Project FY24-BA-001: Germplasm acceleration for FHB resistance breeding in barley

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1. What are the major goals and objectives of the research project?

Our overall goal was to continue to increase the efficiency with which researchers develop new barley varieties via identification and deployment of genes that contribute to reduction in the losses caused by Fusarium head blight (FHB), especially quality discounts due to the accumulation of mycotoxins such as deoxynivalenol (DON). We work to achieve this by developing doubled haploid (DH) and/or speed-bred germplasm from the F1s of cross combinations identified by collaborating breeders. Homozygous lines are immortal reference stocks that provide unequivocal genotyping and phenotyping data.

Our objective was to produce ~2,000 green plantlets from F1 donor plants supplied by collaborating breeders. From these, we aim to produce ~1,000 fertile DH plants, from which we harvest the seed to ship to collaborating breeders.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address these three items below.)*

What were the major activities?

The following graph shows the chronology of activities during the report period for two production years. Our doubled haploid production cycle is not synchronous with the report timeframe. Therefore, we report the final number of DHs from the 2023-2024 production year and the current number of GPs for the 2024-2025 production year.

Calendar Year	Month	F1s to vernalize	F1s in greenhouse	F1 tillers to lab	Tissue culture	Green plantlets to vernalize	Transplant DH to greenhouse	Greenhouse DH seed production	Harvest DH	Ship seed to cooperators
2024	January									
	February									
	March									
	April									
	May									
	June									
	July									
	August									
	September									
	October									
	November									
	December									
2025	January									
	February									
	March									
	April									
	May									
	June									
	July									
	August									
	September									
	October									
	November									
	December									

What were the significant results?

PRODUCTION YEAR: 2023-24

Project completed in 2025. Tissue culture efficiency by cross noted as green plantlets produced per tillers processed. Final number of doubled haploids produced per cross.

ID	Program	Pedigree	Anthers Plated	Green Plantlets	Green Plantlets/ Tiller	Doubled Haploids
H1	UC Davis	UC Capay/M351//UC Alameda	4,140	25	0.18	6
H2	Minnesota	S2M184/2MS20_3227-003	6,990	119	0.51	51
H3	Ohio State	RIL02FL-029/GHRIL02TIFF-107	3,720	530	4.27	63
H4	Virginia Tech	Avalon/VA21HFHB-19DH0301	1,530	1,017	19.94	343
H5	Nebraska-Lincoln	NB19422/2ND38809//NB20439	5,280	295	1.68	61
Total			***21,660***	***1,986***		***524***

PRODUCTION YEAR: 2024-25

Lab and greenhouse work continued. DH production is ongoing in 2025. Number of green plantlets per cross produced to date during funding period.

ID	Program	Pedigree	Anthers Plated	Green Plantlets	Green Plantlets/ Tiller
N1	Ohio State	FL-029/WI-013-08-01//GHRIL0201-088-03	4,710	308	1.96
N2	Virginia Tech	Greg/DH162310	4,830	867	5.39
N3	Nebraska-Lincoln	NB20439/NB17431	4,560	93	0.61
N4	Nebraska-Lincoln	NB22248/NB22224	4,710	37	0.24
N5	UC Davis	UC1995/UC1322	4,590	45	0.29
N6	UC Davis	UC1994/UC Alameda	4,830	16	0.10
Total			***28,230***	***1,366***	

List key outcomes or other achievements.

For the 2023-2024 production year, we exceeded the 200 DH goal by 143 for Virginia Tech. The remaining crosses proved to be challenging. Cross ID “H1” and “H2” are spring growth habit and cross “H5” has 6-row parents. Both are known to be less responsive to anther culture which is reflected in the reduced amount of DH produced.

For the 2024-2025 production year, we added an extra step to the anther culture protocol to help increase root development and vigor of plantlets before entering vernalization.

3. What opportunities for training and professional development has the project provided?

Travis Nickols, who was hired and started at the end of 2023, was provided additional training in tissue culture lab techniques by Dr. Bob Zemetra.

4. How have the results been disseminated to communities of interest?

DH seed and data from the 2023-24 production year were delivered to cooperators. Updates on the DH lab and processes were provided at the 2024 U.S. Wheat and Barley Scab Initiative Forum.

5. What do you plan to do during the next reporting period to accomplish the goals and objectives?

Additional training for Travis Nickols in tissue culture lab techniques will be provided by Dr. Beth Rowan in the next reporting period. Travis Nickols and Laura Helgerson will attend the 2025 U.S. Wheat and Barley Scab Initiative Forum.