U.S. Wheat & Barley
Scab Initiative

Minutes
USWBSI Steering Committee Meeting
Virtual (ZOOM)
April 17, 2025
1:00 – 4:30 PM CT

Attendees

Co-Chairs: Ruth Dill-Macky (Univ. of Minnesota) and Richard Magnusson (Private Grower, MN)

SC Members: Meriem Aoun (Oklahoma State Univ., SAAESD Rep.), Kaitlyn Bissonnette (Cotton Inc., NC), Rick Boyles (Clemson Univ.), Carl Bradley (Univ. of Kentucky), Mark Busman (USDA-ARS, IL, on behalf of Dave Kendra), Alyssa Collins (Pennsylvania State Univ.), Jason Cook (Montana State Univ.), Oswald Crasta (USDA-ARS National Program Leader for Small Grains, MD), Frankie Crutcher (Montana State Univ.), Yanhong Dong (Univ. of Minnesota, MN), Mitch Elmore (USDA-ARS, MN), Lexi Freier-Johnson (8th Avenue Food & Provisions, MN), Joleen Hadrich (Univ. of Minnesota, NCRA Rep.), Guixia Hao (USDA-ARS, IL), Terra Hartman (Bayer Crop Science, MN), Scott Heisel (American Malting Barley Assoc., WI), Rich Horsley (North Dakota State Univ.), Dustin Johnsrud (North Dakota Wheat Commission, Private Grower), Bryan Jorgensen (South Dakota Wheat Commission, Private Grower), Esten Mason (Colorado State Univ.), Jason McCann (RahrBSG, MN), Reuben McLean (Grain Craft, ID), Molly Miller (North American Millers' Assoc.), Gary Muehlbauer (Univ. of Minnesota), Scott Nelson (North Dakota Barley Council), Jessica Rutkoski (Univ. of Illinois, IL), Paul Sadosky (Molson Coors Beverage Co., WI), Sunish Sehgal (South Dakota State Univ.), Kevin Smith (Univ. of Minnesota), Harold Trick (Kansas State Univ.), Jake Westlin (National Assoc. of Wheat Growers), Steven Xu (USDA-ARS, CA), Shaobin Zhong (USDA-ARS, MN on behalf of Andrew Friskop), and Marv Zutz (Minnesota Barley Council)

NFO Staff: Michelle Bjerkness (USWBSI-NFO, MN) and Amber Hoffstetter (USWBSI-NFO, OH)

Not Present: Ken Davis (Grow Pro Genetics, IL), Andrew Friskop (North Dakota State Univ.), Jordan Hawbaker (U.S. Durum Growers Assoc., ND), Dave Kendra (Cibus, CA), Scott Heisel (short period internet went down), Oswald Crasta (after 1:53 pm CT), and Bryan Jorgenson (after 4:05 pm CT)

Richard Magnusson called the meeting to order at 1:01 p.m. CT, a quorum was present.

Opening, Welcome New Members, Approval of Agenda/Minutes

Richard Magnusson provided opening remarks. Since there were new Steering Committee (SC) members, introductions were made. Magnusson asked for any additions or corrections to the agenda. None were brought forth. The agenda was approved by unanimous consent.

SC Meeting Minutes – December 10, 2024

Richard Magnusson asked for any additions or corrections to the 12/10/24 minutes. No additions or corrections were provided.
Motion: Kaitlyn Bissonnette motioned to approve the minutes as presented; Marv Zutz seconded the motion.
Vote: All members were in favor; the motion to accept the December 10, 2024 minutes as presented was approved.

Federal Budget, Appropriations, and Advocacy Efforts

- *USDA-ARS Update*
  Oswald Crasta provided an update from USDA-ARS. The FY25 budget was approved with a Continuing Resolution until the end of the year. It was confirmed with the USDA-ARS leadership that USWBSI funding would remain the same for FY25 as in FY24 at $7.5 million. Typically, by this time, the President's Budget for FY26 would have been published. Crasta anticipates it will be published in the next couple of weeks. A Deferred Resignation Program (DRP) 2.0 was offered to all USDA-ARS employees (option to retire early or resign with 7-month's salary paid). The deadline to take the offer was April 8. At this time, no official number of PIs who took the offer has been provided. The new acting administrator for USDA-ARS is Mr. Joon Park.

- *National Wheat Improvement Committee (NWIC)*
  Jake Westlin gave an update from the National Wheat Improvement Committee (NWIC). The NWIC met following the NFHB Forum in Austin, Texas. Westlin was unable to attend both the 2024 NFHB Forum and the March 2025 Capitol Hill Visit, however, many stakeholders had visited DC and highlighted their shared concerns. The National Association of Wheat Growers (NAWG) and NWIC have had personal conversations with legislators to make sure the important role the USDA-ARS plays in wheat research is known. NAWG also took the opportunity in March at the Wheat Commodity Classic to meet with the Secretary of Agriculture and highlight the role the USDA-ARS plays in the wheat research community. NAWG was able to relay their message of the importance of maintaining wheat research positions in USDA-ARS. NAWG has also worked to communicate with Congress on the importance of the USWBSI and requesting that the appropriations are returned to normal for FY26. NAWG and the NWIC know that communicating with the growers and inviting them to visit facilities is also important to aid in gaining appropriations.

- *North American Millers Association (NAMA)*
  Molly Miller gave an update from NAMA who participated in the NWIC fly-in but also participated in their own fly-in. During their visits with Congress, one of their main priorities was getting the FY25 funding for the USWBSI distributed in a timely manner. They made sure to emphasize that in order for these programs to be successful, funding needs to get to the universities so that labor can be hired and the work progress. Miller reminded everyone that it's important to remind legislators of the research being conducted by USWBSI PIs in their states. NAMA will continue to support and advocate for the USWBSI.

- *National Barley Improvement Committee (NBIC)*
  Scott Heisel was unable to provide a verbal update. A written update is included. (*See Attachment 1*)

FY25 USWBSI Recommendations Status Update
Michelle Bjerkness gave an update on the FY25 Funding. It was anticipated that the FY25 apportionment would be released on Monday, April 14, but it hasn't been received by the USDA-ARS yet. Hopefully the USDA-ARA will be able to process all the agreements by July, and FY25 funds would be available for PIs in August, but indicated it could be as late as September. Oswald Crasta is trying to expedite the agreements for FY25 recognizing that these projects are mission critical to the USWBSI.

Future Advocacy for USWBSI
Ruth Dill-Macky gave an update from the EC's meeting earlier in the week. Due to the funding scenario, the EC has decided to discontinue the Transformational Science (TSCI) Research Category, and it will not be included in the FY26 Request for Pre-Proposals (RFP).

The EC is incredibly grateful for the work NWIC, AMBA, and NAMA have done to advocate on behalf of the USWBSI. During the EC's meeting messaging regarding how the research the USWBSI does impacts local economies (i.e. purchasing supplies from local companies) was discussed. As part of future advocacy efforts, the EC is recommending that the economic value of research funding on local businesses be incorporated. The EC also discussed the outreach needed to increase the awareness of the USWBSI, particularly resources and tools with growers, top farmers who may lack firsthand knowledge of FHB and its consequences. The EC recommended providing funding opportunities for outreach focused project(s) that would enhance the impact of USWBSI outreach efforts to a new generation of farmers.

SC members asked if TSCI would be permanently discontinued. It was confirmed; EC's recommendation is for TSCI to be permanently discontinued. However, USWBSI continues to be interested in engaging new PIs and projects; there just won't be a specific category specified going forward.

There was discussion and support for outreach projects for the younger generation of growers. Suggestions for reaching this audience were discussed, and included thinking about the types of communications and the cropping systems being used.

FY25 Action Plan & Research Priorities Overview
Process for Updating the USWBSI Action Plan, RFP Program Descriptions, and Working Caps
Ruth Dill-Macky reviewed the timeline for updating the USWBSI Action Plan for FY26. Prior to this SC meeting, Research Area (RA) and Coordinated Project (CP) committees held virtual meetings to prepare their recommendations for updates to the Action Plan. The RA/CP Chairs will present their reports from these meetings and recommendations for Action Plan updates to

the SC. After the presentations, Breakout Sessions will allow for stakeholder input on the Action Plan. The RA/CP's will then take these recommendations back to their committees and submit the final recommendation for changes to the Action Plan to the NFO by April 30.

Ruth Dill-Macky explained the process for setting the FY26 Working Caps. During the SC meeting, the RA/CP Chair reports will inform SC members on unmet research needs. Beginning the week of April 21, SC members will be polled to set the Working Caps for FY26 and should use the reports to inform their vote. SC members will have until May 2 to complete the poll for FY26 Working Caps. The results will be tabulated and the EC will meet for consideration and determine their final recommendation on May 8. The EC's final recommendation for the FY26 Working Caps will be sent to the SC for a final vote. The SC is encouraged to think critically when placing their votes. The starting point for the FY26 poll will be based on the FY25 final funding recommendations.

RA/CP Reports, Quick Overview and Recommendations (See Attachments 2-11)
The Research Area/Coordinated Project Chairs each provided a 3-minute presentation.

- FHB Management (MGMT)
  Kaitlynn Bissonnette provided an update from the FHB MGMT Research Area. (*See Attachment 2*)
- Food Safety and Toxicology (FST)
  Mark Busman provided an update from the FST Research Area on behalf of Dave Kendra. (*See Attachment 3*)
- Gene Discovery and Engineering Resistance (GDER)
  Harold Trick provided an update from the GDER Research Area. (*See Attachment 4*)
- Pathogen Biology and Genetics (PBG)
  Guixia Hao provided an update from the PBG Research Area. (*See Attachment 5*)
- Barley Coordinated Project (BAR-CP)
  Mitch Elmore provided an update from the Barley Coordinated Project. (*See Attachment 6*)
- Durum Coordinated Project (DUR-CP)
  Shaobin Zhong provide an update from the Durum Coordinated Project on behalf of Andrew Friskop. (*See Attachment 7*)
- Hard Winter Wheat Coordinated Project (HWW-CP)
  Sunish Sehgal provided an update from the Hard Winter Wheat Coordinated Project. (*See Attachment 8*)
- VDHR Spring Wheat Parents (VDHR-SPR)
  Jason Cook provided an update from the VDHR Spring Wheat Coordinated Project. (*See Attachment 9*)
- VDHR Northern Soft Winter Wheat (VDHR-NWW)
  Jessica Rutkoski provided an update from the VDHR Northern Soft Winter Wheat Coordinated Project. (*See Attachment 10*)
- VDHR Southern Soft Red Winter Wheat (VDHR-SWW)
  Rick Boyles provided an update from the VDHR Southern Soft Red Winter Wheat Coordinated Project. (*See Attachment 11*)

Action Plan Breakouts
The SC broke into groups to discuss changes/updates to the Action Plan.

Action Plan Breakout – Stakeholder Input Reports

- MGMT 1 - Kaitlyn Bissonnette presented on the Breakout Session for FHB MGMT Goals 1 and 3. The consensus from the group was the goals remain applicable. There was discussion on why these two goals have no performance indicators, though the performance indicators are written within the goal statements.
- MGMT 2 - Carl Bradley presented on the Breakout Session for FHB MGMT Goals 2 and 4. There was good discussion specifically on biologicals and growers being exposed more to them for their use in plant health. This might be something the USWBSI focuses more on. There was discussion on drone applications of fungicides which is happening in some regions. This could be something the RA includes in their research pre-proposals. There is a lot of data being generated by drone imaging but not a lot of understanding on how to utilize the data. The group discussed the special call for outreach projects and concluded that reaching growers and making the Return on Investment of USWBSI research clear were well received by the group.
- FST - Mark Busman presented on the FST Breakout Session. Even though the RA aspires to support projects in toxicology, there is currently no funding support available and fewer researchers in the U.S. are working on toxicology research. The group indicated there was a need for more research in trichothecene toxicology research and suggested engaging the broader research community to identify individuals working on it.

- GDER - Harold Trick presented on the GDER Breakout Session. There was discussion on modifying the statement of research needs from “develop efficient gene editing wheat and barley” to “genotype independent editing for wheat” as the group feels that this language better reflects the current status of this research. There was discussion on including durum as a class of wheat or referencing “genotype independent editing for all wheat classes (including durum).”
- PBG - Guixia Hao presented on the PBG Breakout Session. Since the RA is focused on basic research, the RA would like to communicate better with stakeholders, especially growers, how research in this area benefits them. The RA works collaboratively with FHB MGMT and GDER. There was discussion about microbiome research and the RA is hopeful there will be more projects in this area with the new RFP.
- VDHR - Rick Boyles presented on the VDHR Breakout Session. Overall, there were no major changes to the goals. There was discussion on the overlap of Goals 2 and 3. Goal 2 focuses on the adoption of new technologies while Goal 3 focuses on the development of new technologies. The group thought that the reference to the percentage of acreage planted to moderately resistant varieties could be removed since that information is not available in the soft winter wheat regions. It was suggested that it is more important to document the number of varieties released and their FHB resistant levels. There was also discussion on screening the elite germplasm with the use of fungicides to look at variety by fungicide interactions. This language could be left more general so each Coordinated Project could make their own decisions based on their region and practices.

Action Plan Wrap Up & Next Steps

Ruth Dill-Macky provided next steps for updating the Action Plan. Input from the Breakout Sessions will now be taken to the individual RA and CP committees. Any final adjustments on language will be voted on by each committee and returned to the NFO by April 30. The NFO will compile the Action Plan with the suggested changes by May 5 and distribute it to the SC. The new Action Plan will be made available by June 3 to be distributed with the FY26 RFP.

FY25 Research Plan & Budget Update/FY26 Plans

- *Final FY25 Funding Allocation Overview*
  Ruth Dill-Macky provided an overview of the FY25 funding allocation. The total budget for the USWBSI was $13,890,000. The USDA-ARS base funding and fees is $6.2 million. The remainder ($7.6) is awarded as competitive funding through the USWBSI. A total of 90 applications were submitted for FY25 (77 Land Grant University and 13 USDA-ARS). Funding for FY25 was shown by Research Category with comparisons between the PI Requests, Review Panel Recommendations, and the EC Final Recommendations. A few adjustments resulted in several Research Categories being funded below their Working Cap. There were also adjustments for projects funded in FY24 that weren’t funded in FY25. Overall, there were 126 projects funded in 31 states for FY25. The concentration of projects are in the Midwest. Thirty-three institutions received funding from the USWBSI including eight USDA-ARS locations. There was a review of the Project Summary ratings. About 12% of the projects were asked to provide additional details in the application and/or respond to the NFO.

- *Upcoming FY26 Funding Schedule*
  Michelle Bjerkness reviewed the FY25 and FY26 funding schedules. The FY25 agreement amendments should technically start May 1, 2025. The USWBSI will be providing agreement amendment applications to the USDA-ARS. Hopefully, the USDA-ARS will be able to process these quickly, if so, funding could be available to universities in August or September. The FY26 Pre-Proposal system will open in August. The RA/CP Committees will review submissions in October. EC will review pre-proposals in November and prepare a recommendation for the SC in December. All FY26 projects will be established as new agreements.

Governance

- *USWBSI Researcher Co-Chair Position Description/Call for Nominations*
  Richard Magnusson provided an update on the Position Description and Call for Nominations for the Research Co-Chair position. The EC has a Call for Nominations ready for distribution. Nominations will be accepted until June 30. The EC will review the nominations, select and interview finalists, and recommend a top candidate for election to the SC. The top candidate will be included on the SC ballot in October. The new Research Co-Chair will be confirmed in November with a transition to start in December. The SC is encouraged to reach out to possible candidates and nominate individuals; self-nominations are also welcome. Any interested parties with questions are encouraged to reach out to Ruth Dill-Macky who is willing to discuss the role and responsibilities.

- *Awards Program Update*
  Richard Magnusson provided an update on the Awards Program. Gary Muehlbauer is chairing the new award committee which also includes members Eric Olson, Briana Whitaker, and Alyssa Collins. There will be four awards initiating in 2025: Outstanding New Investigator, Collaborative Achievement, Innovative Impact, and Lifetime Achievement. Nominations will open mid-May with a deadline of August 27. Notifications will be sent in October. The Lifetime Achievement and Outstanding New Investigator awardees will be asked to speak at the 2025 National Fusarium Head Blight (NFHB) Forum in Denver, Colorado.

- USWBSI Policies & Procedures Updates
  RA/CP Vice Chair Appointment New Committee Structure (Vice Chairs Transition to Chairs)
  Richard Magnusson reminded the SC members of the new Committee Structure that required CP committees to elect Vice-Chair positions, similar to the RA Committees. Each Committee is now comprised of a Chair, a Vice-Chair, and 2-5 additional members. Chair and Vice-Chair nominations were approved by the EC while member nominations are approved by Committee vote. Vice-Chairs will automatically rotate into the Chair position at the end of the Chair's term. The list of newly approved RA and CP Vice-Chair positions was provided.

- *Policies & Procedures Recommendations from EC*
  Richard Magnusson reviewed the recommendations for the Policies and Procedures. The first is an addition of FOC Co-Chair terms. The proposal is for FOC Co-Chairs to have two-year terms with a staggered rotation between the two Chairs. Terms can be reappointed and adjusted to maintain continuity.
  Motion: Kaitlyn Bissonette motioned to approve the changes to FOC Co-Chair terms; Marv Zutz seconded the motion.
  Vote: All members were in favor; the motion to accept the change to the FOC Co-Chair term in the Policies and Procedures as presented was approved.

  Richard Magnusson explained that the EC is recommending the removal of the inclusion reference from the Policies and Procedures.
  Motion: Bryan Jorgenson motioned to approve the removal of the statement from the Policies and Procedures; Esten Mason seconded the motion.
  Vote: All members were in favor; the motion to remove the statement as presented was approved.

Upcoming USWBSI Meetings

- *Planning of the 2025 National FHB Forum, Denver, CO*
  Esten Mason provided an update on the 2025 NFHB Forum on December 7-9 in Denver, Colorado. The FOC Co-Chairs are Esten Mason and Lisa Vaillancourt. The FOC is currently recruiting speakers. The Forum website is live and hotel reservations will be opening soon with a government per diem rate of $149/night for all attendees. Registration will open this summer and abstract and poster submission deadlines will be in November.

- Steering Committee Meeting, December 9, 2025 (immediately following Forum)
  The EC will hold its meetings with RA and CP Chairs virtually on Monday, December 1 and Tuesday, December 2 and meet in-person on Saturday, December 6. The SC will meet for lunch following the Forum on Tuesday, December 9 with the SC meeting immediately following. There was discussion on the overlap between the SC and NWIC meetings as many of the SC members also plan to attend the NWIC meeting. NWIC may be encouraged to delay their meeting start time by a couple of hours.
  Action Item: NFO to connect with NWIC to determine if an adjustment in timing to avoid overlap with the SC meeting is possible for the 2025 NFHB Forum.

  Richard Magnusson reviewed key deadlines for the SC.

New Business

Esten Mason mentioned that the NWIC's main ask is the USWBSI and perhaps the NWIC Chair they should have a position on the SC. This was tabled and will be added to a future agenda for consideration.

No other new business was brought forth.

Motion: Kaitlyn Bissonnette motioned to adjourn the meeting; Marv Zutz seconded the motion.

Vote: All members were in favor; motioned to adjourn the meeting was approved.

Meeting adjourned at 4:07 p.m. CT

Minutes Recorded and Submitted by:

USWBSI's Networking & Facilitation Office

AMERICAN MALTING BARLEY ASSOCIATION

FY2025/FY2026 NBIC Update

Scott Heisel

FY2025 Appropriations

The continuing resolution for the FY25 at FY24 levels means:

- Continued funding of $13.88 million for the USWBSI.
- Continued funding for the Small Grain Germplasm Initiative at $3.5 million.
- Continued funding for the Barley Pest Initiative at $3.5 million.

FY2026 Appropriation Goals

- Increased funding to FY23 levels or $15 million for the USWBSI.
    - Filling out appropriations requests with key congressional offices. These take 15 - 20 minutes each, so it is a considerable commitment of time.
- Continued funding for the Small Grain Germplasm Initiative at $3.5 million.
- Additional $1.8 million for the BPI to bring it to full funding of $5.3 million.
- $8.0 million for the Resilient Barley Initiative targeting abiotic stresses.

Farm Bill

- Increase authorization for *Fusarium* research on Wheat and Barley from $15 to $20 million.
- Retain existing language capping indirect costs for USWBSI grants at 10%.

The House narrowly passed the Senate-amended budget resolution, 216-214. This only passed because the Freedom Caucus members received guarantees of looking at up to $1.5 trillion in cuts in the future. The reconciliation process can now begin aimed at extending the 2017 tax cuts and making major spending reforms.

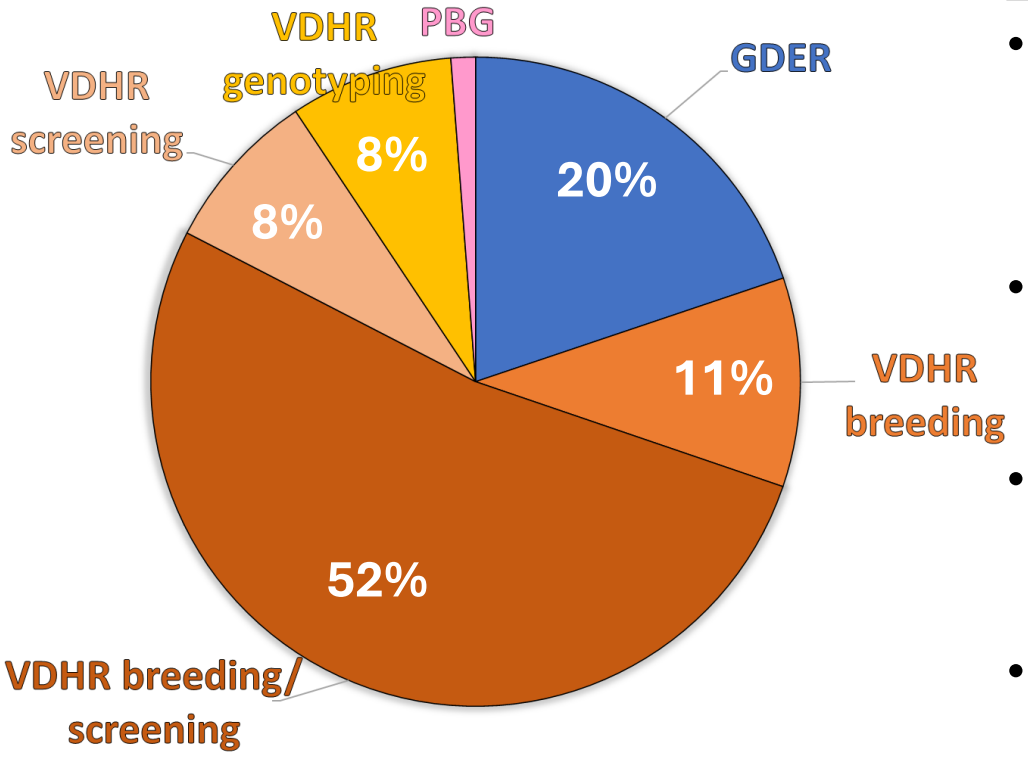
The House Agriculture Committee is tasked with finding $230 billion in savings in the measure after the Senate's version only had $1 billion in cuts. This difference needs to be resolved during reconciliation. Reconciliation could result in some parts of the Farm Bill being addressed without passing a full new Farm Bill. Increases for the commodity and crop insurance titles would have to be balanced with cuts to SNAP and other areas. The Research Title cannot be addressed in the reconciliation process

DRP, RIFs and firings will impact the ability of the USDA to conduct business. Even if all the current ARS small grains programs remain, it is hard to imagine it will not take many years to get back to the current level of research capacity.

Barley Coordinated Project (BAR-CP)

Protecting U.S. Barley from Fusarium Head Blight and DON.

U.S. Wheat & Barley Scab Initiative



FY25 Recommended funding: $1,230,431
21 projects

Highlights and Achievements 2022-2025:

- **Supported breeding programs in 10+ states**
  - Spring and Winter Barley
  - Facilitated Doubled Haploid production to accelerate breeding
- **Lowered cost of genotyping** with the multi-crop chip with 3K barley probes
- **Established new winter barley FHB nurseries (industry push)** in OH, NC, VA, MD, NY, NE, SD, ID
- **Supported fundamental research and crop engineering**
  - Genetic basis of type II resistance in barley
  - Gene editing approaches targeting barley ortholog of Fhb1
  - Transfer of Fhb7 to barley

Barley Coordinated Project (BAR-CP)

U.S. Wheat & Barley Scab Initiative

Action Plan Recommendations from BAR-CP

- VDHR action plan is focused only on wheat – should barley be added?
  - The BAR-CP program description references the goals in the VDHR section
  - Barley is represented in other research areas

- Currently, there is minimal focus on stakeholder communication or partnerships between private and public entities, although these activities do exist (to some degree)
  - One BAR-CP member noted deficiencies in the private sector's incorporation of disease resistance developed by public breeding efforts

- Data management and reporting according to FAIR principles (Findability, Accessibility, Interoperability, and Reusability)
  - Action Plan should explicitly state how genotypic and phenotypic data is to be managed and accessed
  - Requires coordinated effort between breeders, nursery managers, and genotyping/analysis labs

DUR-CP Report

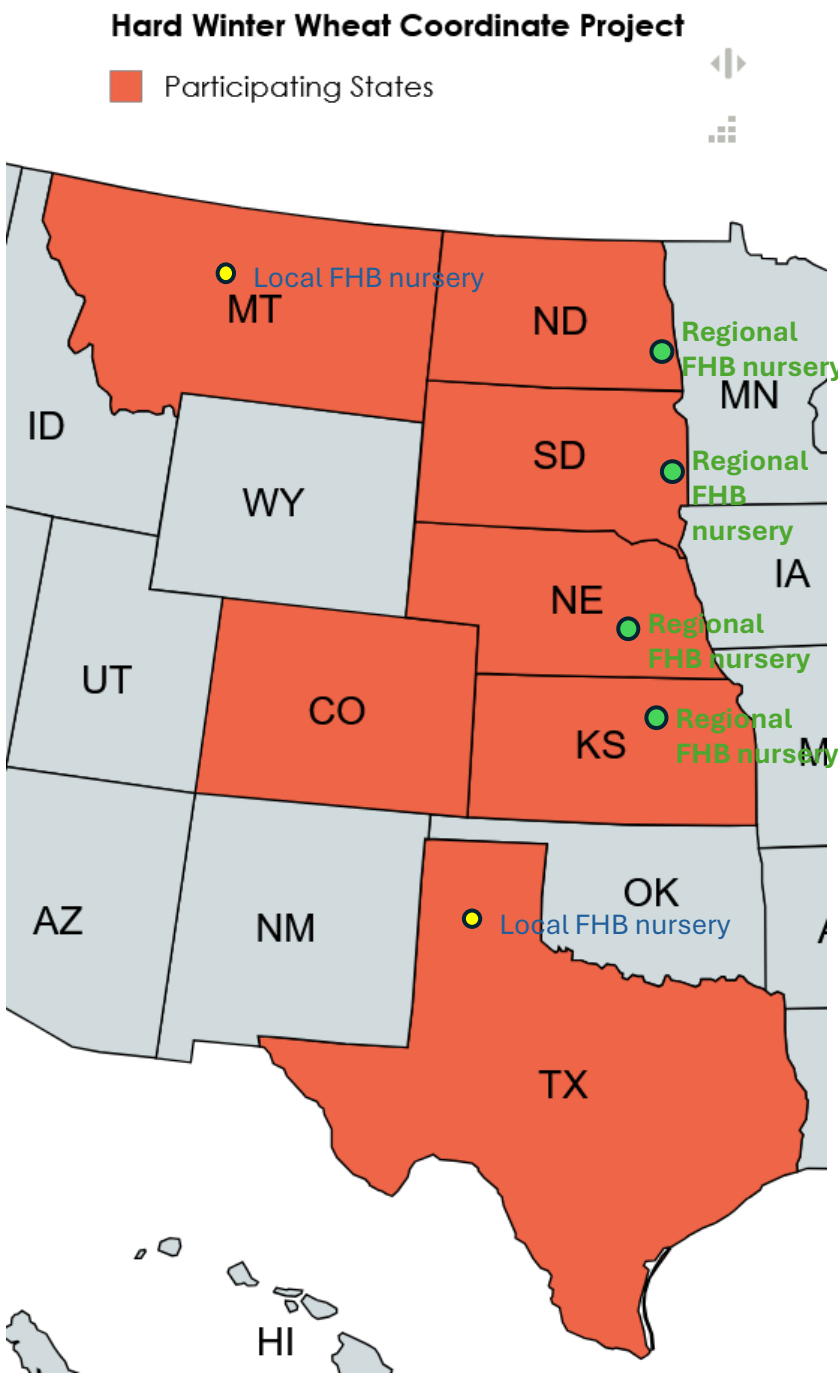
Key Accomplishments (2022-2024)

- Reported variety acreage dedicated to the least susceptible durum varieties has averaged 66% in ND and 34% in MT
- Development of elite lines carrying *Cdu1*, *Fhb1, Fhb7,* and 5AS/5AL QTL in modern durum backgrounds exhibited good yield potential
- Candidate genes for FHB susceptibility have been identified in durum as targets for gene editing to improve FHB resistance

DUR-CP Report

Key Recommendations for Action Plan:

- Agree with current VDHR goals 1-3
- Discussions from DUR-CP group indicated greater emphasis of documenting variety performance with and without fungicides in dryland (grower) environments
- Emphasis on more “centralized” efforts (advancing germplasm with genotyping data)



HWW-CP: Outcomes and Impacts (2022-25)

Varieties released:

1. ND Allison (ND)
2. SD Midland(SD)
3. SD Pheasant (SD)
4. NE Prism (NE)

Significant acreage under previously released MR varieties:

1. ND Noreen (ND) >9 % acres in ND
2. Winner (SD) >15% acres in SD
3. Ruth (NE) ~10% acres in NE
4. Zenda (KS) >5% acres in Eastern and southcentral KS
5. Everest (KS) ~5% acres in Eastern KS
6. TAM 205 (TX) 2% acres in TX

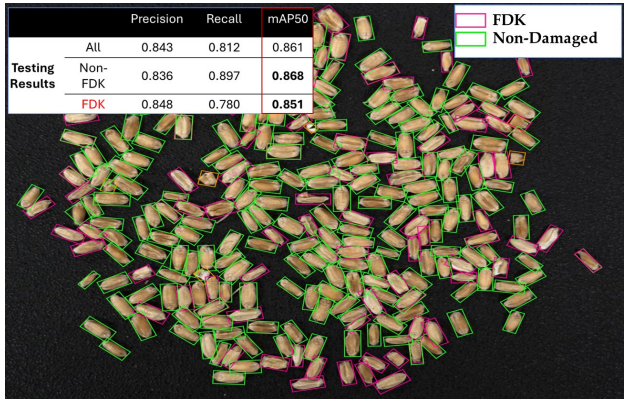
New FHB resistance sources identified

1. HSD2-32 likely deletions on 2DL, 5BL, and 6AS (KSU)
2. KanMark *with introgression from Ae. tauschii accessions TA1599, TA1691, TA2477 and TA 2478* (KSU)
3. TA7709 *CS–Elymus ciliaris* disomic addition 7Yc (KSU)

HWW-CP: Outcomes and Impacts (2022-25)

FHB resistance genes/QTLs and marker identified

1. *Fhb9 mapped new QTL on 2DL* (*USDA-ARS MHK*)
2. *Mapped Rht8* (short allele) reduces FHB resistance (*USDA-ARS MHK*)

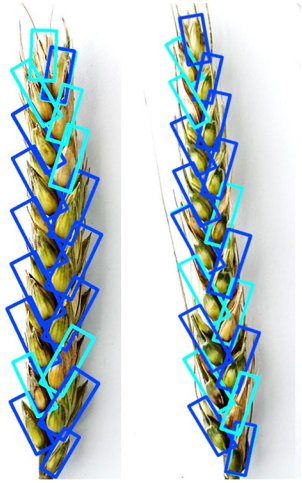


Breeding germplasm developed

1. MABC *Fhb1* + *Fhb9* + *5A lines shared with breeders* (*USDA-ARS MHK*)
2. MABC to transfer *Fhb1*, *Fhb7* and *Fhb9* to US hard winter wheat (BC_2F_2).

New tools and techniques developed

1. Multi Trait Genomic selection for FHB under progress in SD, NE, CO (CSU leading regional effort)
2. AI assisted FDK and DON estimation (SD)



FHB resistant lines and varieties in the trials

23 varieties performing better than checks in KS nursery
11 varieties performing better or similar to Everest in SD nursery
9 HRWW lines/cultivars in ND have FHB Type II (background) resistance
10% lines in 2025 RGON from HWWCP (ND SD, NE) carry *Fhb1*
Increased in *Fhb1* frequency in the HRW wheat breeding program ND, SD, NE
E.g. 39% PYT, 54% AYT in ND program carries *Fhb1*
25-35 % crosses carry at least one FHB resistant parents in the HWWCP breeding programs

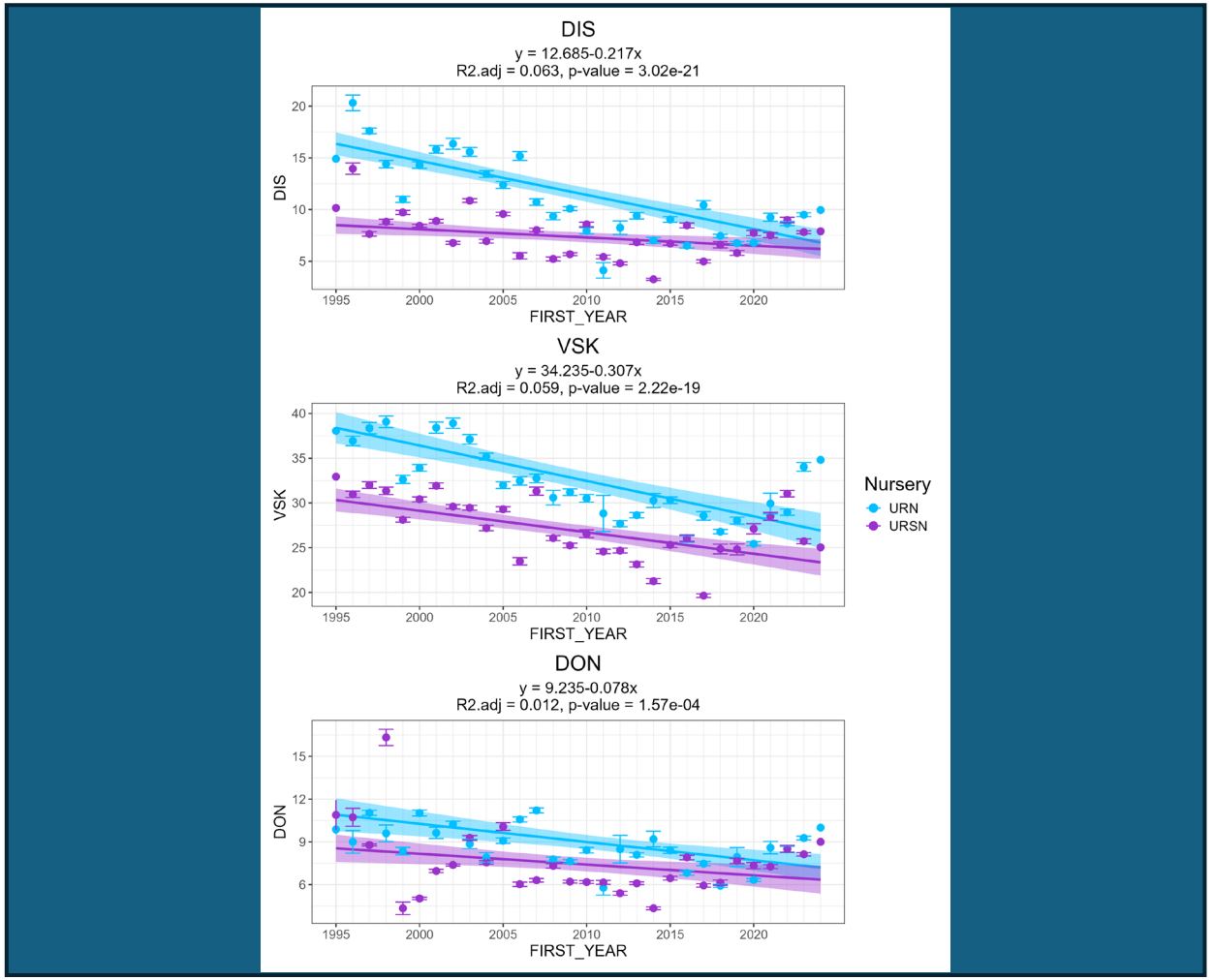
VDHR – Spring Wheat Accomplishments (2022 -2024)

5 varieties released with MR FHB rating.

Development of a 3K Illumina assay for Genomic Selection.

Pyramiding Fhb1, Fhb2, Fhb4, Fhb5, Fhb7, and 5A QTL into elite breeding lines.

Implementation of Genomic Selection in spring breeding programs.



Genetic Gain Uniform Regional Nursery (URN) and Uniform Regional Scab Nursery (URSN). (Charlotte Brault)

VDHR – Spring Wheat Action Plan Considerations

- ❑ **VDHR Goal 1**: Evaluate FHB resistance in commercial varieties and document usage.
  - No changes

- ❑ **VDHR Goal 2:** Breeding efficiency.
  - Implement use of quicker and cheaper ELISA tests to measure DON in early generation experimental lines.
  - Standardize data curation and storage.
  - Emphasize training the next generation of research associates.

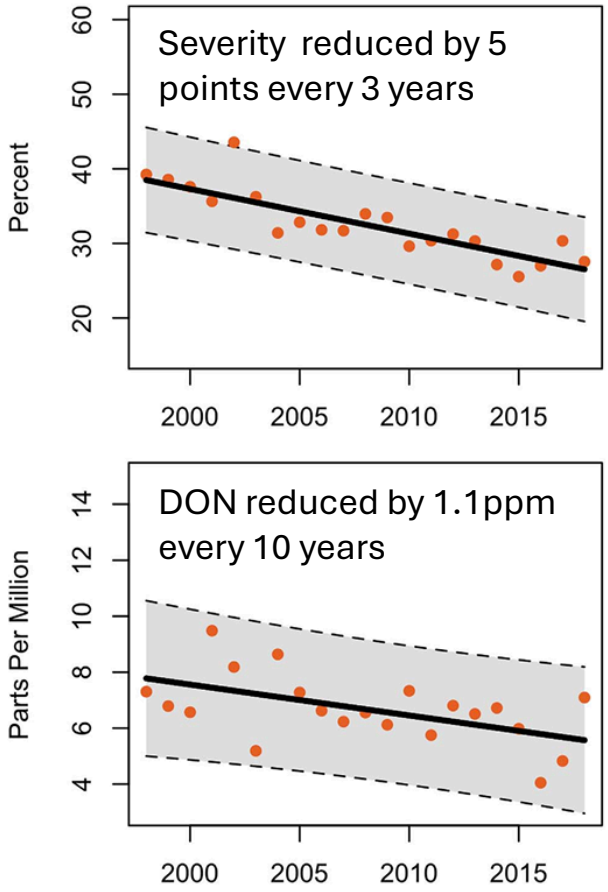
- ❑ **VDHR Goal 3:** Innovation.
  - Make selections in current FHB management environment. (i.e., Genetics X Fungicides interactions)

VDHR NWW CP Key Accomplishments

Together, over the past 4 years we:

- **Released** 18 new scab-resistant varieties that are being grown by farmers (16 'MR' varieties and 2 'M' varieties.)
- **Delivered** 47 new varieties to seedsmen for testing.
- **Continued achieving** genetic gains. *Our rates of genetic gain are significant, and 70% of new breeding lines have at least one known FHB QTL.*
- **Developed and adopted** improved breeding methods. *We published 7 breeding methodology research articles and 5 of 6 programs use Genomic Selection routinely.*
- **Improved efficiency** through greater coordination on testing and genotyping.

Genetic Trends due to our Breeding Efforts



VDHR NWW CP Key Recommendations

- The action plan should remain as is.

- The VDHR Program description should be updated to:
  - Mention hard wheat if hard wheat breeding is being funded.
  - Omit evaluating milling and baking quality on the Uniform Nurseries. Each program already submits their samples for quality testing.
  - Omit the generation of genomic estimated breeding values for uniform nursery entries since lines in these nurseries are already extensively phenotyped.

VDHR-SWW CP 1 Notable Accomplishments

VDHR-SWW cultivar releases since 2022

22 cultivars released since new funding cycle

- 17 licensed to seed companies (77%)
- 9 have Fhb1 (41%)
- 11 with more than one known FHB resistance QTL
- 14 were VDHR doubled haploids (DHs)

Deliverables for future FHB improvement

- Fhb1 frequency increased from 16% to 26%
- 21 USSN entries with H13 + Fhb1
- 30 USSN entries with Fhb1 + F1BJ
- Fhb7 introgression into southern SRWW elites
- Speed breeding infrastructure & protocols developed
- Identification of Fhb1 short segments

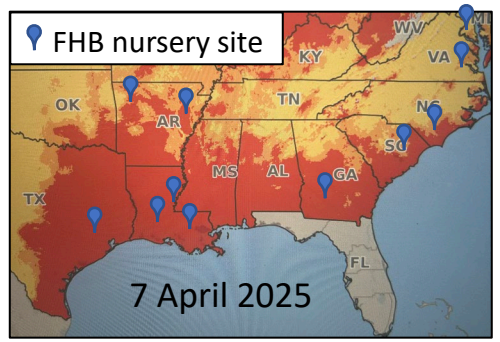
8	non-DH
14	VDHR DH

	Designation	Program	Year	FHB QTL
	GA-19LE12	UGA	2022	
*	GA-19E38	UGA	2022	F1BJ
*	NC11546-14	NCSU	2022	Fhb1, F1BJ, F1AN
	NC12164-200T	NCSU	2022	Fhb1, F1BJ
*	TX17D2337	Texas A&M	2022	F1AN
*	15VDH-33-13	VA Tech	2022	Fhb1, F3BB
*	15VDH-38-01	VA Tech	2022	Fhb1, F1BJ, F3BB
*	16VDH-025	VA Tech	2022	F1BJ
*	17VDH-077	VA Tech	2022	Fhb1, F2DLW
*	GA-20E36	UGA	2023	F1AN
	NC15V25-20	NCSU	2023	Fhb1, F1BJ, F5ANi
*	NC18-16900	NCSU	2023	Fhb1, F1BJ, F3BM
*	LA-NDH119	LSU	2024	Fhb1
*	GA-20E48	UGA	2024	F1BJ, F1AN
*	15VTK-1-101	VA Tech	2024	F1BJ, F3BM
*	VA19FHB-36	VA Tech	2024	F1BJ, F1AN
*	17VTK4-29	VA Tech	2024	Fhb1, F4AN
*	16VDH-023	VA Tech	2024	F1BJ
*	MDW23-1	UMD	2024	F1BJ
*	23-MDW-58	UMD	2024	
-	VA20FHB-18	VA Tech	2025	
-	VA20FHB-20	VA Tech	2025	

VDHR-SWW CP | 2 VDHR Action Plan Considerations

VDHR Goal 1: Assess Progress in Breeding for FHB Resistance

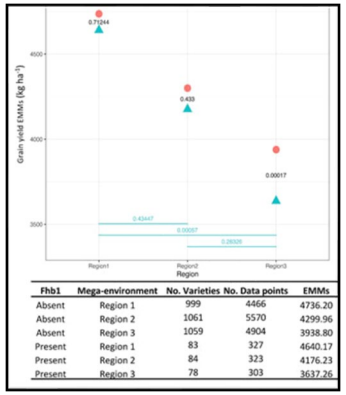
- Emphasize evaluating commercially available varieties to inform growers on FHB resistant varieties.



https://www.wheatscab.psu.edu/

VDHR Goal 2: Increase Efficiency of Cultivar Development

- Resistance genes are showing no indication of being overcome
  - Focus on stacking FHB R genes together and with Hessian fly, BYDV, powdery mildew, and rusts
  - Fully eliminate any yield drag from exotic introgressions

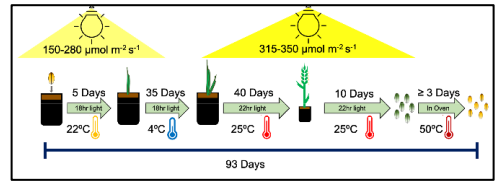


Fhb1	Mega-environment	No. Varieties	No. Data points	EMMs
Absent	Region 1	999	4466	4736.20
Absent	Region 2	1061	5570	4299.96
Absent	Region 3	1059	4904	3938.80
Present	Region 1	83	327	4640.17
Present	Region 2	84	323	4176.23
Present	Region 3	78	303	3637.26

Ballén-Taborda et al. 2022

VDHR Goal 3: Evaluate and Implement New Breeding Technologies

- Become less dependent on outsourcing (*e.g.*, doubled haploids)



Schoen et al. 2023

MGMT Key Accomplishments

- **Fusarium species – diversity in the spike and management implications**
  - Increased sampling efforts to broader geographies
  - Expanded understanding of Fusarium pathogen distribution, co-inoculation and chemotypes
- **FHB prediction models – continued deployment and improving forecasting stability**
  - Expansion of model into new geographies (22 states now)
  - Integration of greater number of observation points to improve accuracy
- **Fusarium fungicide sensitivity – assessing field populations**
  - Low scab years and uneven fungal growth have been a hurdle
  - Centralization of labs collaborating on shared protocols for standardization
  - Long term storage and isolate transfer with Fusarium species project underway

MGMT Program

FHB Management (MGMT) – Description – The FHB Management (MGMT) research area supports research to develop effective and economical disease management practices that reduce FHB severity and mycotoxins in small grain crops to meet the immediate and long-term needs of the wheat and barley industries. This research area involves: tillage practices, crop sequences, and other cultural practices targeting Fusarium-infested residues; fungicides and biocontrol agents with demonstrated field efficacy, and their application technologies; the refinement and deployment of disease prediction and forecasting models, and disease management decision tools; and studies of pathogen survival, inoculum production, dispersal, infection, colonization, mycotoxin production, fungicide sensitivity, and OTHER factors ~~accounting for~~ WITH THE ULTIMATE GOAL OF MITIGATING unacceptable levels of mycotoxins in symptomatic or asymptomatic grain. See the MGMT section of the USWBSI Action Plan for research goals and needs.

MGMT – Goal 1: Develop integrated sustainable management strategies for FHB and mycotoxins that are robust to conditions experienced in production fields of wheat and barley.

MGMT – Goal 2: Help develop and validate the next generation of management and mitigation tools to reduce FHB and associated mycotoxins.

MGMT – Goal 3: Develop a comprehensive understanding of the Fusarium populations and the factors influencing infection and toxin accumulation that can be used to develop the next generation of FHB and DON risk assessment measures.

MGMT – Goal 4: Enhance communication and end-user education/outreach for an audience including, but not limited to, producers, agricultural advisors, research community, and grain processors.

Food Safety and Toxicology (FST) Key Accomplishments: 2022-2024

- Delivered High Quality measurements for Deoxynivalenol and derivatives to PI's
  - Three labs:
    1. U of Minnesota
    2. NDSU
    3. Virginia Tech

- Characterized essential oil nanoemulsions for their antifungal and mycotoxigenic potential for reducing Fusarium infection and DON production during micro malting processing. Poor solubility of natural Photosensitizers is a major problem limiting widespread application of this technology.

FST: Unmet Needs to be Addressed

- Continued updating detection capabilities in order to stay competitive with industry and foreign labs
  - Human food
  - Animal food
  - Pet food
- We no longer fund toxicology-related projects. Should we in order to stay relative for the human and animal food industries?
- Masked and other Fusarium mycotoxins. Should we routinely measure and report – similar to EMEA, LATAM and APAC.

GDER highlights of the key accomplishments (since 2022)

- Mutational breeding population of eikorn wheat for FHB resistance has been developed and made available.

- Mutagenized population of Kronos is being developed for increased tricothecene and FHB resistance.

- Knockdown of defense repressors are exhibiting enhanced FHB resistance including a decrease in observed damage kernals and lower DON accumulation.

- Three high-priority candidate genes were identified thru fine-mapping of a major QTL for FHB resistance on chromosome 4BS.

- Introduction of Fhb7 gene from *Thinopyrum elongatum* into barley.

- Wheat and barley transformation facilities are in place and are active producing both transgenic and gene edited material for users

Key recommendations to be considered for the GDER Action Plan

- No major changes in current action plan

- Continue the discovery and identification of both resistance genes including increased efficiency of identifying mechanisms of resistance and susceptibility as well as detection and validation of host genes for resistance and susceptibility to FHB or DON accumulation
- Continue to identify and validate natural variants and mutations for incorporation into breeding programs

Pathogen Biology and genetics (PBG): Key accomplishments

- **Chemotype and aggressiveness:** discovered no correlation between chemotypes and aggressiveness between the cross of the 3ADON strain and 15ADON.
- **GWAS of Fusarium isolates:** Identified SNPs associated with fungal growth, fungicide resistance, and toxin production
- **Fusarium diversity:** Identified multiple *Fusarium* species and chemotypes, including NIV strains present in the collection from Illinois
- **Fusarium diversity and barley resistance**: barley resistance varied by the strains used for inoculations
- **Pathogenesis genes**: Identified GPCRs critical for FHB, and the regulation roles of TRI6, TRI10 and TRI14 in DON production
- **RNAi to control FHB:** tested Spherical nucleic acid nanomaterials (SNA) and fungal endophyte-mediated RNAi silencing systems
- **Publications: >23**

PBG Research needs:

Goal 1 Characterize plant-fungal interactions and improve pathogen surveillance to provide translational results addressing FHB and mycotoxin contamination in barley and wheat.

- Identify fungal virulence factors and associated plant targets for use in developing FHB resistant cultivars.
- Develop new approaches to disrupt the pathogen lifecycle (including saprotrophic phase, overwintering, early and late infections) that result in decreased disease
- Understand Fusarium populations, population shift, aggressiveness and mixed infection, and the factors influencing infection and toxin accumulation under different environmental and field conditions
- Characterize how host genotypes impact FHB development and DON accumulation across Fusarium species and populations.

Goal 2 Discover epiphytic and endophytic microbes and microbial communities useful for development of control for FHB.

- Characterize microbiome or microbial consortia and interactions between microbes, pathogens and plants
- Identify microbial metabolites or enzymes from microbial communities useful for control of FHB or DON.