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Director's Message

At the outset, I express my heartfelt gratitude to the whole wheat and barley researchers for persistently working to overcome all the challenges and demonstrate remarkable improvements in wheat and barley development amidst the COVID pandemic. I praise researchers as well as the farmers 'community for their remarkable partnership in carrying out their obligations diligently and successfully, as evidenced by record production of wheat (109.59 million tonnes) and barley (1.66 million tonnes) during 2020-21.

During the reporting period, ICAR-IIWBR successfully organized the 60th All-India Wheat and Barley Research Workers meet in virtual mode. The Varietal Identification Committee has identified 9 wheat varieties and also recommended area extension of two wheat varieties and one barley variety for different production environments of India. Following the COVID-19 guidelines, the institute effectively deployed an IT-driven seed delivery portal system for online booking of the latest wheat and barley varieties and later on inviting the farmers and stakeholders to collect the booked seeds on a specified date. In addition, 219 seed firms signed the memorandums of understanding with ICAR-IIWBR to bolster the seed chain system of ICAR-IIWBR varieties. As a milestone activity, at ICAR-IIWBR, a seed processing facility along with a seed godown and shed was built to improve the quality of seed for distribution. I would like to appreciate all employees, collaborators, farmers, and stakeholders on their dynamic teamwork, and I am confident that we'll be able to meet our goals and demonstrate steady development.

I also congratulate the staff of ICAR-IIWBR for receiving various awards of national and international repute. In this pandemic condition, the institute has also shifted its outreach operations, advisories, and extension services to a virtual mode by leveraging social media and other digital channels. I also thank and acknowledge all the collaborators for their dedication to wheat and barley improvement and meeting the demands of a wide range of stakeholders.

I am sure that the scientific information included in this newsletter would be useful to the readers and stakeholders. I wish to congratulate editorial board for bringing out the compiled information of the research and institutional activities, meetings and events, distinguished visitors, awards and recognitions, and HRD programs executed at the ICAR-IIWBR in the form of a newsletter in time. In the future, we sustain our outstanding work on both the research and development fronts, focusing on developing need-based technologies and practices for the benefit of our valued farmers, entrepreneurs, academics, policymakers, and other stakeholders.

Jai Kisan, Jai Vigyan!

(GP Singh)

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New Barley Varieties and Genetic Stocks

RPS Verma, SK Bishnoi and Omvir Singh
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Release of new barley varieties

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). 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 (506ppm) based on three years average performance in AICRP trials. The less β-glucan content in grain and wort is also reflected by highest filtration rate (263 ml/h) amongst all checks. Another trait of current preference is malt diastatic power (860 L) was recorded highest in the variety DWRB182. These two traits have been lacking so far in the malt barley varieties released in the 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 were 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 for saline-sodic soils areas.

The variety DWRB137, a six row-feed barley variety has also been approved for area extension to North Western Plains Zone (Punjab, Haryana, Western U.P., Rajasthan (except Kota and Udaipur divisions) during 2021 by CVRC. This variety was earlier released for NEPZ and CZ, and currently leading the breeder seed production indents in country. Thus, the farmers of NWPZ will also be benefitted from this variety and will harness its potential in the region.

Table 1: Barley varieties released by CVRC/SVRC during 2020 and 2021.

S.N.	Variety	Parentage	Zone /State	Avg. yield (q/ha)	Pot. Yield (q/ha)	Developed at	Production condition
1.	DWRB182	DWRUB52/ DWRB78	NWPZ	49.7	74.5	IIWBR, Karnal	Malt barley under timely sown irrigated conditions
2.	KB1425	K508/ NDB1295	Uttar Pradesh	33.1	47.3	CSAUA&T, Kanpur	Irrigated timely sown, in saline-sodic soils
3.	DWRB137	DWRB28/ DWRUB64	NWPZ NEPZ CZ	52.2 37.9 42.5	80.0 53.6 67.4	IIWBR, Karnal	Timely sown irrigated conditions

Registration of new barley genetic stocks

Thirteen genetic stocks namely, DWRB206, DWRB207, UPB1065, UPB1070, BHS474, BHS478, BCLA3, BCLA11-6, DWRBG1, DWRBG3, DWRBG4, DWRBG5 and DWRBG6 (Table 2) have been registered with ICAR-NBPGR for their unique traits during the year 2020 and 2021. Two of them are unique for resistance to corn leaf aphid for the first time in country. These genotypes have been discovered with specific traits through their evaluation under the AICRP Wheat and Barley multi-location disease/ pest (NBDSN) or quality (BQSN) screening nurseries.

Table 2: Genetic stocks registered with NBPGR, New Delhi during 2020 and 2021.

S.N.	Name	INGR No.	Parentage	Trait(s)	Institute
1.	DWRB207 (DWRFB19)	20019	CDC Manley/ BCU2881	Highly resistant to stripe rust. High 1000 grain weight and low protein content.	IIWBR, Karnal
2	BHS 474 (BBM 777)	20018	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	UPB1065	20083	LIMON/ BICHY2000 //NE167/ CLE176	Low Beta glucan content (<3.5%) and high filtration rate and Kolbach index.	GBPUA&T, Pantnagar
4	UPB1070	20020	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	21100	ZIGZIG/4/ TOCTE// HIGO/LINO/3/ PETUNIA1	Resistant to stripe rust at APR under artificial inoculation	IIWBR, Karnal
6	BCLA3	21102	EB921/ Alfa93	Corn leaf aphid resistance in two-row back ground	IIWBR, Karnal
7	BCLA11-6	21101	BCU390/alfa93	Corn leaf aphid resistance in six-row back ground	IIWBR, Karnal
8	BHS478	21202	BHS385/ BHS369	Seedling resistance against all races of leaf and stripe rust. Seedling resistant to moderately resistant response against all races of stem rust (except for race 11). Adult plant resistance to yellow rust, leaf rust and stem rust.	IARI, Regional Station, Shimla
9	DWRBG1	21204	LEGACY/ 4/TOCTE// GOB/HUMAI10 /3/ATAH92/ ALELI /5/ ARUPO /K8755 //MORA	Barley genotype with a combination of low grain beta glucan (3.8%) and higher grain protein contents (13%).	IIWBR, Karnal
10	DWRBG3	21205	J09049 F3 10/030552	Barley genotype with combination of low grain beta glucan content (3.88%) and desirable thousand grain weight (45g).	IIWBR, Karnal
11	DWRBG4	21203	DWR30/ Shebac	Combination of high beta and high protein.	IIWBR, Karnal
12	DWRBG5	21206	W260/BCU8	Huskless barley genotype with high thousand grain (43.5g) weight, in combination of bold grain percentage (63.2%) and protein content (14.7%).	IIWBR, Karnal
13	DWRBG6	21207	PETUNIA2/M112	Huskless barley resistant for stripe rust at APR and for new pathotypes 6S0 and 7S0 at SRT and also having higher starch content.	IIWBR, Karnal

RESEARCH NOTES

Assessing genetic diversity for heat tolerance in wheat using newly developed SSR markers

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SSRs are prerequisite for marker assisted wheat breeding programs. For the genetic diversity analysis, a total of 177 heat stress-responsive gene(s) from coding and non-coding regions from wheat genome were searched. All those genes that have previously been shown to impart heat tolerance in transgenic plants by homologous and heterologous over expression and that showed either elevated or decreased expression in response to heat stress were evaluated. Primers were designed from the flanking sequences of the identified microsatellite repeat region. Using gradient PCR conditions, 40 polymorphic SSRs were selected to analyse the genetic diversity analysis. The mean value of PIC was 0.35 with primers in the range of 0.03-0.73. Number of alleles produced per primer varied from 2 to 6, with a mean of 2.58. A UPGMA dendrogram revealed four major clusters among tested wheat genotypes (Fig. 1). Perhaps, this is first comprehensive report on newly developed heat-responsive heat gene and MIR gene based SSRs in wheat and their validation. This study's findings will be useful for marker-assisted breeding efforts targeted at improving heat tolerance, diversity analysis and for characterizing trait specific wheat germplasm.

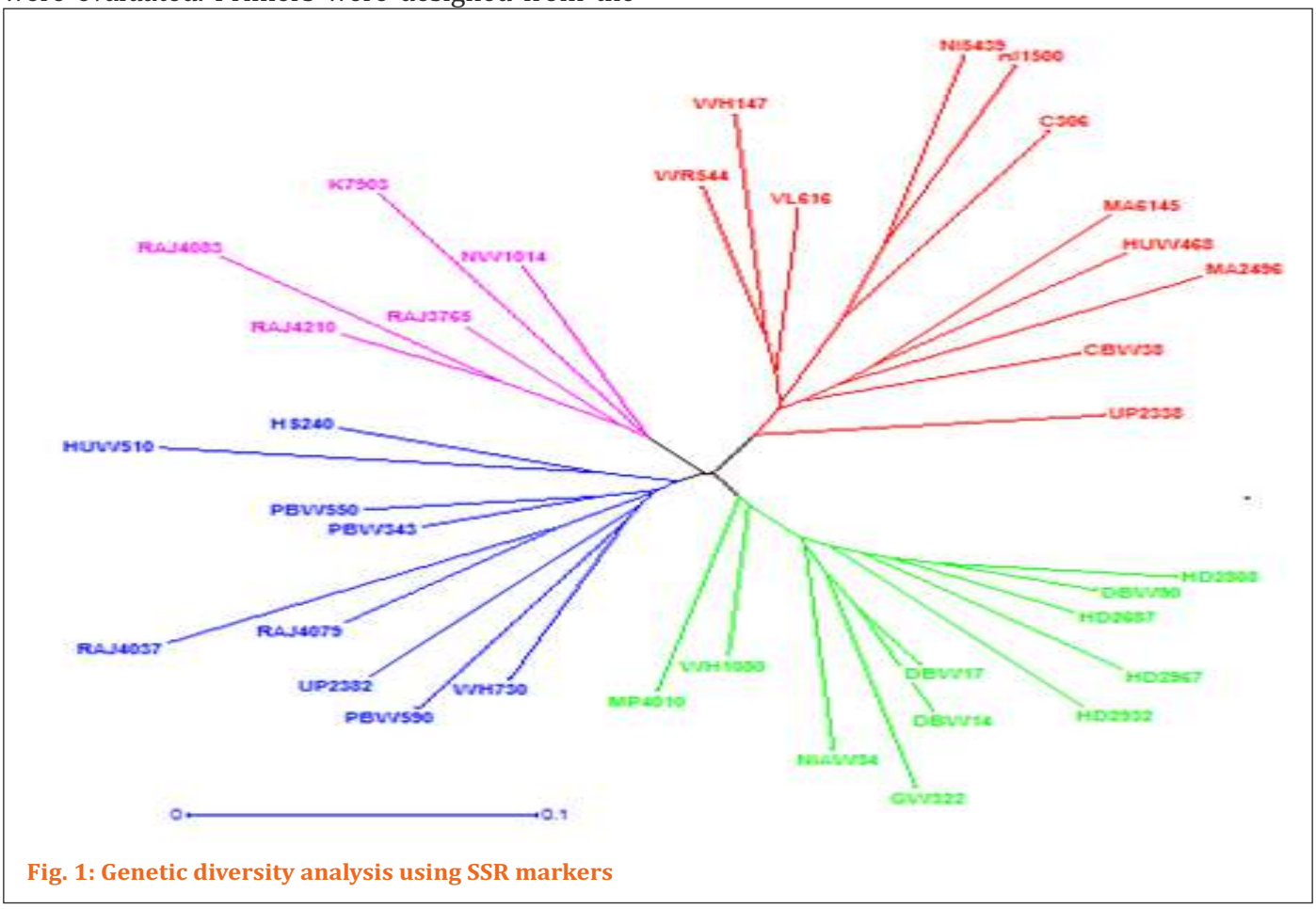

Fig. 1: Genetic diversity analysis using SSR markers

Identification of early maturing and heat tolerant wheat genotypes suitable for North Eastern Regions of India

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Wheat is an important staple cereal crop contributing towards food security. Development and deployment of new varieties having high yield potential coupled with tolerance to prevailing insect pests is required to ensure food security. In India, the North eastern plain zone (NEPZ) has about 9.0 mha area of total wheat area and crop season is relatively shorter and crop experiences terminal heat stress. Warmer temperatures have already been determined to be one of the major abiotic factors in slowing the wheat productivity growth in South Asia and globally and estimated yield losses in South Asia that can range from 6 to 10% per degree rise in temperature during the grain-filling period. In view of these constraints the present study was undertaken to identify early maturing and heat tolerant wheat genotypes. A set of 50 wheat genotypes including five checks (DBW14, DBW187, HD2967, RAJ3765 and Sonalika) were evaluated under timely sown (normal environment) and late sown (heat stress environment) conditions at four locations (NDUAT, Ayodhya, BCKV, Kalyani, BAU, Sabour and BAU, Ranchi) in NEPZ during 2020-21 crop season. The reduction was observed in the days to heading (9%), days to maturity (10%), plant height (5%), thousand grains weight (5%) and grain yield (18%). The genotypes Raj3765, NEST-20-13, NEST-20-16, NEST-20-27, NEST-20-14 and NEST-20-36 had minimum reduction in yield under late sown conditions. Heat susceptibility index (HSI) classified the genotypes into three categories; heat tolerant HSI <0.8 (17 genotypes), moderately tolerant HSI >0.8 to <1.0 (8), moderately susceptible HSI >1.0 to <1.2 (9 genotypes and highly susceptible HSI>1.2 (16 genotypes). The best five heat tolerant genotypes ranked as RAJ3765>NEST-20-13>NEST-20-16>NEST-20-27>NEST-20-14>NEST-20-36 as per calculated HSI (Table 3). The earliest maturing genotypes identified in the study ranked as SONALIKA >NEST-20-27>DBW 14 >NEST-20-37>NEST-20-26>NEST-20. Based on both low HSI and earliest maturity the genotypes NEST-20-27, NEST-20-37, NEST-20-26, NEST-20-25 and NEST-20-39 were identified to be the best performing as compared to the checks. These genotypes can be used as donors to improve heat tolerance and also to develop early maturing genotypes suited for North eastern conditions.

Table 3: Entries exhibiting high heat tolerance along with earliness in maturity.

Entry	Days to maturity	Timely Sown	Late Sown	HSI	HSI Rank
NEST-20-36	117	36.08	35.25	0.13	2
NEST-20-13	117	33.36	32.33	0.17	3
NEST-20-16	113	35.00	33.61	0.22	4
NEST-20-14	115	37.00	35.44	0.24	5
NEST-20-27	110	42.69	40.89	0.24	6
NEST-20-31	114	39.92	38.22	0.24	7
NEST-20-17	113	38.75	35.64	0.45	8
NEST-20-41	112	44.78	40.92	0.48	9
NEST-20-2	114	42.25	38.53	0.49	10
NEST-20-23	112	44.83	40.78	0.51	11
Raj3765 (C)	113	41.97	41.58	0.05	1
HD2967 (C)	113	42.75	38.11	0.61	14
DBW187 (C)	112	43.22	36.86	0.82	18
Sonalika (C)	110	47.17	39.36	0.93	22
DBW14 (C)	110	41.11	29.14	1.46	41

Evaluation and identification of wheat genotypes for spot blotch resistance

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Spot blotch is an important fungal disease of wheat caused by *Bipolaris sorokiniana* causing yield losses ranging 15–25%. Host resistance is recognized as an economical and eco-friendly approach of managing spot blotch. Therefore, the present study was undertaken to identify new sources of spot blotch resistance. A set of 64 genotypes including few genetic stocks alongwith susceptible check Sonalika were evaluated for spot blotch resistance. The genotypes were planted in the polyhouse in the first week of December, 2020 in a single row plot of 1m length keeping row to row and plant to plant distance was 25 cm and 5 cm, respectively at ICAR-IIWBR, Karnal. Mixture of susceptible genotypes was planted as spreader rows at borders and also after every ten rows to promote disease development and spread. Spot blotch disease was created artificially using a mixture of *B. sorokiniana* isolates collected from Faizabad, Pantnagar, Coochbehar and Kalyani, which are identified at hot spot locations of spot blotch incidence and were multiplied on sorghum grains. The infected sorghum grains were then sprayed in between the planted rows as well as in the spreader rows. Apart from that the spores were harvested in water from the infected sorghum grains. The spore suspension was adjusted to about 10^4 spores/ml of water was evenly sprayed at three different Zadoks growth stages (25), viz., tillering (GS-20), flag leaf emergence (GS-37) and anthesis (GS-65) in the evening hours. To maintain sufficient humidity, misting as well as irrigation was given to the plants after inoculations. Disease assessment was done for each plot visually at early dough stage (GS-83) as per Zadoks scale. Recording of spot blotch incidence was done following a double-digit scale (00–99) as a modification of Saari and Prescott's severity scale. Based on disease severity, the genotypes were classified into six groups viz., highly resistant (0-10), resistant (11-20), moderately resistant (21-40), moderately susceptible (41-60), susceptible (61-80) and highly susceptible (81-99) based on disease severity. Out of 64 lines, 11 genotypes were recorded as highly resistant, 7 resistant, 5 moderately resistant,17 moderately susceptible, 14 susceptible and 10 highly susceptible. The genotypes Chirya 1, GS/2019-20/5048, GS/2019-20/9003, Chirya1, Chirya 3, PAU16060, GS/2019-20/3023, GS/2019-20/5032, GS/2019-20/7012 and EHT-3/2019-20-403 were recorded highly resistant to spot blotch (Table 4) whereas, genotypes DBW 46, FLW 13, FLW 31, PAU 16058, Sonalika, WH 147, GS/2019-20/4036, GS/2019-20/4045, GS/2019-20/4046 and GS/2019-20/4057 were recorded as highly susceptible. These identified sources can be used as donors for enhancing spot blotch resistance in wheat.

Table 4: Spot blotch score and pedigree information of genotypes evaluated

Entry	Code	Days to heading	Spot blotch score	Pedigree
SB-21-42	GS/2019-20/5048	88	03	KACHU/DANPHE*2//KENYA SUNBIRD/KACHU
SB-21-53	GS/2019-20/9003	78	03	BECARD/FRNCLN//2*BORL14
SB-21-12	Chirya 1	83	13	Chinese Spring/Ag.Cu//Glennson-81/3/Alondra/Pavon76/4/Ningmai-4/Olesen//Alondra/Yangmai-4
SB-21-1	Chirya 3	76	23	CHINESE PRING/AG.CU//GLENNSON-81/3/ALONDRA/PAVON-76/4/NINGMAI- 4/OLESEN//ALONDRA/YANGMAI-4

SB-21-10	PAU 16060	84	24	*T. durum* cv. WH868-*Ae. caudata* acc. 3556 amphiploid/CS Ph1//2*WL 711
SB-21-23	GS/2019-20/3023	78	24	MUCUY*2//SUP152/BAJ #1
SB-21-39	GS/2019-20/5032	77	24	BORL14*2/8/REH/HARE//2*BCN/3/ CROC_1/AE.SQUARROSA (213)// PGO/4/HUITES/5/T.DICOCCON PI94624/AE.SQUARROSA (409)// BCN/6/REH/HARE//2*BCN/3/ CROC_1/AE.SQUARROSA (213)// PGO/4/HUITES/7/MUTUS
SB-21-46	GS/2019-20/7012	84	24	MUCUY/3/SWSR22T.B./2*BLOUK #1//WBLL1*2/KURUKU
SB-21-58	EHT-3/2019-20-403	79	24	KUTZ//KFA/2*KACHU
SB-21-64	Sonalika (Susceptible check)	78	89	II-53-388/ANDES//(SIB)PITIC-62/3/LERMA-ROJO-64

Trait discovery for novel spot blotch resistance sources in wild barley

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Spot blotch (SB) caused by *Cochliobolus sativus* is a very devastating global fungal disease (Fig. 2) of barley prevailing around the world, particularly in warmer and humid areas. In India, the disease is a major hindrance in growing healthy crop of barley and wheat in the North Eastern Plains Zone. However, it has recently been showed its prevalence in the North Western Plains Zone due to climate change with somewhat hotter winters. The pathogen causes a significant biomass and yield losses to the crops under severe incidence resulting in complete burning of green foliage including spike infection due to rapid killing of plant parts.This is a polycyclic disease and its inoculum survives through plant debris as well as soil and known for its fast-dispersing capacity due to its air borne conidia under favourable environmental conditions. Since there is a lack of resistance to the fungal pathogen in the existing popular barley varieties in India, some new resistance sources against SB, either within or outside cultivated barley are much sought after. Amidst the global climate change, the fungal pathogens are evolving at a rapid pace. Therefore, the genetic base must be broadened involving novel resistance sources. Further, the diversity of resistance in the primary gene pool of barley is low. Hence, the wild relatives particularly the ancestral species of cultivated

Fig. 2: Very high levels of spot blotch incidence on infector and test material at BHU, Varanasi during crop season 2020-21.

barley *Hordeum spontaneum,* which are readily crossable with *Hordeum vulgare,* are considered to be important sources of SB resistance.

In the present study, with an objective of identification of novel sources, a set of 49 wild barley (*H. spontaneum*) accessions subjected to spot blotch phenotyping during rabi 2020-21. Out of the total 49 accessions, 45 accessions were received from ICARDA gene bank, Morocco with IG numbers, for utilization in India for barley pre breeding program, while the rest four were sourced from IIWBR gene bank at Karnal. Since SB is a more pronounced problem in the Eastern India, a set of 49 wild barley (H. spontaneum) accessions were evaluated for SB resistance under hotspot/artificial inoculation at B.H.U Varanasi and NDUA&T, Kumarganj, Ayodhya during rabi 2020-21.

The data were recorded on three consecutive observations at both the places following the double-digit scoring method as being used in AICRP Wheat and Barley (Table 5). Based on the highest scores attained at two locations, 13 accessions were found to be highly resistant (maximum DD score up to 24) (Table 5), while 13 others were observed as moderately resistant (DD score up to 45). Another 19 accessions were categorized as moderately susceptible (DD score between 46-57), whereas 4 accessions ranged from susceptible to highly susceptible (DD score > 67).

The results clearly revealed that *Cochliobolus sativus* could infect the *H. spontaneum,* however, there were several accessions observed as resistant. As these accessions are of diverse geographic origin (mostly west Asia), they are expected to provide the required genetic diversity for SB resistance in the Indian barley improvement program.

Table 5: Wild barley accessions resistant to spot blotch

S.N.	Accession	BHU Varanasi			NDUA&T Kumarganj			Reaction type
		15/02	25/02	07/03	17/03	24/03	31/03	
1	IG142486	NG	NG	NG	00	13	24	R
2	IG144113	00	01	02	00	24	23	R
3	IG144933	00	01	24	12	24	24	R
4	IG144951	00	01	13	12	12	24	R
5	IG145494	00	01	24	00	12	24	R
6	IG145498	00	12	24	00	12	24	R
7	IG145539	00	01	02	01	12	24	R
8	IG145556	00	02	24	00	12	24	R
9	IG145602	01	02	24	00	13	24	R
10	IG145604	00	01	24	00	13	24	R
11	IG145610	00	01	13	00	12	24	R
12	IG146811	00	00	02	00	24	24	R
13	PI-212305	00	01	24	01	12	24	R
	Infector	35	68	89	35	78	78	HS

Novel sources of aphid resistance in wild barley

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Corn leaf Aphid (CLA), *Rhopalosiphum maides* (Fitch), is considered as one of the devastating insect-pest of barley causing about 14-27 % yield losses under severe infestation. Aphids cause damage to shoots and ear heads by sucking the plant sap. The shoots turn yellowish in colour and the whole plant gives stunted appearance, while under severe incidence sometimes even the spikes fail to emerge causing absolute loss of grains. Currently, the aphid damage is managed mainly by

repeated insecticidal application but use of chemical control adds to the input cost of the small holder farmers for barley, which is primarily considered to be a low input crop. Moreover, the evolution of insecticide resistance, with some species exhibiting resistance to multiple insecticidal classes is another issue for need of host resistance. Therefore, incorporation of genetic resistance in barley can be considered as the best alternative to manage aphids as it will be sustainable, cost-effective and environmentally safe.

In literature, it is reported that wild genotypes have prominent resistance against diseases e.g., rusts and also against insects like aphids. The reports of Russian wheat aphid (*Diuraphis noxia* Mordvilko) resistance in wild wheats are available in literature. Since resistance is present in wild wheat against Russian wheat aphid, it was hypothesized that similarly there exists a possibility of having tolerance against aphid species in wild barley. Keeping this in view, the present study was planned to identify sources of aphid resistance in wild barley against corn leaf aphid (CLA), under screen house conditions. A total of 49 wild barley (*Hordeum spontaneum*) accessions (45 received as IG numbers from ICARDA Morocco and 4 from IIWBR Genebank) were screened against CLA under artificial epiphytotic conditions during Rabi season, 2020-21 at ICAR-IIWBR, Karnal. The aphid infestation recording as aphid counts/shoot were done three times during the season and grades were given according to 1-5 points scale as described in Table 6.

Amongst 49 tested accessions, a total of 10 accessions (IG nos.135854, 144123, 144128, 144157, 144161, 144898, 145504, 145523, 145528, 145604) were found to be in resistant category rating (Score-2), while 12 accessions (IG nos. 39565, 142356, 144116, 144117, 144911, 145080, 145155, 145597, Chiwo-15488, EC-286059, PI-220523 and PI-212305) showed moderately resistant aphid response (Score-3). Susceptible aphid resistance response (Score-4) was expressed in 15 genotypes and highly susceptible response was shown in 12 genotypes (Table 7).

The differential behaviour of aphid response to H. spontaneum genotypes clearly indicates that there is wide genetic diversity available among these genotypes. This can be further be verified with multilocation evaluation for utilization in barley breeding program in country, where still we lack this trait in released cultivars.

Table 6: Grading and rating of aphid infestation used for screening barley accessions and their frequency.

Grade	Approx. numbers of aphids/shoot	Rating	# Accessions
1	0	Immune	0
2	1-5	Resistant	10
3	6-10	Moderately resistant	12
4	11-20	Susceptible	15
5	21 and above	Highly susceptible	12

Table 7: Evaluation of wild barley accessions for aphid resistance during rabi 2020-21.

S.N.	IG-Accession	Score	SN.	IG-Accession	Score	SN.	IG-Accession	Score
1	38780	5	18	144129	4	35	145504	2
2	38931	5	19	144157	2	36	145508	5
3	39127	4	20	144161	2	37	145523	2
4	39565	3	21	144898	2	38	145528	2
5	135854	2	22	144903	4	39	145539	4

6	142356	3	23	144911	3	40	145556	4
7	142486	5	24	144913	5	41	145597	3
8	144112	4	25	144927	4	42	145602	4
9	144113	5	26	144930	5	43	145604	2
10	144114	4	27	144933	5	44	145610	4
11	144116	3	28	144951	5	45	146811	4
12	144117	3	29	144983	4	46	Chiwo-15488	3
13	144121	5	30	145080	3	47	EC-286059	3
14	144123	2	31	145155	3	48	PI-220523	3
15	144124	5	32	145494	5	49	PI-212305	3
16	144127	4	33	145498	4			

DWRNB28: A potential huskless barley genotype for better nutritional quality

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ICAR-Indian Institute of Wheat and Barley Research, Karnal

Barley is an important course cereal grain crop which ranks fourth after rice, wheat and maize in the world. The crop is mainly utilized for animal feed, malting and human food purposes globally in this order. In India, as a common practice barley flour is being mixed with wheat and gram to make chapattis more nutritious in rural areas of northern plains and hills, particularly in Rajasthan, Uttar Pradesh and Bihar since old time. Due to changing in the life style, diabetes and heart attack diseases are becoming prominent in India as well as worldwide. In this respect, hulless barley may play a critical role to reduce the effect of both diseases. A large portion of human diet consists of cereals which are important sources of minerals/ nutrients especially micro nutrients like Iron (Fe), Zinc (Zn), Iodine (I) and Selenium (Se). To identify a genotype with higher micronutrients is essential and also useful in improving nutritional quality of the crop.

A set of 22 genotypes of hulless barley involving 15 exotic lines, 2 released cultivars, 3 advanced breeding lines, 1 each registered germplasm line was evaluated for nutritional quality traits i.e., Iron (Fe) and Zinc (Zn). The genotypes were grown at ICAR-IIWBR, Karnal during 2020-21 crop season for nutritional quality evaluation and the grain samples were analyzed for iron and zinc content by atomic absorption spectroscopy (AAS) method at quality laboratory of ICAR-IIWBR, Karnal (Table 8). DWRNB28, a two-row huskless barley introduction as INBYT(2013)-HI-6, ICARDA derived from the cross (NACKTA/ HJAA33//FNC1) was found to possess higher values of iron (42.4 ppm) and zinc content (43.4 ppm). These values were superior over the hulless cultivars as well as registered genetic stocks for iron and zinc content. It is having a unique combination of higher Fe and Zn contents better than the released huskless check cultivars and two genetic stocks DWRB191 and DWRB192 already registered for Fe and Zn contents, respectively. It was closely followed up by few other genotypes like DWRNB5, KNB20-11, INBON 2016-69, INBYT-HI 2017-4 and check NDB 943.

It was also evaluated for agro-morphological traits at ICAR-IIWBR, Hisar and for disease reaction (stripe rust at 5 locations) during 2015-16 and 2016-17 in Initial Barley Disease Screening Nursery (IBDSN) under artificial epiphytotic conditions. The genotype revealed immune to higher resistance against stripe rust (ACI=0.0 HS=0) and (ACI=3.0 HS=15MS), respectively at adult plant stage (Table 9). DWRNB28 possess good agronomic features with dwarf plant type (plant height of 64.4 cm), medium duration for

flowering (86 days) and maturity (118 days). It is highly resistant to stripe rust, the most common disease of Northern plains of India. Hence, DWRNB28, is a hulless barley genotype with a combination of better nutritional quality, good agronomic traits and high resistance to stripe rust, which can serve as a potential donor in food barley improvement program in country.

Table 8: Nutritional quality of new barley genotypes during 2021.

S.N.	Name of genotype	Row Type	Iron (ppm)	Zn (ppm)
1	DWRNB5	2	40.4	42.5
2	DWRNB20	2	37.7	41.1
3	DWRNB28	2	42.4	43.4
4	KNB-20-11	2	41.1	42.2
5	INBON- (2016)-24	2	35.1	39.4
6	INBON- (2016)-69	2	41.8	43.0
7	INBON- (2016)-72	2	36.4	38.7
8	DWRFB40	6	37.7	40.6
9	DWRFB58	6	37.7	39.4
10	BCU6220	6	35.7	41.5
11	DWRNB14	6	36.4	41.5
12	DWRNB17	6	37.7	41.3
13	DWRNB23	6	36.4	38.0
14	INBYT-HI- (2013)-8	6	37.7	39.9
15	INBYT-HI- (2017)-21	6	35.7	42.0
16	INBYT-HI-(2017)-23	6	37.7	38.0
17	INBYT-HI-(2017)-4	6	41.1	44.4
18	INBON-(2017)-48	6	37.1	40.1
19	NDB943 (C)	6	39.7	42.0
20	PL891 (C)	2	37.7	38.9
21	DWRB191 (RG)	2	39.1	40.6
22	DWRB192 (RG)	2	37.1	40.4

Table 9: Disease reaction of DWRB28 in IBDSN during 2015-16 and 2016-17.

Genotype	Stripe rust reaction			
	IBDSN (2015-16)		IBDSN (2016-17)	
	ACI	HS	ACI	HS
DWRNB28	0.0	0	3.0	1 5MS
Karan16	17	40S	29	60S
NDB 943	80	100S	80	100S
Infector	66	100S	84	100S

ACI= average coefficient of infection, HS= highest score across all locations

Identification of novel sources for soil salinity tolerance in wild barley

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The importance of soil salinity tolerance in barley is immense primarily because it is generally cultivated in inferior soils having high amount of soluble soil salts and secondarily because in many studies the soil salinization has been predicted to increase in near future in India. The popular cultivated barley varieties lack a high degree of soil salinity tolerance and suffer significant yield loss under saline environments. The tolerant accessions from cultivated barley are reported in extremely low frequency and they are not providing very effective tolerance under highly saline-alkaline or brackish water environments. Therefore, in order to have the diverse and effective tolerance for soil salinity in barley, the trait needs to be supplemented with diverse sources, particularly the wild barley. In this context, the direct ancestor of cultivated barley i.e.Hordeum spontaneum, is one of the most important resources. In the present study, with an objective of identification of novel sources, a set of 49 wild barley (*H. spontaneum*) accessions was subjected to soil salinity tolerance evaluation during rabi 2020-21 at IIWBR Research Farm Hisar (Fig. 3). Out of the total 49 accessions, 45 accessions were received from ICARDA gene bank, Morocco with IG numbers, for utilization in India for barley pre breeding program, while the rest four were sourced from IIWBR gene bank at Karnal.

The test material was grown at IIWBR Seed and Research Farm, Hisar during Rabi 2020-21 crop season in the pre-identified area with defined salinity levels. The experimental field had an electrical conductivity (EC) of 13.33 dS/m and a pH of 8.26. The EC of the irrigation water was 7.5 dS/m and the pH was 7.5. The crop was grown under irrigated conditions with recommended fertilizer application in paired rows of 2 m length at 30 cm apart. The initial germination of the test material was good and crop growth progressed well till about one month and thereafter the salinity stress impact in terms of seedling mortality and reduced growth and vigour started appearing in the susceptible lines. The final phenotypic score based on survival, overall growth and vigour of the genotypes on 0-5 scale, where 0= highly susceptible and 5=highly tolerant genotypes was recorded for all the genotypes at flowering stage.

Based on the highest scores attained, 23 accessions were found to be highly tolerant

Fig. 3: Very high levels of salinity for screening of test material at IIWBR Seed Farm Hisar during Rabi 2020-21.

(score 5) (Table 10), while 8 accessions were recorded as tolerant (score up to 4). Rest of the 18 accessions had a score of <3.0 and were categorized as moderately susceptible, susceptible or highly susceptible. Therefore, the study indicated with preliminary screening that the effective diverse tolerance for soil salinity from these wild barley accessions are available, for supplementing the salinity tolerance in cultivated barley.

Table 10: Evaluation of wild barley accessions for salinity tolerance during rabi 2020-21.

S.N.	IG-Accession	Score	S.N.	IG-Accession	Score	S.N.	IG-Accession	Score
1	38780	4	18	144129	5	35	145504	5
2	38931	3	19	144157	4	36	145508	5
3	39127	3	20	144161	5	37	145523	5
4	39565	2	21	144898	5	38	145528	5
5	135854	4	22	144903	3	39	145539	5
6	142356	4	23	144911	0	40	145556	5
7	142486	3	24	144913	4	41	145597	5
8	144112	5	25	144927	5	42	145602	4
9	144113	4	26	144930	5	43	145604	0
10	144114	5	27	144933	3	44	145610	5
11	144116	5	28	144951	3	45	146811	2
12	144117	5	29	144983	0	46	Chiwo-15488	5
13	144121	5	30	145080	4	47	EC-286059	5
14	144123	5	31	145155	0	48	PI-220523	5
15	144124	5	32	145494	3	49	PI-212305	5
16	144127	0	33	145498	2			
17	144128	5	34	145502	1			

Promising malt barley genotypes in pipeline

Lokendra Kumar, Dinesh Kumar, Rekha Malik, Jogendra Singh, Chuni Lal, SK Bishnoi, AS Kharub, Omvir Singh and RPS Verma

ICAR-Indian Institute of Wheat and Barley Research, Karnal

Barley is an important cereal crop of the world since time immemorial. It is utilized for various purposes including feed, food and as a raw material for malting and brewing industries. Barley grain is considered as the base of malting and brewing industries. The quality of malt based industrial products largely depend upon the quality of raw materials utilized. Therefore, to meet out the industrial demands of quality raw materials, development of high yielding and superior genotypes of malt barley is of prime importance. Breeders utilize the available variability to create diversity, followed by selection of superior progenies and finally fixed breeding lines are developed and further tested at multi-locations for yield assessment. The best performing lines are later released as varieties for commercial cultivation after evaluation in AICRP Wheat and Barley trials.

In the present experiment, a set of 24 advanced bulks of two-row malt barley and 4 check cultivars (DWRB123, DWRB160, DWRB182 and RD2849) was evaluated for grain yield and its components, yellow rust reaction, bold grain proportion (%), test weight (Kg/hl), TGW (g), Protein (%), Grain Beta glucan (%), Filtration Rate (ml/hr), Diastatic power (0L), HWE (%fgdb), Kolbach Index and weighted Malt Quality Score at ICAR-IIWBR, Karnal. New genotypes like, MBST6, MBST22 and MBST23 are having higher diastatic power (>1100 L) with higher grain protein and HWE levels, while others like MBST7, MBST9 and MBST21 have comparable MQ scores to that of checks (Table 11).

The study indicates that there exists a possibility to combine the higher grain yield, disease resistance with better malting quality in desirable back grounds. These genotypes may be further utilised in malt barley improvement programme to get further genetic gain for desirable traits required by malting and brewing industry.

Table 11: Promising advance bulks of malt barley identified.

Genotype	Parentage	Yield (q/ha)	Yellow rust ACI (HS)	% Bold	HW (Kg/hl)	TGW (g)	Protein (%)	FR (ml/hr)	DP (0L)	HWE (%)	KI	MQ Score (21)
MBST-6	DWR28 /BH902	56.38	8.8	96.9 (20S)	69.2	50.2	12.0	145	120	81.1	39	17
MBST-7	DWRUB52 /BH885	57.43	2.5	95.1 (10S)	70.7	50.9	11.6	310	81	77.4	35	16
MBST-9	DWRB101 /DWR28	61.36	0.1 (TMR)	97.2	69.3	53.4	11.1	270	96	81.0	37	18
MBST-21	DWRB101 /DWRB123	57.15	1.3 (5S)	92.4	69.4	52	11.8	290	86	82.7	33	17
MBST-22	DWRB123 /DWR28	57.60	2.0 (10MS)	97.9	69.4	54.6	13.0	295	110	80.0	35	18
MBST-23	DWRUB52 /DWR81	54.53	5 (20S)	98.0	69.0	53.9	12.1	305	116	81.1	37	19
DWRB123 (c)	DWRUB54 /DWR51	54.8	--	95.8	70.8	54.80	11.9	-	-	-	-	-
DWRB160 (c)	DWRB62 /DWRB73	52.91	5 (10S)	98.2	66.7	52.91	10.2	210	90.1	76.5	38	15
DWRB182 (C)	DWRUB52 /DWRB78	45.16	5.3 (20MS)	85.6	66.3	45.16	12.4	295	105.3	75.5	34	16
RD2849 (c)	DWRUB52 /PL705	49.68	2 (5S)	85.6	71.5	49.68	11.9	320	84.0	78.6	36	17

GW = Thousand grain weight (g); HW = Hectoliter Weight (kg/hl); Bold = Bold grains (%); Protein (%); FR = Filtration rate (ml/hr); HWE= (Hot water extract fine grind dry weight basis); KI = Kolbach Index MQ Score= weighted malting quality score max 21.

SUCCESS STORY

Efficient seed delivery to the farmers through registration on IIWBR Seed Portal

AK Sharma, CN Mishra, Umesh Kamble, Poonam Jasrotia and GP Singh

ICAR-Indian Institute of Wheat and Barley Research, Karnal

ICAR-IIWBR, Karnal has developed seed portal to supply the TL seed of recent wheat & barley varieties viz., DBW 303 (Karan Vaishnavi), DBW 187 (Karan Vandna) DBW222 (Karan Narendra) and DWRB 137 for the farmers. The seed portal was designed and executed through IIWBR website during the September month. All the interested farmers were allowed to provide needful information including his/her name, village, mobile number, district and state, upload soft copy of Aadhar card, select the variety and quantity of seed to be purchased. After that he/she received an OTP on his/her mobile and then a message was sent to all such farmers that their request has been registered with the IIWBR. This facility was utilized by about 5000 farmers from different states like Haryana, Punjab, U.P., Bihar, MP and Rajasthan, who successfully registered on the portal during 10.9.2021 to 23.9.2021. The portal was closed after the successful registration of the farmers as per the seed availability. The major task before the institute was to distribute the seeds to the registered farmers. The farmers

were then grouped into clusters as per their districts and states, accordingly farmers were informed through bulk SMS sent during 8th October to 15th October 2021 to come and collect the indented/ allotted seed on specific date and time. The institute then organized seed distribution through five counters so as to follow COVID-19 guidelines of social distancing and options for digital modes of payment (QR code, net banking or card swipe) were given. This way, IIWBR has distributed >500q TL seed of indented wheat and barley varieties consecutively from last two years to the farmers through this updated IT technology driven and user friendly tool as most of the farmers were really happy and satisfied to receive the seed of recent varieties conveniently.

INSTITUTIONAL ACTIVITIES

60th All India Wheat and Barley Research Workers' Meet

The 60th All India Wheat and Barley Research Workers' Meet was organized at ICAR-Indian Institute of Wheat and Barley Research, Karnal in virtual mode during August 23-24, 2021. The meet was inaugurated by Dr. T. Mohapatra, Secretary, DARE and Director General, ICAR, New Delhi. The

other dignitaries who graced the occasion were Dr. TR Sharma, DDG (Crop Science); Dr. YP Singh, ADG (FFC); Dr. AK Singh, ICAR-IARI; Dr. NK Singh, ICAR-NIPB; Dr. Sanjay Kumar, ICAR-IISS; Dr. Ravi Singh, CIMMYT; Dr. AK Joshi, CIMMYT; Dr. Michael Baum, ICARDA; Dr. Harbans Bariana, University of Sydney and Dr. Ashutosh Sarker, ICARDA. After the inauguration, sessions on review of the research progress of 2020-21, followed by five-year appraisal of the north eastern plains zone centres and planning of ensuing 2021-22 crop season were organized. In addition, one session on international collaboration with the CIMMYT, ICARDA, ACIAR and JIRCAS was held wherein the past collaborative research and future prospects were deliberated. The work plan meetings for finalization (discipline wise) of activities for season 2021-22 were held before the actual virtual meeting. The meeting of Crop Improvement was held on August 03, 2021, Crop Protection and Quality and Basic Sciences on August 05, 2021, Barley Network on August 07, 2021, Resource Management and Social Sciences on August 10, 2021. Varietal Identification Committee (VIC) meeting was held under Chairmanship of Dr. TR Sharma, DDG (CS) on August 23, 2021 and has identified 9 wheat varieties and also recommended area extension of 2 wheat and one barley variety.

Days of National and International Importance

ICAR Foundation Day

The ICAR-IIWBR celebrated the 93rd Foundation Day of ICAR on July 16, 2021. On this occasion plantation programme was organized and number of saplings were planted on the premises of ICAR-IIWBR.

Women Farmer Day

Women Farmer Day was celebrated on 15.10.2021 at Pragati Samajsewi Sansthan, Karnal in which 130 women farmers from different villages of Karnal participated.

World Food Day

World Food Day was celebrated on October 16 with 120 school children from Govt. Senior Secondary School, village Subri, Karnal. Students were sensitized on the need of balance diet for healthy life style.

Constitution Day

Constitution Day (National Law Day) was celebrated to commemorate the adoption of the constitution of India on 26th November 2021.

Agricultural Education Day

On the occasion of Agricultural Education Day, students from Govt. Senior Secondary School, Sangoha and Kutail visited the various laboratories of IIWBR, Karnal and interacted with scientists on 3rd December, 2021.

World Soil Day

World Soil day was celebrated at village Furlak on 5th December, 2021 and campaigned on "Halt Soil Salinization, Boost Soil Productivity". The main objective of this programme was to raise the awareness on the importance of maintaining healthy ecosystem and human well being by addressing the growing challenges in soil management, fighting soil salinization, increasing soil awareness and encouraging societies to improve soil health.

National Farmer Day

National Farmer Day was organized at village Amritpur Khurd on 23rd December, 2021.

Swachchhta Pakhwada Organized

Under the Swachchata Pakhwada (December 16-31, 2021) ICAR-IIWBR, Karnal organized various activities such as cleanliness drive of offices and corridors, review of weeding out of old records, awareness campaign on water conservation, safe disposal of all kind of waste, cleanliness drive of public places, poster competition among school going children programme, awareness campaign on waste management etc.

Sanitation Campaign at Karan Lake near village Uchana, Karnal on 24.12.2021

Azadi ka Amrit Mahotsav

As a part of Azadi ka Amrit Mahotsav, Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI, Mysore delivered the lead lecture on "Swasth Bharat: Nutritional challenges with Daal Roti" organized by ICAR-IIWBR, Karnal on 21.08.2021

Hindi Diwas and Rajbhasha Utsav Programme

Hindi Diwas was celebrated on 14th September, 2021 and a fortnight Rajbhasha Utsav programme was organized during 14-30 September, 2021. Dr. GP Singh, Director, ICAR-IIWBR, Karnal motivated the officials to do the noting in Hindi (Devnagri lipi) rather than english.

Meetings Organized

Farmers-Scientist Interface meeting

Farmers-Scientists Interface on climate resilient varieties, technologies and systems was organized for farmers on 28th September, 2021. Around 200 farmers from Gharaunda and Nilokheri participated in the programme. They also watched the virtual inauguration of NIBSM, Raipur by Hon'ble Prime Minister.

Training and Extension Programme

Awareness/Plantation/Exhibition Programmes

- Awareness Programme on Nutri Rich Cereals and tree plantation programme was organized at village Gagsina on 17th August, 2021.
- Tree plantation programme was organized at village Nabipur on 28.08.2021. On this occasion, around 100 saplings of Arjun, Jamun, Neem were planted through active participation of the farmer on the boundary of playground.
- Goshthi and Exhibition at KVK Tepla, Ambala was organized under Azadi ka Amrit Mahotsav on 04.09.2021 under the theme "Food and Nutrition for farmers: Women Self Group Efforts.
- An awareness programme on "Waste to Wealth" was organized at Kunjpura village for the farmers and at Govt. Senior Secondary School, Kunjpura, Karnal for school children on 12.10.2021.
- An awareness programme for school children on "Krishi me sah-udyamita evam rojgaar kee sambhawnao" was organized under the aegis of Azadi Ka Amrit Mahotsava on 26th November, 2021.
- Farmer's awareness programme organized on promotion and popularization of nutri-dense and disease resistant wheat varieties for higher productivity and prosperity at KVK, ICAR-IISR Lucknow, Uttar Pradesh on 28th December, 2021.

Farmer's awareness programme at KVK, ICAR-IISR Lucknow, Uttar Pradesh on 28th December, 2021.

Trainings

- Four days hybrid mode (virtual+physical mode) training programme was organized on "Technological interventions for rural entrepreneurship & farmers' prosperity in eastern India" at ICAR-IIWBR, Karnal during 27-30th July, 2021. Around 50 scientists from various KVKs from NEPZ attended the programme.

Training programme at ICAR-IIWBR, Karnal.

- Ten days online training Programme was organized in collaboration with EEI, Nilokheri on "Effective extension methods for upscaling and outscaling of wheat and barley production technologies" during September 1-10, 2021.
- One day training programme on "Promotion and popularization of wheat varieties" was organized at KVK Kashipur, Uttarakhand on 10th September, 2021.

Training programme at KVK Kashipur, Uttarakhand (10th September, 2021)

- One day training programme on "Promotion and popularization of wheat varieties" at Seed Research and Farm, Hisar on 5th September, 2021.

Training programme at Seed Research and Farm, Hisar (5th October, 2021)

- Three days (October 23-25, 2021) training programme on "Uttarkhand me Gehun evam Jau ki unnat kheti" was organized for 50 farmers from Dehradun district of Uttarakhand.
- Three days training (30th November to 2nd December, 2021) programme on "Uttarakhand me gehun evam Jau ki unnat kheti" was organized for 20 farmers from Nainital district of Uttarakhand.
- A three days training (6-8 December, 2021) programme on "Uttarakhand me gehun evam Jau ki unnat kheti" was organized for 20 farmers from Chamoli district of Uttarakhand and 35 farmers from Haridwar district of Uttarakhand.

Seed day

Wheat and Barley seeds were distributed to farmers by registration through on-line IIWBR seed portal from 18-21st October, 2021. Around 10500 farmers registered themselves in the portal.

Wheat and Barley Seed Distribution at ICAR-IIWBR (18th- 21st October., 2021)

Awards

VS Mathur Memorial Award Lecture

Dr. KV Prabhu, Chairperson, PPV&FRA, N. Delhi delivered the VS Mathur Memorial Award lecture on "Wheat Breeding: A relook with future perspective on sustaining India's food and Nutritional security" organized by Society for Advancement of Wheat and Barley Research and ICAR-IIWBR on September 25th, 2021.

K Ramiah Memorial Award

Dr. GP Singh, Director, ICAR-IIWBR, Karnal for his outstanding contribution in field of agricultural research was conferred with Dr. K Ramiah Memorial Award-2019-20 by the National Academy of Agricultural Sciences. This award was given to him during the XVth Agricultural Research Congress held at BHU, Varanasi on 13th November, 2021.

7th VS Mathur Memorial Award 2020

The Indian Society of Genetics and Plant Breeding conferred the 7th VS Mathur Memorial Award 2020 to Dr. Gyanendra Singh, PI (Crop Improvement), ICAR-IIWBR, Karnal for his outstanding contribution in the field of Wheat Genetics and Breeding.

BP Pal Memorial Life Time Achievement Award-2021

Dr. R Chatrath, Emeritus Scientist was conferred with BP Pal Memorial Life Time Achievement Award-2021 by the Indian Society of Genetics and Plant Breeding.

Distinguished Scientist award

Dr. Sudheer Kumar conferred with distinguished Scientist award in the field of Plant pathology by Astha Foundation, Meerut during VI International Conference in Hybrid Mode on Global Research Initiatives for Sustainable Agriculture & Allied Sciences on 13-15th December, 2021.

Outstanding Scientist Award

Dr Prem Lal Kashyap conferred with Outstanding Scientist Award (2021) in the field of Plant Pathology by Agriculture and Environmental technology Development Society (AETDS), Uttarakhand, India in 3rd International Conference GIAFAS-2021 organised at SGRR University, Dehradun, Uttarakhand, India on October 17-18, 2021.

Visitors

- Sh. Narendra Singh Nehra, Assistant Director (implementation), Rajbhasha, Ministry of Home Affair visited the ICAR-IIWBR, Karnal on 25.10.2021.
- Sh. Sanjay Garg, Additional Secretary, DARE and Secretary, ICAR, New Delhi visited ICAR-IIWBR, Karnal on 25.11.2021.
- Sh. GP Sharma, Director (Finance) visited ICAR-IIWBR, Karnal on 27.12.2021.

Institute Research Council (2021)

The Institute Research Council Meeting (IRC) was held twice during the year 2021. The second IRC meeting was organized during 25th& 26th October, 2021 wherein all the scientists presented their individual research achievements for the year 2020-21, under different institute and externally funded projects.

Infrastructure Developed

Seed Processsing Plant

A fund received under CSIF project to the tune of ₹123 lakhs from DA&FW, Govt. of India and ₹20.0 lakh from revolving fund scheme of ICAR-IIWBR, Karnal were utilized for the creation of 4TPH seed processing facilities at ICAR-IIWBR along with seed godown and shed. This facility was inaugurated by Dr. GP Singh, Director, IIWBR, Karnal on October 8, 2021.

Personnel

Joining

- Shri Ram Avtar Parashar, joined as CF&AO on promotion w.e.f. 30.09.2021 (FN).
- Dr. Vishnu Kumar, Scientist (SS) was on lien and joined back ICAR-IIWBR Karnal on 01.09.2021.
- Shri Sushil Kumar Singh, joined as CAO, on promotion w.e.f. 11.10.2021 (FN).
- Dr. Om Vir Singh, Principal Scientist joined ICAR-IIWBR Karnal w.e.f. 25.10.2021 on transfer.
- Dr. Anuj Kumar, Scientist, joined ICAR-IIWBR Karnal w.e.f. 01.12.2021 on transfer.

Transfers

- Dr. BK Meena, ACTO transferred to ICAR-IARI, New Delhi w.e.f. 09.09.2021 (AN).
- Dr. SK Singh, Prinipal Scientist transferred to ICAR-IARI, New Delhi w.e.f. 07.10. 2021.
- Shri Gajanand Yadav, SAO transferred to ICAR-NDRI, Karnal w.e.f. 07.10.2021.
- Shri Jagdish Chander, F&AO transferred to ICAR-NDRI, Karnal as Sr. F&AO w.e.f. 13.10.2021.
- Dr. Gopalareddy K., Scientist transferred to ICAR-SBI, Coimbatore w.e.f. 13.11.2021.

Promotions

- Dr. Raj Pal Meena promoted from Sr. Scientist- to Principal Scientist w.e.f. 30.3.2020.
- Dr. Hanif Khan promoted from Sr. Scientist- to Sr. Scientist (Level -13A) w.e.f. 07..01.2020.
- Dr. Sonia Sheoran promoted from Sr. Scientist- to Sr. Scientist (Level -13A) w.e.f. 07..01.2020.
- Dr. Satish Kumar promoted from Sr. Scientist to- Sr. Scientist (Level -13A) w.e.f. 21.04.2021.
- Dr. C.N. Mishra promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 20.04.2019.
- Dr. Prem Lal Kashyap, promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 23.04.2019
- Dr. Karnam Venkatesh promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 01.09.2019.
- Dr. Charan Singh promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 15.12.2019.
- Dr. Om Prakash Gangwar promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 27.04.2020.
- Dr. Mamrutha HM promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 02.05.2020.
- Dr. Vikas Gupta promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 15.09.2020.
- Dr. Pramod Prasad promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 15.09.2020.
- Dr. Sendhil R., promoted from Scientist (Sr. Scale) to Sr. Scientist w.e.f. 15.09.2020.
- Dr. Vanita Pandey promoted from Scientist to Scientist Sr. Scale (Level -11) w.e.f. 01.07.2019.
- Shri Vijay Singh promoted to Technical Officer (Field/Farm) w.e.f. 18.10.2020.
- Shri Ishwar Singh promoted to Technical Officer (Field/Farm) w.e.f. 20.02.2021.
- Shri Vinod Kumar promoted to Technical Assistant (T-3) (Workshop) w.e.f. 18.05.2021.
- Shri Ronak Ram promoted to Technical Officer (Field/Farm) w.e.f. 10.5.2021.
- Shri Sunil Kumar promoted to UDC w.e.f. 15.09.2021.

Retirements

- Dr. J. Kumar, Principal Scientist on 31.08.2021
- Sh. Paramjeet Singh, SSS on 31.08.2021
- Shri Ishwar Singh, TO on 31.12.2021