.2-50.3**
PL928	45.6	33.2	49.3	49.6	42.1	**44.0**	**33.2-49.6**
PL929	35.0	33.1	40.4	38.0	32.7	**35.8**	**33.1-38.0**
PL932	39.6	35.2	42.6	41.7	37.6	**39.3**	**35.2-42.6**
RD3031	41.5	32.9	48.0	40.1	41.9	**40.9**	**32.9-48.0**
RD3032	45.3	27.8	43.2	45.7	42.2	**40.8**	**27.8-45.7**
RD3033	34.4	32.1	45.9	44.1	34.8	**38.3**	**32.1-45.9**
RD3034	45.1	36.3	46.4	43.4	40.0	**42.2**	**36.3-46.4**
UPB1095	37.5	28.4	44.6	35.1	35.3	**36.2**	**28.4-44.6**
UPB1096	33.5	26.8	37.9	36.0	36.0	**34.0**	**26.8-37.9**
BH902 ©	45.9	35.5	52.7	44.7	42.2	**44.2**	**35.5-52.7**
BH946 ©	41.3	32.7	48.2	41.4	37.0	**40.1**	**32.7-48.2**
DWRB137©	44.9	32.8	50.7	46.9	39.0	**42.9**	**32.8-50.7**
HUB113©	42.5	32.3	46.5	42.4	35.8	**39.9**	**32.3-46.5**
RD2899©	45.6	34.3	41.9	39.1	39.8	**40.1**	**34.3-45.6**
Mean	**42.2**	**33.7**	**45.5**	**43.1**	**38.4**		

Table 2: Crude protein content (% dry weight) of different entries

Genotype	Karnal	Ludhiana	Durgapura	Pantnagar	Hisar	Average	Range
BH1037	10.3	10.4	11.5	10.2	13.9	**11.3**	**10.2-13.9**
BH1038	9.5	14.1	11.3	10.5	12.3	**11.5**	**9.5-14.1**
DWRB222	9.8	13.7	10.7	9.8	10.6	**10.9**	**9.8-13.7**
HUB277	9.4	12.9	11.5	11.0	13.4	**11.6**	**9.4-13.4**
HUB279	11.7	12.6	10.9	9.9	10.9	**11.2**	**9.9-12.6**
KB1912	9.0	10.3	11.1	8.8	9.0	**9.6**	**8.8-11.1**
KB1916	10.9	12.2	12.5	9.0	12.5	**11.4**	**9.0-12.5**
KB1946	13.6	15.8	14.2	12.2	13.9	**13.9**	**12.2-15.8**
NDB1756	9.1	10.4	10.2	9.2	10.0	**9.8**	**9.1-10.4**
PL927	10.2	10.0	11.1	9.3	10.2	**10.2**	**9.3-11.1**
PL928	8.9	10.7	10.3	10.0	8.9	**9.8**	**8.9-10.7**
PL929	11.1	10.2	10.9	9.6	10.8	**10.5**	**9.6-11.1**
PL932	9.3	11.4	11.6	9.4	14.8	**11.3**	**9.3-14.8**
RD3031	10.0	15.0	10.7	9.6	11.1	**11.4**	**10.0-15.0**
RD3032	10.2	14.9	10.8	10.4	9.1	**11.1**	**9.1-14.9**
RD3033	9.8	12.4	9.2	8.6	10.3	**10.3**	**9.2-12.4**
RD3034	10.5	12.9	9.9	9.7	12.1	**11.0**	**9.7-12.9**
UPB1095	10.8	10.1	11.6	10.4	10.7	**10.7**	**10.1-11.6**
UPB1096	10.8	9.9	11.6	10.3	8.9	**10.3**	**8.9-11.6**
BH902 ©	9.3	12.9	9.3	8.7	9.2	**9.9**	**8.7-12.9**
BH946 ©	10.6	13.7	10.4	9.2	14.1	**11.6**	**9.2-14.1**
DWRB137©	10.0	10.4	10.6	9.3	10.0	**10.1**	**9.3-10.6**
HUB113©	10.0	10.4	9.9	8.9	9.6	**9.8**	**8.9-10.4**
RD2899©	10.5	10.7	11.1	9.0	10.1	**10.3**	**9.0-10.7**
Mean	**10.2**	**12.0**	**11.0**	**9.7**	**11.1**		

Table 3: Starch content (% dry weight) of different entries

Genotype	Karnal	Ludhiana	Durgapura	Pantnagar	Hisar	Average	Range
BH1037	62.7	58.8	65.1	60.3	59.0	**61.2**	**58.8-65.1**
BH1038	62.9	58.8	63.0	60.7	59.9	**61.1**	**58.8-63.0**
DWRB222	63.2	60.0	64.1	61.2	60.7	**61.8**	**60.0-64.1**
HUB277	63.2	59.4	62.3	60.3	59.3	**60.9**	**59.3-63.2**
HUB279	61.7	59.0	63.5	61.6	60.8	**61.3**	**59.0-63.5**
KB1912	63.8	58.6	65.7	62.3	61.7	**62.4**	**58.6-63.8**
KB1916	61.8	60.4	62.6	61.5	60.2	**61.3**	**60.2-62.6**
KB1946	61.1	59.2	61.6	61.2	60.3	**60.7**	**59.2-61.6**
NDB1756	63.6	60.4	65.1	62.5	61.6	**62.6**	**60.4-65.1**
PL927	61.5	60.8	64.7	62.0	61.7	**62.1**	**60.8-64.7**
PL928	63.6	59.1	63.8	61.8	61.2	**61.9**	**59.1-63.8**
PL929	63.0	59.7	65.0	62.3	61.6	**62.3**	**61.6-65**
PL932	62.1	59.6	63.5	61.6	58.6	**61.1**	**58.6-63.5**
RD3031	60.7	57.6	61.7	60.3	59.7	**60.0**	**59.7-60.7**
RD3032	61.4	57.4	62.3	60.7	61.3	**60.6**	**57.4-61.4**
RD3033	61.3	58.2	63.2	61.3	59.1	**60.6**	**58.2-63.2**
RD3034	62.9	59.8	65.7	62.3	60.7	**62.3**	**59.8-65.7**
UPB1095	62.0	57.5	63.7	59.8	60.6	**60.7**	**57.5-63.7**
UPB1096	61.5	57.1	62.8	59.9	60.5	**60.4**	**57.1-62.8**
BH902 ©	62.7	59.4	65.7	61.9	61.4	**62.2**	**59.4-65.7**
BH946 ©	62.5	59.0	64.2	61.8	58.7	**61.2**	**58.7-64.2**
DWRB137©	62.1	59.8	64.1	62.0	61.5	**61.9**	**59.8-62.1**
HUB113©	61.8	60.1	65.9	61.4	60.1	**61.9**	**60.1-65.9**
RD2899©	63.1	59.1	62.6	60.9	61.0	**61.3**	**59.1-63.1**
Mean	**62.3**	**59.1**	**63.8**	**61.3**	**60.5**		

Table 4: Bold (> 2.5 mm) and thin (<2.2 mm) grain percentage in different entries

Genotype	Karnal	Ludhiana	Durgapura	Average	Karnal	Ludhiana	Durgapura	Average
BH1037	91.3	66.9	96.1	**84.8**	1.2	9.3	0.6	**3.7**
BH1038	92.2	61.0	87.3	**80.2**	1.0	13.4	3.3	**5.9**
DWRB222	92.6	72.2	82.5	**82.4**	0.9	7.6	3.9	**4.1**
HUB277	85.3	62.1	89.5	**79.0**	2.3	11.2	1.8	**5.1**
HUB279	80.1	65.6	88.6	**78.1**	4.8	11.0	2.1	**6.0**
KB1912	60.8	40.9	78.0	**59.9**	6.7	27.2	5.3	**13.1**
KB1916	82.7	77.1	75.4	**78.4**	3.6	5.8	7.6	**5.7**
KB1946	89.2	85.2	64.8	**79.7**	1.3	3.4	10.4	**5.0**
NDB1756	91.2	70.2	90.2	**83.9**	1.4	3.4	2.5	**2.4**
PL927	86.7	68.8	94.3	**83.2**	2.6	9.8	1.5	**4.6**
PL928	95.7	70.5	95.8	**87.3**	1.0	8.1	1.1	**3.4**
PL929	71.1	65.4	83.3	**73.3**	5.0	9.9	3.4	**6.1**
PL932	71.9	56.5	76.3	**68.2**	2.8	15.8	3.4	**7.3**
RD3031	75.2	56.7	93.4	**75.1**	3.7	14.2	0.7	**6.2**
RD3032	90.4	43.4	82.5	**72.1**	2.1	26.6	6.7	**11.8**
RD3033	60.4	59.8	95.2	**71.8**	7.1	10.6	0.6	**6.1**
RD3034	78.9	55.4	82.4	**72.2**	2.7	13.5	2.7	**6.3**
UPB1095	76.9	51.1	85.0	**71.0**	2.3	20.3	4.8	**9.1**
UPB1096	36.6	29.6	51.0	**39.1**	15.6	35.2	15.4	**22.1**
BH902 ©	90.0	65.6	95.8	**83.8**	2.0	11.1	1.0	**4.7**
BH946 ©	89.7	65.8	95.6	**83.7**	1.2	9.7	1.2	**4.0**
DWRB137©	92.3	57.2	95.3	**81.6**	1.1	14.0	0.7	**5.3**
HUB113©	81.8	56.6	89.4	**76.0**	3.1	14.9	2.1	**6.7**
RD2899©	90.8	61.5	76.6	**76.3**	1.7	13.6	5.5	**6.9**
Mean	**81.4**	**61.0**	**85.2**		**3.2**	**13.3**	**3.7**	

Table 5: Hectoliter weight (kg/hl) in different entries

Genotype	Karnal	Ludhiana	Durgapura	Average
BH1037	60.2	54.1	64.9	**59.7**
BH1038	60.5	53.4	63.6	**59.2**
DWRB222	64.2	58.2	65.4	**62.6**
HUB277	62.8	51.7	65.8	**60.1**
HUB279	63.1	52.7	66.0	**60.6**
KB1912	61.2	51.8	66.6	**59.9**
KB1916	58.7	57.3	62.3	**59.4**
KB1946	61.5	60.5	60.7	**60.9**
NDB1756	62.5	56.9	66.2	**61.9**
PL927	57.5	56.7	65.3	**59.8**
PL928	62.6	54.0	65.4	**60.6**
PL929	60.4	54.7	66.5	**60.5**
PL932	59.3	54.6	63.8	**59.2**
RD3031	56.1	47.8	61.3	**55.1**
RD3032	60.3	47.9	61.4	**56.5**
RD3033	54.1	46.4	58.5	**53.0**
RD3034	65.3	58.3	67.9	**63.8**
UPB1095	61.6	53.3	66.0	**60.3**
UPB1096	57.6	47.6	61.3	**55.5**
BH902 ©	62.0	54.6	66.7	**61.1**
BH946 ©	60.4	54.6	66.3	**60.4**
DWRB137©	62.6	55.1	66.0	**61.2**
HUB113©	61.6	55.9	66.3	**61.3**
RD2899©	63.1	55.4	63.0	**60.5**
Mean	**60.8**	**53.9**	**64.5**	

IVT-IR-FB North Eastern Plain Zone

Table 1: Thousand grain weight (g), protein and starch contents of different entries

Genotype	1000 gw			Protein (%)			Starch (%)		
	Sabour	Kanpur	Average	Sabour	Kanpur	Average	Sabour	Kanpur	Average
BH1037	31.1	38.7	**34.9**	11.7	10.9	**11.3**	59.5	60.8	**60.2**
BH1038	36.9	35.9	**36.4**	11.0	9.7	**10.4**	59.4	60.5	**60.0**
DWRB222	36.6	34.2	**35.4**	9.9	9.6	**9.8**	60.5	60.5	**60.5**
HUB277	38.8	40.7	**39.8**	11.7	10.4	**11.1**	59.3	60.3	**59.8**
HUB279	36.5	38.4	**37.4**	11.3	9.5	**10.4**	59.9	61.5	**60.7**
KB1912	30.6	35.7	**33.1**	11.1	8.6	**9.9**	59.7	62.5	**61.1**
KB1916	30.0	40.0	**35.0**	12.9	10.5	**11.7**	57.4	60.9	**59.2**
KB1946	38.1	37.0	**37.6**	16.6	11.3	**14.0**	57.6	61.0	**59.3**
NDB1756	34.6	38.2	**36.4**	10.6	8.8	**9.7**	60.0	61.5	**60.8**
PL927	31.5	38.5	**35.0**	11.9	10.6	**11.3**	59.2	60.8	**60.0**
PL928	30.3	38.3	**34.3**	11.2	9.8	**10.5**	59.7	60.4	**60.1**
PL929	38.4	36.4	**37.4**	12.6	9.9	**11.3**	59.9	60.9	**60.4**
PL932	26.7	38.7	**32.7**	12.7	9.9	**11.3**	59.4	60.1	**59.8**
RD3031	24.9	42.6	**33.8**	11.6	10.6	**11.1**	58.6	60.1	**59.4**
RD3032	34.0	40.1	**37.0**	10.2	9.6	**9.9**	59.2	59.9	**59.6**
RD3033	36.7	41.6	**39.2**	12.7	8.8	**10.8**	59.4	60.7	**60.1**
RD3034	34.9	37.0	**36.0**	10.3	9.9	**10.1**	60.2	60.6	**60.4**
UPB1095	34.2	34.1	**34.1**	9.8	9.2	**9.5**	59.8	61.2	**60.5**
UPB1096	25.8	34.4	**30.1**	11.9	9.5	**10.7**	58.2	60.4	**59.3**
BH902 ©	27.4	36.9	**32.2**	13.1	10.0	**11.6**	58.3	60.2	**59.3**
BH946 ©	27.6	36.9	**32.3**	11.6	9.4	**10.5**	58.8	60.9	**59.9**
DWRB137©	37.1	40.0	**38.6**	11.1	9.6	**10.4**	60.2	61.0	**60.6**
HUB113©	31.6	37.5	**34.5**	10.8	8.9	**9.9**	59.5	61.6	**60.6**
RD2899©	33.6	36.8	**35.2**	11.6	9.3	**10.5**	59.2	61.2	**60.2**
Mean	**32.8**	**37.9**		**11.7**	**9.8**		**59.3**	**60.8**	

IVT-IR-FB Central Zone

Table 1: Thousand grain weight (g), protein and starch contents of different entries

Genotype	1000 gw				Protein (%)				Starch (%)			
	Gwalior	Vijapur	Udaipur	Average	Gwalior	Vijapur	Udaipur	Average	Gwalior	Vijapur	Udaipur	Average
BH1037	36.5	42.1	41.6	**40.1**	13.1	13.8	12.7	**13.2**	58.3	59.5	64.3	**60.7**
BH1038	35.1	46.3	43.9	**41.8**	13.7	14.3	13.0	**13.7**	57.8	60.3	63.5	**60.5**
DWRB222	36.7	41.4	38.6	**38.9**	12.4	13.4	12.2	**12.7**	58.8	60.0	62.7	**60.5**
HUB277	42.8	45.6	40.5	**43.0**	14.0	15.9	11.9	**13.9**	58.5	58.8	63.0	**60.1**
HUB279	39.1	45.6	37.3	**40.6**	14.0	15.2	14.2	**14.5**	58.5	59.0	62.4	**60.0**
KB1912	31.7	44.2	44.9	**40.3**	14.6	13.8	12.2	**13.5**	58.0	59.6	64.5	**60.7**
KB1916	29.1	36.2	NA	**32.6**	12.6	14.3	NT	**13.5**	58.6	59.0	NA	**58.8**
KB1946	30.0	38.9	NA	**34.4**	12.3	16.9	NT	**14.6**	64.7	58.0	NA	**61.4**
NDB1756	36.1	39.0	42.0	**39.0**	12.5	14.4	12.6	**13.2**	58.7	59.8	63.6	**60.7**
PL927	33.8	40.5	45.9	**40.1**	13.5	14.4	13.6	**13.8**	58.2	59.8	64.4	**60.8**
PL928	41.7	44.3	37.9	**41.3**	12.7	13.8	11.7	**12.7**	58.9	59.6	63.8	**60.8**
PL929	37.5	41.0	34.5	**37.6**	14.7	16.4	12.1	**14.4**	58.7	59.1	63.4	**60.4**
PL932	33.4	39.2	37.9	**36.8**	14.0	15.6	13.9	**14.5**	58.1	59.0	61.3	**59.5**
RD3031	42.8	42.9	45.1	**43.6**	12.7	13.9	12.9	**13.2**	58.1	58.2	61.6	**59.3**
RD3032	42.3	48.0	45.2	**45.2**	12.1	13.3	12.8	**12.7**	59.3	60.6	61.8	**60.6**
RD3033	36.0	38.4	37.2	**37.2**	13.9	14.6	12.7	**13.7**	57.1	58.4	62.3	**59.3**
RD3034	33.4	46.4	38.2	**39.3**	17.5	14.6	13.0	**15.0**	56.5	60.3	63.6	**60.1**
UPB1095	25.8	34.8	42.6	**34.4**	12.5	16.9	11.5	**13.6**	57.9	57.4	62.6	**59.3**
UPB1096	39.8	30.0	35.6	**35.1**	12.6	17.8	13.4	**14.6**	58.2	56.8	63.8	**59.6**
BH902 ©	39.1	40.1	43.9	**41.0**	12.4	13.2	11.2	**12.3**	58.2	60.5	64.2	**61.0**
BH946 ©	37.2	40.8	36.0	**38.0**	12.9	13.9	11.8	**12.9**	58.4	59.9	63.0	**60.4**
DWRB137©	40.5	43.7	44.5	**42.9**	12.2	14.0	12.1	**12.8**	59.4	59.4	63.4	**60.7**
HUB113©	36.4	32.4	40.7	**36.5**	13.1	13.2	12.4	**12.9**	58.3	58.9	62.9	**60.0**
RD2899©	31.0	37.9	42.5	**37.1**	14.3	13.9	12.3	**13.5**	57.3	59.5	62.3	**59.7**
Mean	**36.1**	**40.8**	**40.8**		**13.3**	**14.6**	**12.6**		**58.5**	**59.2**	**63.1**	

AVT-IR-FB North Western Plain Zone

Table 1: Thousand grain weight (g) of different entries

Genotype	Karnal	Ludhiana	Durgapura	Bathinda	Pantnagar	Hisar	Shriganganagar	Average	Range
BH1029	34.7	27.4	49.5	38.9	37.7	30.3	37.8	**36.6**	**27.4-49.5**
HUB272	42.5	28.0	44.5	40.6	40.8	33.6	34.8	**37.8**	**28.0-44.5**
K1822	41.3	30.9	47.4	38.4	39.0	37.0	40.4	**39.2**	**30.9-47.4**
PL911	36.4	29.0	57.7	32.4	37.7	30.1	40.8	**37.7**	**29.0-57.7**
PL917	48.3	38.4	49.1	38.0	43.4	41.1	39.1	**42.5**	**38-49.1**
RD3012	39.8	33.7	44.4	36.4	37.8	31.3	41.2	**37.8**	**31.3-44.4**
BH902 ©	50.0	38.7	53.1	44.1	46.5	36.4	40.4	**44.2**	**36.4-53.1**
BH946 ©	40.0	33.5	51.1	41.4	41.5	37.7	39.5	**40.7**	**33.5-51.1**
DWRB137 ©	46.9	29.9	52.3	45.2	38.2	41.5	33.8	**41.1**	**29.9-52.3**
HUB113 ©	43.8	26.0	48.2	40.8	39.8	36.0	35.4	**38.6**	**26.0-48.2**
Mean	**42.4**	**31.6**	**49.7**	**39.6**	**40.2**	**35.5**	**38.3**		

Table 2: Crude protein content (% dry weight) of different entries

Genotype	Karnal	Ludhiana	Durgapura	Bathinda	Pantnagar	Hisar	Shriganganagar	Average	Range
BH1029	10.5	14.3	9.4	11.5	10.0	9.8	12.0	**11.1**	**9.4-14.3**
HUB272	10.1	13.5	8.7	12.1	10.0	10.6	11.3	**10.9**	**8.7-13.5**
K1822	11.2	12.9	10.4	12.8	9.5	11.5	12.2	**11.5**	**9.5-12.9**
PL911	10.1	13.3	9.7	12.8	10.1	9.9	11.4	**11.0**	**9.7-13.3**
PL917	9.3	12.1	9.1	12.5	8.6	10.1	11.7	**10.5**	**8.6-12.5**
RD3012	8.7	11.2	9.7	12.3	9.1	11.2	12.7	**10.7**	**8.7-12.7**
BH902 ©	9.6	11.8	9.4	10.0	8.6	11.3	12.0	**10.4**	**8.6-12.0**
BH946 ©	10.5	11.6	10.0	11.4	9.4	11.1	11.7	**10.8**	**9.4-11.7**
DWRB137 ©	9.9	13.7	9.7	11.9	8.4	10.8	12.4	**11.0**	**8.4-13.7**
HUB113 ©	9.6	13.8	9.2	10.5	8.7	10.9	11.9	**10.7**	**8.7-13.8**
Mean	**10.0**	**12.8**	**9.5**	**11.8**	**9.2**	**9.7**	**11.9**		

Table 3: Starch content (% dry weight) of different entries

Genotype	Karnal	Ludhiana	Durgapura	Bathinda	Pantnagar	Hisar	Shriganganagar	Average	Range
BH1029	60.9	57.5	61.1	60.5	60.1	61.6	60.0	**60.2**	**57.5-61.6**
HUB272	62.3	58.8	61.3	60.5	60.8	62.5	60.8	**61.0**	**58.8-62.3**
K1822	61.2	58.9	59.9	59.7	59.8	61.1	60.5	**60.2**	**58.9-61.2**
PL911	62.3	59.0	61.6	60.4	61.3	62.7	61.0	**61.2**	**59.0-62.7**
PL917	63.5	60.7	62.4	60.0	61.9	63.4	60.6	**61.8**	**60.0-63.5**
RD3012	65.0	61.7	62.4	61.3	62.3	62.7	59.6	**62.1**	**59.6-65.0**
BH902 ©	62.8	60.5	61.4	61.4	61.4	62.0	60.8	**61.5**	**60.5-62.8**
BH946 ©	60.6	59.5	61.5	60.8	60.4	61.9	61.0	**60.8**	**59.5-61.9**
DWRB137 ©	62.4	58.2	61.2	60.0	60.9	62.2	60.7	**60.8**	**58.2-62.4**
HUB113 ©	61.9	58.3	61.6	61.3	61.4	62.2	61.2	**61.1**	**58.3-61.9**
Mean	**62.3**	**59.3**	**61.4**	**60.6**	**61.0**	**62.2**	**60.6**		

AVT-IR-FB North Eastern Plain Zone

Table 1: Thousand grain weight (g), protein & starch of different entries

Genotype	Thousand grain weight			Protein (% dwb)			Starch (%dwb)		
	Sabour	Kanpur	Average	Sabour	Kanpur	Average	Sabour	Kanpur	Average
BH1029	23.4	34.7	**29.0**	14.0	10.8	**12.4**	57.3	63.7	**60.5**
HUB272	28.6	34.9	**31.7**	12.0	10.7	**11.4**	58.2	62.7	**60.5**
K1822	26.1	38.2	**32.1**	13.7	11.5	**12.6**	57.6	62.7	**60.2**
PL911	21.7	33.2	**27.5**	12.1	10.8	**11.5**	58.3	63.5	**60.9**
PL917	31.8	38.1	**35.0**	10.5	10.6	**10.6**	60.0	63.9	**62.0**
RD3012	27.3	41.1	**34.2**	11.7	10.3	**11.0**	59.5	65.5	**62.5**
BH902 ©	24.8	41.0	**32.9**	13.8	10.8	**12.3**	57.9	63.2	**60.6**
BH946 ©	27.4	35.7	**31.5**	11.1	10.8	**11.0**	58.8	62.7	**60.8**
DWRB137 ©	31.8	39.8	**35.8**	11.5	9.7	**10.6**	59.1	63.0	**61.1**
HUB113 ©	25.8	40.0	**32.9**	11.6	11.1	**11.4**	58.3	62.1	**60.2**
	26.9	**37.7**		**12.2**	**10.7**		**58.5**	**63.3**	

AVT-IR-FB Central Zone

Table 1: Thousand grain weight (g), protein & starch of different entries

Genotype	Thousand grain weight				Protein (% dwb)				Starch (%dwb)			
	Gwalior	Udaipur	Vijapur	Average	Gwalior	Udaipur	Vijapur	Average	Gwalior	Udaipur	Vijapur	Average
K1822	31.0	NA	NA	31.0	11.5	NA	NA	11.5	59.0	NA	NA	59.0
RD3013	43.4	36.4	41.5	40.4	12.3	13.1	13.7	13.0	59.3	62.2	59.8	60.4
BH959 ©	47.8	38.2	41.0	42.4	10.9	10.4	13.4	11.6	60.2	62.2	58.7	60.4
DWRB137©	37.1	44.8	46.7	42.8	12.7	11.8	13.8	12.8	58.7	63.0	59.9	60.5
RD2899 ©	35.0	46.3	42.2	41.2	11.8	11.4	13.3	12.2	59.8	63.9	59.6	61.1
Mean	38.9	41.4	42.8		11.8	11.7	13.6		59.4	62.8	59.5	

IVT-RF-NEPZ

Table 1: Thousand grain weight (g), protein & starch of different entries

Genotype	Thousand grain weight				Protein (% dwb)				Starch (%dwb)			
	Kanpur	Saini Farm	Sabour	Average	Kanpur	Saini Farm	Sabour	Average	Kanpur	Saini Farm	Sabour	Average
HUB275	43.7	34.8	37.1	38.5	9.9	13.8	9.8	11.2	61.7	57.8	60.1	59.9
HUB276	48.0	37.5	40.4	42.0	9.0	11.2	9.0	9.7	60.5	60.7	60.2	60.5
KB1940	40.9	40.0	31.7	37.6	8.7	10.6	10.1	9.8	62.7	60.5	59.4	60.9
KB1944	42.6	42.3	35.0	39.9	10.2	12.9	11.4	11.5	60.2	58.3	58.9	59.1
KB1947	34.7	34.2	34.3	34.4	8.7	11.1	12.6	10.8	61.3	61.0	58.2	60.2
NDB1754	41.3	30.3	39.0	36.9	8.9	10.6	12.0	10.5	60.6	59.2	59.0	59.6
RD3035	54.0	37.0	48.1	46.3	9.7	11.3	9.3	10.1	60.4	58.9	59.8	59.7
RD3036	49.3	39.8	47.2	45.4	8.2	11.5	9.3	9.7	61.3	58.4	60.2	60.0
RD3037	54.5	42.0	NA	48.2	8.6	10.6	NA	9.6	61.9	59.7	NA	60.8
RD3038	44.5	34.1	25.5	34.7	9.3	10.8	11.9	10.7	60.8	58.5	59.3	59.5
K603©	45.3	38.4	40.2	41.3	8.6	9.0	9.7	9.1	60.5	59.7	59.7	60.0
LAKHAN©	45.3	35.8	36.3	39.1	8.6	11.5	8.9	9.7	60.6	58.9	59.9	59.8
Mean	45.3	37.2	37.7		9.0	11.2	10.4		61.0	59.3	59.5	

AVT-SST

Table 1: Thousand grain weight (g), protein & starch of different entries

Genotype	Thousand grain weight				Protein (% dwb)				Starch (% dwb)			
	Kanpur	Fatehpur	Hisar	Average	Kanpur	Fatehpur	Hisar	Average	Kanpur	Fatehpur	Hisar	Average
BH1039	38.8	16.6	34.5	**29.9**	10.7	14.2	11.1	**12.0**	58.4	55.7	60.6	**58.2**
DWRB224	37.4	24.8	42.8	**35.0**	10.8	14.4	12.1	**12.4**	58.4	56.1	61.6	**58.7**
HUB280	38.9	31.1	36.5	**35.5**	12.3	16.7	14.3	**14.4**	58.4	55.8	60.0	**58.1**
KB1822	37.3	NA	35.5	**36.4**	11.2	NA	12.0	**11.6**	58.3	NA	59.6	**59.0**
KB1909	29.0	NA	34.0	**31.5**	14.7	NA	16.0	**15.4**	56.8	NA	58.1	**57.5**
KB1911	41.2	NA	41.2	**41.2**	10.9	NA	12.9	**11.9**	58.3	NA	61.0	**59.7**
NDB1757	33.3	31.7	35.1	**33.4**	10.7	15.1	13.1	**13.0**	57.9	56.9	59.7	**58.2**
RD3016	41.9	38.9	37.5	**39.4**	9.8	13.3	10.0	**11.0**	58.6	57.4	61.4	**59.1**
RD3039	34.4	32.2	36.5	**34.4**	12.2	16.2	12.5	**13.6**	58.3	56.1	59.7	**58.0**
RD3040	48.2	27.8	44.7	**40.2**	11.4	17.9	12.6	**14.0**	59.0	54.5	59.3	**57.6**
RD3041	36.7	34.5	34.6	**35.2**	11.7	15.1	12.3	**13.0**	58.9	57.4	60.3	**58.9**
RD3042	38.0	23.5	41.2	**34.2**	10.4	14.4	10.9	**11.9**	58.9	55.5	61.2	**58.5**
NDB1173©	38.0	36.1	34.0	**36.0**	10.9	15.1	13.6	**13.2**	59.0	57.3	59.8	**58.7**
RD2794©	34.1	29.7	36.1	**33.3**	10.1	15.2	11.5	**12.3**	59.2	55.9	60.9	**58.7**
RD2907©	39.5	31.2	38.5	**36.4**	11.5	14.4	11.4	**12.4**	58.7	56.6	60.5	**58.6**
Mean	**37.8**	**29.8**	**37.5**		**11.3**	**15.2**	**12.4**		**58.5**	**56.3**	**60.2**	

Zonal Monitoring Reports Rabi 2020-21

Zonal Monitoring Report
Central Zone

Team – I

Period	Team	Centres Visited
17-19 Feb., 2021	Drs. SI Patel. JB Singh, RP Meena and Vikas Gupta	Vijapur, Anand, Dhanduka, Sanosara, Amreli and Junagadh

Breeding trials allocated & monitored:

Centre	Trials	Remarks
Vijapur	AVT-IR-TS, AVT-IR-LS, AVT-RI-TS, SPL-HYPT , SPL-CI-HYPT, NIVT-2, NIVT-3B, NIVT-4, NIVT-5B	Properly conducted
Anand,	AVT-IR-TS, AVT-IR-LS	Properly conducted
Dhanduka,	NIVT-5B, AVT-RI-TS	Properly conducted
Sanosara,	AVT-RI-TS, AVT-IR-LS	Properly conducted
Amreli	AVT-IR-TS, AVT-RI-TS	AVT-RI-TS rejected due to dogs and peacock damage in all the replications
Junagadh	AVT-IR-TS, AVT-IR-LS, AVT-RI-TS, NIVT-2, NIVT-3B, NIVT-4, NIVT-5B	Properly conducted

Trials not conducted / rejected by monitoring team: AVT-RI-TS at Amreli

Entries recommended for purification:

Trial	Entry	Remarks
AVT-IR-LS	CZ-LS- 201, 202	Few off-types were present
AVT-RI-TS	CZ-RI-311	Few off-types were present
SPL-HYPT (IR-ES)	SPL-HYPT-103, 108	Few off-types were present
SPL-CI-HYT	HYT-203, 209, 221	Few off-types were present
NIVT-2	N- 322, 325	Mixture of plant type and spike was observed
NIVT-3B	N- 511, 521	Few off- types were observed
NIVT-4	N- 610, 613, 621	Few off- types were observed

Entries recommended to be dropped from further testing:

Trial	Entry	Remarks
AVT-IR-TS	CZ-TS-108	Segregation for ear waxiness, plant height and maturity
NIVT-2	N-320, 325,	Segregation for height, maturity
	335	Segregation for plant height and waxiness
NIVT-3B	N-513	variation for ear head waxy and non-waxy
	N - 509	Segregation for waxiness and ear type
NIVT-4	N – 611	Segregation for maturity and ear type
NIVT-5B	N-805	Segregation for ear-head waxiness
SPL-HYPT (IR-ES)	SPL-HYPT-106	Segregation for maturity and ear colour
SPL-CI-HYT	HYT-213	Segregation for maturity

Report on Agronomy trials

Centre	Trial	Date of Sowing	Remarks
Vijapur	IR-DOS-TAD	D1: 13.11.2020 D2: 03.12.2020	Trial conduct is very good. Proper plant stand.
	RIR-TS-TAD	24.11.2020	
	SPL-IR-ES-HYPT	04.11.2020	Trial conduct is very good, proper plant stand. HYPT-Agron 104 Seems late. Lodging in HYPT-Agron 111
	SPL-1	As per schedule	Trial conduct is very good with proper plant stand. Lodging in early sown crop In 25th October sown crop, ear head

			becomes black, look like blotch affected.
	SPL-4	04.11.2020	Trial conduct is very good with proper plant stand.
Dhanduka	SPL-2	07.11.2020	
Junagadh	IR-DOS-TAD	D1: 13.11.2020 D2: 03.12.2020	
	SPL-1: 25th October sowing was not executed due to rainfall		
	SPL-4	06.11.2020	Trial conduct is very good. Proper plant stand. No visual difference within treatments.

Report on Physiology Trials: all allocated trials conducted properly

Trial	Centre	Remarks
MLHT-2	Vijapur, Junagadh	Properly conducted
DHTSN	Junagadh	Properly conducted

Entries showing promising performance in breeding trials:

Trial	Entry
NIVT-2	N-304, 316, 331, 333
NIVT-3B	N-520, 524
NIVT-4	N-601, 615, 618
NIVT-5B	N-802, 818, 819, 820

Report on Pathological Nurseries:

Centre	Nursery	Remarks
Vijapur	PPSN	Rust disease development was excellent. Leaf blight development was also observed in some entries. In AVT, the entry No. 64 recorded stem rust severity score of 20S while entry No. 195 exhibited leaf rust severity score of 60S. In NIVT, entry no. 69 showed leaf rust severity of 20S.
Junagadh	PPSN	Rust disease development was excellent. In AVT, the entry No. 62 & 64 recorded stem rust severity score of 10S and 30S, respectively while entry No. 195 exhibited leaf rust severity score of 80S. In case of NIVT, entry no. 36 & 69 exhibited stem rust & leaf rust severity of 20S each.

Barley Trials:

Centre	Trials	Remarks
Vijapur	IVT-IR-FB,	Properly conducted, lodging was reported in IVT-IRFB-7, 14, 20, 22
	AVT-IR-FB-CZ	Conduct was good. However poor germination in AVT-IR-FB-CZ-3
	AVT-IR-NB All zones Huskless	Conduct was good, plant population was less in AVT-IR-NB-5, 6

Special comments, if any:
Cooperators in CZ raised concern regarding increasing their contributions in NIVTs of CZ & PZ.

Signature of the monitoring team members:

(SI Patel)	(JB Singh)	(RP Meena)	(Vikas Gupta)

Barley Network (AICW&BIP)
Monitoring Report of Central Zone

Duration: 18-21 February, 2021 **Location visited:** Agra, Morena, Gwalior, Jhansi, and Tikamgarh

Team Members

Dr. RPS Verma, Pr. Scientist & PI, Barley Improvement, IIWBR, Karnal
Dr. Jogendra Singh, Pr. Scientist (Plant Breeding), Barley Improvement, IIWBR, Karnal
Dr. SS Rajput, Barley Breeder, SKN Ag. University, Jobner

The team constituted by the Director, IIWBR, Karnal for monitoring of the barley trials in central zone, visited the different locations as per schedule, however, Dr. SS Rajput did not join the team due to urgent examination duty at University.

A: Location wise observations
Agra

Six agronomic experiments were monitored at this location on 18th February. All the experiments were conducted as per layout, experimental design, allocation of treatments and managed excellently at Agra centre except error was observed in the layout of the barley agronomy experiments Nos. SPL 1 (main plot and sub plots exchanged) and SPL-5 (RBD used in place of Split plot design), **hence both the experiments/ trials were rejected** by the team.

Morena

Three trials, IVT-IR-FB, IVT/AVT-IR-NB (Hulless) and AVT-IR-FB-CZ were monitored on 18th February and trials were found in good condition. However, three entries (E3, E5 and E6) showed poor gemination in the IVT/AVT-IR-FB (Hulless) trial.

Gwalior

The team visited three coordinated barley yield trials (IVT-IR-FB, IVT/AVT-IR-NB (Hulless) and AVT-IR-FB-CZ) at this location on 19th February in forenoon. All the trials were in good condition and as per the technical programme. However, three entries (E3, E5 and E6) showed poor gemination in the IVT/AVT-IR-FB (Hulless) trial.

Jhansi

The team monitored one coordinated barley yield trial (IVT/AVT-IR-NB-Hulless) at this location on 19th February, 2021in after noon. The trial was in good condition and as per the technical programme. However, three entries (E3, E5 and E6) showed poor gemination in this trial.

Tikamgarh

The team visited at the centre on 20th February, 2021. Two allotted trials (IVT/AVT-FB (Hulless) and AVT-IR-FB were conducted at the centre. Trials were in good condition and the crop expression was very good. However, three entries (E3, E5 and E6) showed poor gemination in the IVT/AVT-IR-FB (Hulless) trial.

B: Disease / pest incidence.

No incidence of yellow rust and leaf blight were observed at any location. Incidence of covered and loose smut was observed on few entries at minor scale.

C: Trials rejected: Two agronomic trials (SPL 1 and SPL 5) at Agra were rejected because of wrong lay out.

D: Poor germination:

IVT-IR-FB-CZ= E 13, E 16

AVT-IR-FB-CZ= none

AVT/IVT-IR-NB= E3, E5 and E6

E: Entries observed as segregating/mixtures

The following entries were noticed to have significant amount of segregation/mixture in various trials, though there were other entries also with few off types.

Trial Name	Entries with	
	Segregation / mixtures	Off types
IVT-IR-FB	IVT-IR-FB-6 and 23	IVT-IR-FB-1, 13 and 25
AVT- IR- FB-CZ	--	AVT-IR-FB-CZ-1, 4, 5 and 6
IVT/AVT-IR-NB	AVT-IR-NB-4	AVT-IR-NB-1 and 3

(Jogendra Singh)
Principal Scientist
Barley Improvement
ICAR-IIWBR, Karnal

(RPS Verma)
Principal Scientist & Principal Investigator
Barley Improvement, ICAR-IIWBR, Karnal

Proforma for Zonal Monitoring Report 2020-21
Zone: North Western Plain (NWPZ) Team III

Period of visit: 1st to 4thMarch, 2021

Name of team members:

Dr Lokendra Kumar, Pr. Scientist, ICAR-IIWBR, Karnal
Dr SK Bishnoi, Scientist, ICAR-IIWBR, Seed & Research Farm, Hisar
Dr PS Shekhawat, Plant Pathologist, RARI, Durgapura
Dr SS Rajput, Barley Breeder, RARI, Durgapura

Centres visited:

Bawal, Durgapura, Tabiji, Bhilwara, Kota and Navgaon

Breeding trials allocated & monitored:

Centre	Trial	Remark*
Bawal	IVT-IR-TS-MB (NWPZ)	Trial was very good
Durgapura	IVT-IR-TS-MB (NWPZ)	Trial was very good
	AVT-IR-TS-FB (NWPZ)	Trial was very good
	IVT-IR-TS-FB (NWPZ)	Trial was very good
	IVT/AVT-IR-Hulless (NWPZ)	Trial was very good
Tabiji	AVT-IR-TS-FB (NWPZ)	Trial was very good
	AVT-IR-TS-FB (NWPZ)	Trial was very good
Bhilwara	AVT-SST-SAL/ALK (NWPZ)	Trial was very good
Kota	AVT-TS-FB (CZ)	Trial was very good
Navgaon	IVT-IR-TS-MB (NWPZ)	Below average
	AVT-IR-TS-FB (NWPZ)	Trial was very good

**Evaluated trials as very good, good and average based on conduction*

Trial recommended for rejection:

Centre	Trial	Remark
Navgaon	IVT-IR-TS-MB (NWPZ)	Due to salinity patches and other unknown reasons, no entry of this trial was observed up to the mark in their growth, development and expression. Hence monitoring team recommends this trial for rejection at this centre.

Entries recommended for purification:

Trial	Entry	Remark
AVT-IR-TS-NB (NWPZ)	Entry No: 2 Entry No: 4	Height variation Variation in height & pigmentation
IVT-IR-TS-FB (NWPZ)	Entry No: 19	Height variation
IVT-IR-TS-MB (NWPZ)	Entry No: 15	Height variation

Entries recommended for exclusion of their yield data:

Trial	Entry	Remark
AVT-IR-TS-NB (NWPZ)	Entry No: 5	Mixture of different plant types
IVT-IR-TS-MB (NWPZ)	Entry No: 3	No germination of this entry at all locations
IVT-IR-FB (NWPZ)	Entry No: 13	Poor germination in all replications (20%)
AVT-SAL/ALK (NWPZ)	Entry No: 15	Very poor germination in all replications (10%)
AVT-IR-TS-Hulless (NWPZ)	Entry No: 2 Entry No: 5 Entry No: 6	Poor germination in all replications (20%) Poor germination in all replications (25%) Poor germination in all replications (20%)

Entries exhibiting higher diseases incidence /insect infestation:

Centre	Trial	Entry number & disease
Durgapura	IVT-IR-MB (NWPZ)	Stripe rust : Entry No: 5 (TMS), Entry No: 22 (SMS)
Bhilwara	AVT-SAL/ALK (NWPZ)	Powdery mildew: Entry No: 1 (1), Entry No: 4 (2), Entry No: 6 (1), Entry No: 9 (3) and Entry No: 10 (2)

Report on Agronomical Trials:

Centre	Trial	Remark
Durgapura	Spl-1, Spl-2, Spl-3, Spl-4, Spl-5, Spl-6	Trials were very good

Report on DUS Trials/Nurseries:

Centre	Trial/Nursery	Remark
Durgapura	DUS Barley, NBGSN, EIBGN, IBYT-HI, IBON-HI, BQCSN-1, BQCSN-2, BQCSN-3, BQCSN-4	All Trials and nurseries were very good

Report on seed production programme

Centre	Programme name	Remark
Durgapura	Nucleus seed (Wheat) Raj 4079, Raj 4037, Raj 3077, Raj 3765, Raj 4120, Raj 4238,	Very good
	Nucleus seed (Barley) RD 2052, RD 2899, RD 2907, RD 2035, RD 2715, RD 2786, RD 2794	Very good

Special comments, if any
1.Voluntary centres requested for timely release of funds

Signature of the monitoring team members

(Lokendra Kumar) (SK Bishnoi) (PS Shekhawat) (SS Rajput)

Proforma for Zonal Monitoring Report 2020-21

Zone: North Western Plain (NWPZ) Team II

Period of visit: 8-11 March, 2021

Name of team members:

Name	Remarks
Dr RPS Verma, PI (Barley) ICAR-IIWBR, Karnal	
Dr PL Kashyap Sr. Scientist, ICAR-IIWBR Karnal	
Dr Dinesh Kumar, PS Biochemistry, ICAR-IIWBR, Karnal	Joined at Hisar on day 1
Dr Simarjit Kaur, Barley Breeder, PAU, Ludhiana	Joined at Hisar on day 1 and Ludhiana on day 3

The team constituted by the Director, IIWBR, Karnal for monitoring of the barley trials in NWP zone, visited the different locations however, there was a little deviation in the schedule. The team started early on day 2 from Hisar for SG Nagar and could cover SG Nagar and Bathinda on same day and stayed at Bathinda in place of SG Nagar. On day 3 (10 March) the team visited PAU Ludhiana (one day ahead of schedule) and finished the programme on 10 March itself in place of 11 March. This became possible mainly because of significantly improved road conditions in the region.

Centres visited:

CCSHAU, Hisar, IIWBR Hisar, Sri Ganganagar, Bathinda and Ludhiana

Trials monitored:

Centre	Trial	Remark*
CCSHAU Hisar	**Breeding**: IVT-IR-MB, IVT-IR-FB, AVT-IR-FB (NWPZ), IVT-IR-NB-Hls, AVT-SST-SAL/ALK, BQSN **Agronomic**: SPL 2,3,4,5 and 6 **Pathology**: NBDSN, EBDSN	All Breeding and agronomic trials were very good except SPL2 and SPL 4, which were having very poor crop stand and so much weed infestation **Pathology**: Stripe rust was on infector with some secondary spread on test lines
IIWBR Hisar	AVT-SST-SAL/ALK	Trial was good but more stress in R3 and 4 affected adversely, so R1 and R2 data may be considered.
Sri Ganganagar	IVT-IR-MB, AVT-IR-FB	Trials were very good
PAU Bathinda	IVT-IR-MB, AVT-IR-FB	Trials were very good
PAU Ludhiana	**Breeding**: IVT-IR-MB, IVT-IR-FB, AVT-IR-FB (NWPZ), IVT-IR-NB AVT-SST-SAL/ALK, BQSN **Agronomic**: SPL 1, 2,3,4, and 5 **Pathology**: NBDSN, EBDSN, IBDSN, chemical control for Yr	All Breeding and agronomic trials were very good. **Pathology**: Stripe rust was on infector with some secondary spread on test lines

*Evaluated trials as very good, good and average based on conduction

Trial recommended for rejection:

Centre	Trial	Remark
CCSHAU Hisar	Agronomic trials: SPL2 and SPL 4	Very poor crop growth and stand with heavy weed infestation
IIWBR Hisar	Salinity trial: Rep 3 and 4	Sever salinity stress in these two reps resulting in big patches of crop mortality. Rep 1 and 2 are OK for reporting

Entries recommended for purification:

Trial	Segregation/ Mixture beyond purification	Needs purification
AVT-IR-FB	--	Entry No: 2, 3, 4, 5 & 9,
IVT-IR-TS-FB	Entry No: 6 & 23	Entry No: 1, 13, 25
IVT-IR-TS-MB	Entry No:6 & 14	Entry No: 1, 2, 5, 8, 12, 15, 17, 19, 19, 20, 21 & 22
AVT-SST	Entry No: 2 & 5	Entry No: 6
AVT/IVT-IR-NB	Entry No: 4	Entry No: 1 & 3

Entries with very poor germination

Trial	Entry	Remark
IVT-IR-TS-MB	Entry No: 3	No germination at all locations
IVT-IR-FB (NWPZ)	Entry No: 13	Poor germination in all locations
AVT-SAL/ALK (NWPZ)	Entry No: 15	Very poor germination in all replications (10%)
AVT-IR-TS-Hulless (NWPZ)	Entry No: 2, 5 & 6	Poor germination in all replications (<20%)

Entries exhibiting higher diseases incidence:

Trial	Blight	Smuts	Rusts(YR)
IVT-IR-TS-MB	-	E18 (CS)	E5 (10S)
IVT-IR-FB	E14(45), E18(47)	E5, E22 (LS)	E14(10S), E21(30S)
AVT-SAL/ALK	E8(56), E11(57), E12(67)	E3, E5(CS+LS), E9(CS)	
AVT-IR-NB	E1(35), E4(34)	E2(CS)	E4 (60S)
AVT-IR-FB	E3,4,6 (35 each)	E2(LS)	

Signature of the monitoring team members

(Dinesh Kumar) (PL Kashyap) (Simarjit Kaur)

(IRPS Verma)

Annexure 1: Location wise leaf blight data (DD scale) recorded during monitoring

Entry Nos.	IVT-IR-FB		IVT-IR-MB		AVT-IR-FB-NWP		AVT-IR-NB		AVT-SST	
	Hisar	Ludhiana	Hisar	Ludhiana	Hisar	Ludhiana	Hisar	Ludhiana	Hisar	IIWBR Hisar
1	02	01	02	02	12	13	01	35	35	00
2	12	01	03	12	02	24	02	13	34	00
3	13	13	34	00	00	35	02	23	23	00
4	12	13	34	12	13	35	02	34	02	00
5	13	03	13	13	23	23	01	13	13	00
6	23	01	02	01	23	35	01	00	25	13
7	02	01	00	12	14	24			02	00
8	02	13	01	01	13	24			36	36
9	13	12	01	00	12	14			02	00
10	14	13	02	00	13	24			02	00
11	02	23	01	24					57	00
12	13	23	13	00					35	67
13	13	23	01	23					02	00
14	45	45	01	00					46	00
15	02	13	13	01					02	00
16	02	13	13	00						
17	35	12	13	02						
18	47	35	02	02						
19	03	01	13	02						
20	13	23	01	01						
21	02	02	13	02						
22	13	13	01	12						
23	12	34								
24	13	13								
25	02	13								

Proforma for Zonal Monitoring Report 2020-21

Zone: North Western Plain (NWPZ) Team III

Period of visit: 23-24 March, 2021

Name of team members:

Name
Dr RPS Verma, PI (Barley) ICAR-IIWBR, Karnal
Dr. Lokendra Kumar, PS Breeding, IIWBR Karnal

The team for monitoring of the barley trials at Modipuram and Pantnagar in NWP zone, visited the two locations on 23 and 24 March. On day 1 the team monitored four trials at SVP U Ag. & Tech, Modipuram, while on day 2 the trials and nurseries at GBPUA &T, Pantnagar were monitored. The specific observations at each location are mentioned below.

Trials monitored:

Centre	Trial	Remark*
Modipuram	IVT-IR-MB, IVT-IR-FB, AVT-IR-FB (NWPZ), IVT-IR-NB	All Breeding trials were very good with poor germination in few entries in huskless trial
Pantnagar	**Breeding**: IVT-IR-MB, IVT-IR-FB, AVT-IR-FB (NWPZ), IVT-IR-NB-His, EIBGN, NBGSN, IBYT-HI, IBON-HI **Pathology**: IBDSN, NBDSN, EBDSN	All Breeding trials and nurseries were very good and there was poor germination in few entries in huskless trial **Pathology:** The incidence of leaf blights (mainly net blotch followed by spot blotch) was severe on infector and few test entries, however, the incidence of stripe rust was not observed either in nurseries or in trials.

Trial recommended for rejection: None

Entries recommended for purification:

Trial	Segregation/ Mixture beyond purification	Needs purification
AVT-IR-FB	--	Entry No: 1, 3, 6, 9 & 10
IVT-IR-TS-FB	Entry No: 6 & 23	Entry No: 1, 3, 13,
IVT-IR-TS-MB	Entry No: 6 & 14	Entry No: 1, 2, 12, 15, 19
AVT/IVT-IR-NB	Entry No: 4	Entry No: 1 & 3

Entries with very poor germination

Trial	Entry	Remark
IVT-IR-TS-MB	Entry No: 3	No germination at all locations
IVT-IR-FB (NWPZ)	Entry No: 13, 16	Poor germination in all locations
AVT-IR-TS-Hulless (NWPZ)	Entry No: 2, 5 & 6	Poor germination in all replications (<20%)

Entries exhibiting higher diseases incidence:

Trial	Blight
IVT-IR-TS-MB	-
IVT-IR-FB	E14(67), E17(89)
AVT-IR-NB	--
AVT-IR-FB	--

Signature of the monitoring team members

25/3/2021

(Lokendra Kumar)

25/3/21

(RPS Verma)

Zonal Monitoring Report NEPZ (Barley Trials) 2020-21
Period of visit: 01.03.2021 to 04.03.2021

Name of team members:

Dr. P K Gupta, Barley Breeder, CSAUA&T, Kanpur
Dr. Chuni Lal, Barley Breeder, ICAR-IIWBR, Karnal
Dr. A S Kharub Principal Scientist, ICAR-IIWBR, Karnal
Dr. S. P. Singh, Plant Pathologist, NDUA&T, Faizabad - Not Attended

Centres visited:

Dilipnagar, Farm, CSAUA&T, Kanpur
Kanpur, CSAUA&T, Kanpur
Kumaraganj, NDUA&T, Faizabad
Masodha, Crop Rese. Stn., NDUA&T, Faizabad
Varanasi, BHU, Varanasi
Saini, Regional Research Centre, CSAUA&T, Kanpur

Breeding trials allocated & monitored:

Centre	Trial	Remark*
Dilipnagar	SAL-IR	Very Good
Kanpur	IVT-IR-FB; IVT-RF-FB; IVT/AVT-IR-FB (HL); AVT-IR-FB	Very Good
Kumarganj	SAL-IR; IVT-IR-FB; IVT-RF-FB; IVT/AVT-IR-FB (HL), AVT-IR-FB	Good
Varanasi	IVT-IR-FB; IVT-RF-FB; IVT/AVT-IR-FB (HL), AVT-IR-FB	Very Good
Saini	IVT-RF-FB	Very Good

There is problem in layout of Rainfed trial at Varanasi and Kumarganj locations. Most of the entries in replications are in the same line.
In Kanpur, IVT/AVT-IR-FB (HL) trial, seed packets of two entries (3&4) were not received.
At saini seed packets of plot no 4,21,30, 48 were missing and seed packets of plot no 8,13,27,42 were double. These were corrected as per Dr Lokendra Kumar suggestion but the entries were not matched with other locations at the time of monitoring

Trials not conducted / rejected by monitoring team: Agronomy trial on date of sowing *vis-à-vis* varieties (SPL 1) was rejected because the trial was in suppression due to wrong herbicide application.

Entries showing promising performance in breeding trials:

Trial	Entries	Remarks
IVT-IR-FB	IVT-IRFB-E1, 7, 8, 21	Visually superior
AVT-IR-FB	AVT-IRFB-E2, 4, 8, 10	Visually superior
IVT-RF-FB	IVT-RFFB-E5, 6,	Visually superior
IVT/AVT-IRFB (HL)	IVT/AVT-IRFB-HL-E2, 3, 6	Visually superior
SAL-IR-FB	1,3, 11,12	Visually superior

Entries with poor germination in breeding trials:

Trial	Entry	Remarks
IVT-IR-FB	13,16	
IVT-RF-FB	3, 7,10,11	
IVT/AVT-IRFB (HL)	Not uniform at all stations	
SAL-IR-FB	10,13,15	

Entries recommended for purification:

Trial	Entry	Remarks
IVT-IR-FB	IVT-RFFB-E2,9, 23,24	
AVT-IR-FB	AVT-IRFB-E1,6	
SAL-IR-FB	SAL-FB 2	

Entries recommended to be dropped from further testing:

Trial	Entry	Remarks
IVT/AVT-IRFB-HL	IVT/AVT-IRFB-HL-E4,	Mixture of plants with different heights
SAL-IR-FB	SAL-FB 5	Mixture of waxy and non-waxy types

Report on National and International Nurseries

Centre	Nurseries Planted	Remarks
Kanpur	GSBON, GSBYT, EIBGN, NBGSN	Entry 13,11,21,20 were promising in GSBYT
Faizabad	EIBGN and NBGSN 49 wild accessions	At all the three locations these were in good conditions
Varanasi	GSBON, GSBYT, EIBGN, NBGSN 49 wild accessions	Entry 21 in GSBYT and Entry nos. 77, 78,104, 1401,137 were promising. Wild accessions no. 1,9,14,15,19, 25,27,28,39, 42,44,45 had leaf blight of 01 to 12 scores in a scale of 00 to 99 Accession nos. 6,7,29, 31 not germinated

Report on Barley Quality Components Nurseries

Centre	Nursery	Remarks
Kanpur	Four nurseries of BQCN were planted	BC4966 no germination

Entries exhibiting higher diseases incidence / insect infestation:

Trial	Entry	Remarks
IVT-IR-FB	Entry No 2,3,69,10,11,12,13, 14, 15,17,18,19,23, 25,	A score of 99 was observed for leaf blight at Varanasi
IVT-RF-FB	2	A score of 99 was observed for leaf blight at Varanasi
AVT-IR-NB	Entry No. 2	Higher incidence (10%) of covered smut

Report on Agronomical Trials:

Centre	Trial	Remark
Kanpur	SPL1, SPL 3, SPL5	SPL 1 was not good due to wrong herbicide application and so trial rejected, Other two trials on Yield maximisation and Zn X varieties were good but no visible treatment differences.
Masodha	SPL1, SPL 3, SPL5	All the three trials were excellent and as per layout. Not much treatment differences visible except in date of sowing treatment.
Varanasi	SPL1, SPL 3, SPL5	All the three trials were excellent and as per layout. There are visible observations among treatments in yield maximisation and date of sowing experiment. Crop expression was very good.

Report on Pathological/entomological Nurseries and trials:

Centre	Remark
Kanpur	All the three (NBDSN, EBDSN and IBDSN) barley plant pathological nurseries were conducted satisfactorily. Infection of leaf blight had just started; the levels were not good enough for scoring. A separate nursery (NBDSN) was sown for screening against aphids. One trial on "Management of aphid" was also conducted.
Faizabad	All the three (NBDSN, EBDSN and IBDSN) barley plant pathological nurseries were conducted masterly. Infection had just started at lower leaves, and was not good enough for scoring.
Varanasi	All the three (NBDSN, EBDSN and IBDSN) barley plant pathological nurseries were conducted excellently. The disease pressure of leaf blight was very high.

NEPZ cooperators and team members are of the opinion that in rainfed trial, there should be one irrigation or it can be restricted irrigation trial instead of pure rainfed. Because there is no rainfed area, at least one irrigation is available everywhere. The issue can be discussed in at the time of work planning meeting.

Signature of the monitoring team members

-sd- **-sd-** **sd-** **-**

(Dr PK Gupta) **(Dr Chuni Lal)** **(Dr A S Kharub)**

VIRTUAL ZONAL MONITORING OF ALL INDIA COORDINATED WHEAT AND BARLEY TRIALS OF NORTHERN HILLS ZONE
RABI 2020-21

Date of Monitoring: 17.4.2021 (10.00 a.m. to 5.00 p.m.)

Name of team members:

Name	Centre
Dr. Lakshmi Kant, Principal Scientist (ZC-cum-Chairman)	ICAR VPKAS, Almora
Dr. O.P. Gangwar ,Scientist (Plant Pathology)	IIWBR, R.S. (Flowerdale), Shimla
Dr. Madhu Patial, Scientist (Plant Breeding)	ICAR-IARI, RS (Tutikandi), Shimla
Dr. Gurudev Singh, Scientist (Agronomy)	CSKHPKV, HAREC, Bajaura

Centres virtually monitored :

Centre
ICAR-IARI, RS Shimla; CSKHPKV, HAREC, Bajaura ; CSKHPKV, RWRC, Malan ; CSKHPKV, HAREC, Dhaulakuan; KVK, Berthin; ICAR-VPKAS, Almora; Majhera; Ranichauri and Rajauri.

Trials allocated (Plant Breeding & Agronomy)

Centre	Trial	Remark
ICAR-IARI, RS, Shimla	WHEAT AVT-TS- IR, AVT- TS- RF, AVT-LS- RI, IVT- TS- RF BARLEY AVT- TS- RF	Very Good
HAREC, Bajaura	WHEAT AVT-TS- IR, AVT- TS- RF, AVT-LS- RI, IVT- TS- RF and BARLEY AVT- TS- RF	Very Good Only one replication was harvested for fodder cut at 75 DAS Very Good
KVK, Berthin	BARLEY AVT- TS- RF	Very Good (two uncut replications were harvested)
RWRC,Malan	WHEAT AVT-TS- IR, AVT- TS- RF, AVT-LS- RI, IVT- TS- RF BARLEY AVT- TS- RF	Very Good
HAREC, Dhaulakuan	WHEAT AVT- TS- RF, AVT- LS- RI, IVT-TS- RF	Very Good
Majhera	WHEAT AVT- TS- RF, AVT- LS- RI, IVT-TS- RF BARLEY AVT- TS- RF	Very Good . only 4th replication of AVT-LS-RI was poor due to the effect of drought may be due to poor soil depth (poor performance) hence may be rejected. Very Good

Centre	Trial	Remark
ICAR-VPKAS, Almora	WHEAT AVT-TS- IR, AVT- TS- RF, AVT- LS- RI, IVT- TS- RF BARLEY AVT- TS- RF	Very Good
Ranichauri	WHEAT AVT- TS- RF, AVT- LS- RI, IVT- TS- RF BARLEY AVT- TS- RF	Though the trials were conducted nicely but two trials i.e AVT- LS- RI and IVT- TS- RF failed due to erratic and poor plant stand as a result of prolonged drought. Well conducted but failed due to poor plant stand occurring due to prolonged drought.
Rajauri	BARLEY AVT- TS- RF	Very Good

N.B. Most of the centres harvested two replications of barley trial for fodder and retained two without cut.

Trials rejected by monitoring team: 03 *i.e* wheat AVT- LS- RI, IVT- TS- RF and barley AVT- TS- RF at Ranichauri

Entries exhibiting higher diseases/insect infestation*:

Trial	Entry (Disease Response)
Wheat	
AVT- TS- IR	NHTSZ 2005: Yellow Rust: 40S NHTSZ 2004: Yellow Rust: 20S NHTSZ 2002: Loose smut 2-3% at Malan
AVT- TS- RF	NHRFZ 2001: Loose Smut at Malan, Shimla, Almora, Majhera and Dhaulakuan only NHRFZ 2005: Loose smut at Majhera and Ranichauri
AVT- LS- RI	Yellow Rust score at Bajaura only : NHLSZ 2009=20S
Barley	
AVT -TS-RF	No incidence of yellow rust. Covered smut was seen at Berthin

*Rust infection was at the lowest level in most of the genotypes this year due to drought and also appeared late.

Report on Agronomical Trials:

Trials allocated	
HAREC,Bajaura	Wheat- SPL1, SPL 2, SPL 4 Barley- SPL 1, SPL 2, SPL 5
RWRC, Malan	Wheat- SPL1, SPL 2, SPL 4 Barley- SPL 1, SPL 2, SPL 5

Trial	Centre	Remarks (all Very Good)
WHEAT AGRONOMY EXPERIMENT		
SPL-1	HAREC,Bajaura RWRC, Malan	Among the different dates of sowing, last week of October (D1 -25th Oct.) to first week (D2 - 5th Nov.) of November is the best sowing time for wheat. It is as per the visual observation.
SPL-2	HAREC,Bajaura	Seed treatment with Sea Weed Extract (SAGREEKA)

Trial	Centre	Remarks (all Very Good)
	RWRC, Malan	followed by two foliar applications showed prominent treatment effect on growth and development of wheat.
SPL-4	HAREC,Bajaura	Significant effect of varying nitrogen doses and plant growth retardants was observed in wheat. The foliar application of tabuconazole also recorded low incidence of yellow rust compared to no application.
	RWRC, Malan	
BARLEY AGRONOMY EXPERIMENTS		
SPL -1	HAREC,Bajaura	Among the different dates of sowing the D_1 (3rd Nov. and D_2 (13th Nov.) were found to be better compared to later dates of sowings.
	RWRC, Malan	
SPL-2	HAREC,Bajaura	Significant treatment effect was observed on the growth and development of barley. However, the application of growth retardants did not show much significant effect on the reduction of plant height in barley.
	RWRC, Malan	
SPL-5	HAREC,Bajaura	Better growth and development was observed with the soil and foliar applications of $ZnSO_4$.
	RWRC, Malan	

Entries recommended for purification:

Trial	Entries	Remark
Wheat		
AVT –TS- IR	NIL	All entries were pure.
AVT- TS- RF	NIL	All entries were pure.
AVT- LS- RI	NHLSZ 2004	Tall off type.
IVT –TS- RF	NHIVT 2009	Waxy /non waxy at Shimla and Almora and need purification.
Barley		
AVT –TS- RF	NIL	NIL

Entries recommended to be dropped from further testing:

Trial	Entries	Remark
IVT- TS- RF	NHIVT 2002	Plants segregation for spike shape *i.e* clubed and tapering spikes.

Signature of the monitoring team

Dr Lakshmi Kant VPKAS, Almora	Dr. O.P. Gangwar IIWBR, RS, Shimla	Dr. (Mrs) Madhu Patial IARI, RS, Shimla	Dr. Gurudev Singh CSKHPKV, HAREC,Bajaura

Barley Frontline Demonstrations (2020-2021)

During the *rabi* crop season 2020-21, 250 Barley Frontline Demonstrations (BFLDs) of one acre each were allotted to 31 cooperating centers all over India in eight states namely, HP, UP, J&K, Punjab, Haryana, Rajasthan, MP and Karnataka. Out of these, all 250 BFLDs were conducted by 31 centers, covering 262.38 acres area of 315 farmers. Improved barley varieties with complete package of practices (irrigation management, nutrient management, weed control, seed treatment etc.) were demonstrated.

Centre wise distribution of barley FLDs during *rabi* 2020-21 (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)	12	12	12.5*	18
2.	ICAR-IARI, RS, Amartara Cottage, Shimla (HP)	5	5	5	19
3.	KVK (YSPUH&F), Lahaul & Spiti -2, Tabo, Kaza, L&S (HP)	5	5	5	25
North Eastern Plains Zone (NEPZ)					
4.	NDUA&T, Kumarganj, Ayodhya (UP)	10	10	10	10
5.	KVK (IAS-BHU), Barkachha, Mirzapur (UP)	10	10	10	10
6.	CSAUA&T, Kanpur (UP)	10	10	10	10
7.	BHU, Varanasi (UP)	12	12	16*	16
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	19
10.	PAU, Ludhiana (Punjab)	8	8	8	8
11.	KVK, (PAU), Khokhar Khurd, Mansa (Punjab)	10	10	10.38*	13
12.	KVK (PAU), Kheri, Patran Road, Sangrur (Punjab)	5	5	5	5
13.	KVK (PAU), Goneana, Mukatsar (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	13	13
18.	ICAR-IIWBR, Karnal (Haryana)	5	5	5	5
19.	RARI (SKNAU), Durgapura, Jaipur (Rajasthan)	10	10	10	10
20.	KVK (Pragati Trust), Tankarda, Chomu, Jaipur (Rajasthan)	5	5	5	5
21.	KVK (AU-Kota), Akorashi, Dhindora, Hindauncity, Karauli (Rajasthan)	8	8	11*	11
Central Zone (CZ)					
22.	RCOA (MPUA&T), Udaipur (Rajasthan)	10	10	10	10
23.	KVK (MPUA&T), Dhoinda, Rajasmand (Rajasthan)	10	10	10	10
24.	KVK (JNKVV), Kuthulia Farm, Rewa (MP)	8	8	8	8
25.	KVK (JNKVV), Purushottampur, Panna (MP)	8	8	8	8
26.	KVK (JNKVV), Tikamgarh (MP)	8	8	8	8
27.	KVK (RVSKVV), Biaora, Rajgarh (MP)	5	5	5	5
28.	COA (JNKVV), Ganj Basoda, Vidisha (MP)	10	10	10	10
29.	KVK (BUA&T-Banda), Govt Agri Farm, Khiria Misra, Bamourikala, Devgarh Road, Lalitpur(UP)	5	5	6.5*	7
30.	KVK (BUA&T-Banda), Bharari, Jhansi (UP)	5	5	5	5
Peninsular Zone (PZ)					
31.	MARS, UAS, Dharwad (Karnataka)	10	10	10	10
Total		**250**	**250**	**262.38**	**315**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

State wise distribution of barley FLDs during *rabi* 2020-21 (in acres)

S.N.	State	BFLDs Allotted	BFLDs Conducted	Area Sown (acres)	No. of farmers/ Locations
1.	HP	22	22	22.5*	62
2.	J&K	8	8	8.0	19
3.	UP	62	62	67.5*	68
4.	Punjab	33	33	33.38*	36
5.	Haryana	33	33	36.0*	35
6.	Rajasthan	43	43	46.0*	46
7.	MP	39	39	39.0	39
8.	Karnataka	10	10	10.0	10
Total		**250**	**250**	**262.38**	**315**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

Zone wise distribution of barley FLDs during *rabi* 2020-21 (in acres)

S.N.	Zone	BFLDs Allotted	BFLDs Conducted	Area Sown (acres)	No. of Farmers/ Locations
1.	NHZ	22	22	22.5*	62
2.	NEPZ	52	52	56.0*	56
3.	NWPZ	97	97	103.38*	116
4.	CZ	69	69	70.5*	71
5.	PZ	10	10	10.0	10
Total		**250**	**250**	**262.38**	**315**

** Area covered more than allotted which is restricted to area equal to allotted FLDs.*

State wise yield gain during *rabi* 2020-21

State	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (%)
HP	24.63	18.25	34.93***
J&K	34.55	-	-
UP	36.70	25.18	45.78***
Punjab	37.68	34.80	08.26*
Haryana	44.68	42.28	05.68*
Rajasthan	53.38	44.70	19.41***
MP	38.60	29.00	33.10***
Karnataka	23.75	-	-

**** 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 UP (45.78 %) followed by HP (34.93%), MP (33.10 %), Rajasthan (19.41%) and Punjab (08.26 %). The lowest gain in yield was reported in Haryana (5.68 %).

Zone wise productivity over regional productivity during *rabi* 2020-21

Zone	BFLDs yield (q/ha)	Regional mean yield (q/ha)	Gain (%)
NHZ	24.63	17.75	38.73***
NEPZ	36.05	23.10	56.06***
NWPZ	44.58	38.33	16.31***
CZ	40.43	30.33	33.31***
PZ	23.75	-	-

**** 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 NEPZ (56.06 %) followed by NHZ (38.73 %), CZ (33.31 %) and NWPZ (16.31 %).

Zone wise productivity over check during *rabi* 2020-21

Zone	BFLDs yield (q/ha)	Check mean yield (q/ha)	Gain (%)
NHZ	24.63	18.25	34.93***
NEPZ	36.05	23.63	52.59***
NWPZ	44.58	41.93	06.32*
CZ	40.43	32.00	26.33***
PZ	23.75	-	-

**** 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 mean yield was highest in NEPZ (52.59 %) followed by NHZ (34.93 %), CZ (26.33 %) and NWPZ (06.32 %). Therefore, efforts should be made to increase barley yield in the NEPZ and CZ by promoting recent barley production technologies in collaboration with the state department of agriculture. The yield gain under barley FLD was highest at Mirzapur (132.12%) centre and lowest at Hisar (03.81%) center.

Centre wise performance of improved barley varieties during *rabi* 2020-21

Zone and Centre	BFLDs yield (q/ha)	Check yield (q/ha)	Gain (%)
NHZ			
Bajaura	24.58	18.18	35.21***
Shimla	25.00	19.00	31.58 NS
NEPZ			
Ayodhya	35.63	27.75	28.38***
Mirzapur	47.88	20.63	132.12***
Kanpur	27.50	23.13	18.92**
Varanasi	32.65	22.83	43.04***
Gorakhpur	38.58	24.25	59.07***
NWPZ			
Kathua	34.55	-	-
Ludhiana	44.63	42.63	04.69 NS
Mansa	32.70	29.63	10.38**
Sangrur	47.00	43.50	08.05 NS
Muktsar	33.60	31.10	08.04***
Bathinda	39.80	37.00	07.57***
Hisar	47.63	45.88	03.81 NS
Rewari	52.50	50.00	05.00***
Bhiwani	38.45	36.25	06.07***
Karnal	44.00	40.00	10.00 NS
Durgapura, Jaipur	65.75	52.75	24.64***
Chomu, Jaipur	42.25	34.38	22.91**
Karauli	63.50	55.05	15.35***
CZ			
Udaipur	44.98	38.20	17.74***
Rajasmand	43.78	36.90	18.63***
Rewa	37.63	23.63	59.26***
Panna	27.50	21.40	28.50***
Tikamgarh	34.65	23.50	47.45***
Rajgarh	41.25	35.60	15.87*
Vidisha	50.13	40.48	23.84***
Lalitpur	37.78	29.43	28.38***
Jhansi	42.50	36.75	15.65***
PZ			
Dharwad	23.75	-	-

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

Variety wise performance of improved barley varieties during *rabi* 2020-21

Zone and Centre	Improved variety	Average yield (q/ha)	Check variety	Average yield (q/ha)	Yield gain over check (%)
NHZ					
Bajaura	HBL 713	25.63	HBL 316	19.63	30.57**
Bajaura	HBL 713	23.33	Local	17.00	37.21***
Bajaura	HBL 713	25.58	Sonu	18.75	36.40***
Shimla	HBL 713	25.00	Local	19.00	31.58 NS
NEPZ					
Ayodhya	RD 2907	37.50	Narendra Jau-2	30.63	22.45*
Ayodhya	RD 2907	34.38	Azad	25.83	33.11***
Mirzapur	RD 2907	47.88	Azad	20.63	132.12***
Kanpur	RD 2907	27.50	K 508	23.13	18.92**
Varanasi	RD 2907	32.65	HUB 113	22.83	43.04***
Gorakhpur	RD 2907	38.58	RD 2660	24.25	59.07***
NWPZ					
Kathua	RD 2907	34.55	-	-	-
Ludhiana	RD 2907	44.63	PL 807	42.63	4.69 NS
Ludhiana	PL 891	31.50	-	-	-
Mansa	RD 2907	32.70	Local	29.63	10.38**
Sangrur	RD 2907	47.00	PL 807	43.50	8.05 NS
Muktsar	RD 2907	33.60	Local	31.10	8.04***
Bathinda	RD 2907	39.80	Local	37.00	7.57***
Hisar	RD 2907	47.63	BH 393	45.88	3.81 NS
Rewari	RD 2907	52.50	BH 393	50.00	5.00***
Bhiwani	RD 2907	38.45	BH 393	36.25	6.07***
Karnal	RD 2907	44.00	BH 393	40.00	10.00 NS
Durgapura, Jaipur	RD 2907	66.25	RD 2552	54.18	22.29***
Durgapura, Jaipur	RD 2907	65.00	RD 2660	50.63	28.40***
Chomu, Jaipur	RD 2907	42.25	RD 2035	34.38	22.91**
Karauli	RD 2907	63.50	RD 2035	55.05	15.35***
CZ					
Udaipur	DWRB 137	45.43	RD 2035	39.13	16.10***
Udaipur	RD 2899	44.55	RD 2552	37.28	19.52***
Rajasmand	DWRB 137	43.78	Local	36.90	18.63***
Rewa	DWRB 137	35.98	JB 58	23.25	54.73***
Rewa	RD 2899	40.35	JB 58	24.23	66.56***
Panna	RD 2899	26.68	JB 58	21.25	25.53***
Panna	DWRB 137	28.00	JB 58	21.50	30.23***
Tikamgarh	RD 2899	36.53	JB 58	22.50	62.33***
Tikamgarh	DWRB 137	33.53	JB 58	24.08	39.25***
Rajgarh	RD 2899	41.25	Local	35.60	15.87*
Vidisha	RD 2899	50.50	Local	40.50	24.69***
Vidisha	DWRB 137	41.25	Local	40.45	1.98***
Lalitpur	DWRB 137	37.78	Munda	29.43	28.38***
Jhansi	DWRB 137	42.50	Munda	36.75	15.65***
PZ					
Dharwad	DWRB 137	23.75	-	-	-

**** 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 (25.63 q/ha) at Bajaura centre in NHZ, RD 2907 (48.88 q/ha) at Mirzapur in NEPZ, RD 2907 (66.25 q/ha) at Durgapura Jaipur in NWPZ, RD 2899 (50.50 q/ha) at Vidisha in CZ and DWRB 137 (23.75 q/ha) at Dharwad in PZ were the highest average yielding. The huskless barley variety PL 891 yielded 31.50 q/ha at Ludhiana center, the huskless check was not reported. Checks were not reported at Kathua and Dharwad centers. The demonstrated new barley varieties were introduced for first time in these areas.

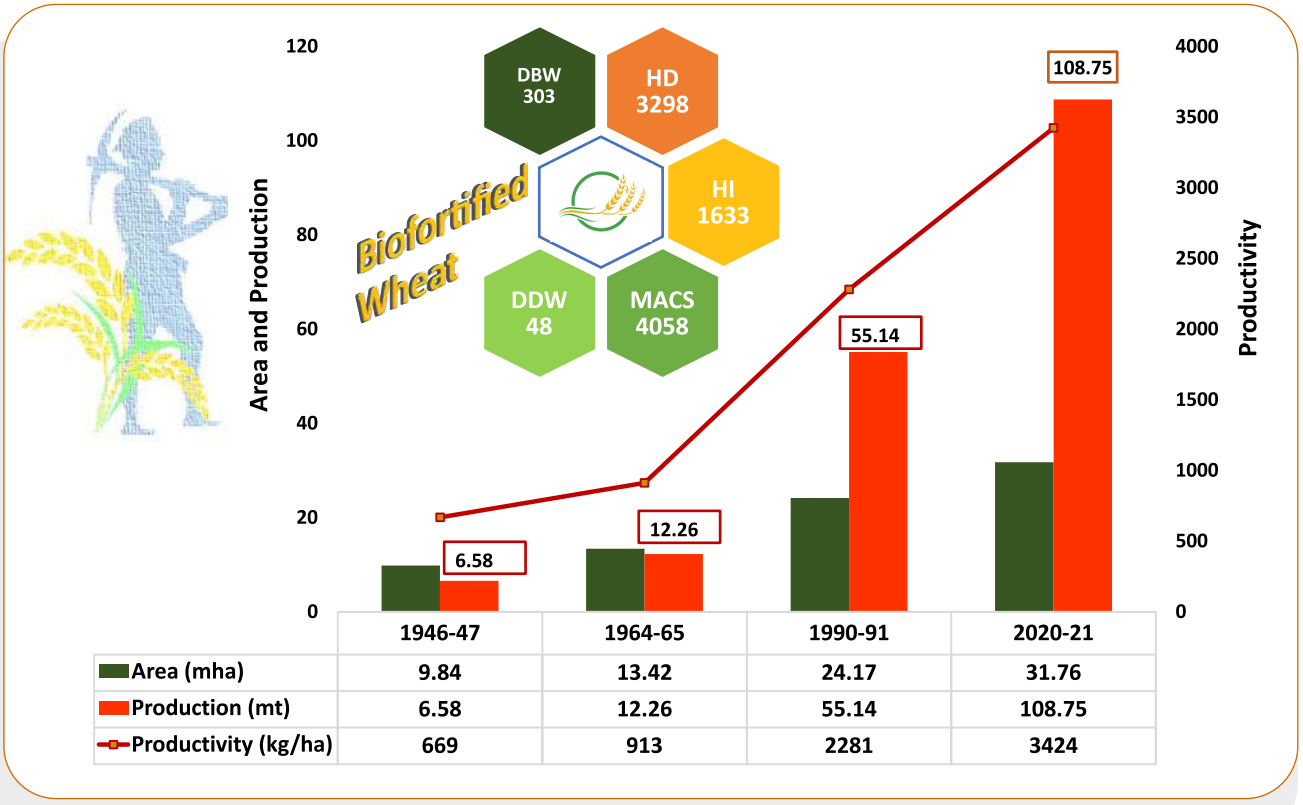
Yield potential of barley varieties in different zones during *rabi* 2020-21

Zone	Centre	Variety	Yield (q/ha)
NHZ	Bajaura	HBL 713	29.10
NEPZ	Mirzapur	RD 2907	53.53
NWPZ	Durgapura Jaipur	RD 2907	70.00
CZ	Vidisha	RD 2899	52.50
PZ	Dharwad	DWRB 137	25.00

The varieties HBL 713 (29.10 q/ha), RD 2907 (53.53 q/ha), RD 2907 (70.00 q/ha), RD 2899 (52.50 q/ha) and DWRB 137 (25.00 q/ha) performed better than other varieties at Bajaura, Mirzapur, Durgapura Jaipur, Vidisha and Dharwad centres in the NHZ, NEPZ, NWPZ, CZ and PZ, respectively.

Barley varieties grown in different zones during *rabi* 2020-21

Zone	Improved varieties	Check varieties	Popular varieties in the region
NHZ	HBL 713	HBL 316, Sonu, Local	Sonu, Dolma, HBL 276, HBL 316, Local
NEPZ	RD 2907	Narendra Jau-2, K 125 (Azad), K 508, HUB 113, RD 2660	K 125, K 409, K 508, K 551, K 560, K 1055, Rd 2552, RD 2660, RD 2794, HUB 113, Jyoti, Manjula, Narendra Jau-2, Narendra Jau-3, Lakhan, Local
NWPZ	RD 2907, PL 891	PL 807, BH 393, RD 2035, RD 2052, RD 2660, Local	PL 807, BH 393, BH 902, BH 946, RD 2035, RD 2052, RD 2660, RD 2715, RD 2786, RD 2794, DWRUB 52, Local
CZ	DWRB 137, RD 2899	JB 58, RD 2035, RD 2552, Munda, Local	RD 2035, RD 2552, RD 2715, RD 2660, RD 2786, JB 1, JB 58, Karan 201, Munda, Local
PZ	DWRB 137	-	-



	1946-47	1964-65	1990-91	2020-21
Area (mha)	9.84	13.42	24.17	31.76
Production (mt)	6.58	12.26	55.14	108.75
Productivity (kg/ha)	669	913	2281	3424

60th All India Wheat & Barley Research Workers' Meet
(August 23-24, 2021)

60वीं अखिल भारतीय गेहूँ एवं जौ अनुसंधान कार्यशाला
में आयोजित गोष्ठी के दौरान जारी किया गया