

Project FY22-SW-004: A Double Haploid Initiative to Speed Development of FHB Resistant Soft Winter Wheat.

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

The goal of this project is to expand the regional Double Haploid (DH) initiative to more quickly develop and release high-yielding varieties that contain an effective FHB resistance pyramid.

Specific Objectives are: 1) Develop DH lines that combine multiple effective FHB resistance genes/QTL. 2) Utilize marker assisted selection (MAS) to enrich topcross F1 populations for those genes/QTL. 3) Share new DHs with all VDHR-SWW breeders after the initial culling such that each breeder evaluates many more DHs than otherwise possible.

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

Obj 1) Seed of three crosses made in the spring of 2023 was submitted to the Heartland Plant Institute for development of DHs. All three crosses combine eh very high-yielding and FHB resistant recent LSU release AGS 3022 (LA16020-LDH22) with high-yielding parents containing other effective FHB QTL.

CROSS	PEDIGREE	PARENT GENES / QTL
LA23034	AGS 3022/15VTK-1-101	RHT2, Fhb1JT, Fhb4AN, YR17, LR9, 1RS.1AL, SBM1///Rht-B1a,Rht-D1b, Fhb_3B_Massey, Fhb_1B_JT, Yr17/Lr37/Sr38, Lr18,Sr36/Pm6,H13,Sbm1
LA23140	LA15099GBW-11-1-3/AGS 3022	,Rht-D1b, Ppd-D1ains, vrn-b1short, Fhb1ANe, Fhb4ANe, Yr17/Lr37/Sr38, Lr18,Yr4BL, Pm54,H13,Sbm1, non-Bx7OE,Ax2*2+12,soft,RRrRRR,/RHT2, Fhb1JT, Fhb4AN, YR17, LR9, 1RS.1AL, SBM1
LA23301	NC15305-L1/AGS 3022	KASP = Fhb1, H13, Bdv2; Pred = 1BJ, 4AN, Pm1a /RHT2, Fhb1JT, Fhb4AN, YR17, LR9, 1RS.1AL, SBM1

What were the major activities?

Obj 1, 3) DHs evaluated each cycle are a combination of lines derived from LSU crosses and DHs shared by other VDHR-SWW programs. DHs selected from this group are advanced to the Genomic Selection Prelim tested at two locations. Advanced yield trials and regional trials include LSU DHs each year. Obj 2) 414 DHs selected and harvested in 2023 as first year headrows were shared with other VDHR-SWW breeders to allow them the opportunity for selection and advancement.

Obj 3) There were 275 new DHs evaluated as headrows at two locations in the 2023-24 season. Fifty-four DHs from the previous cycle evaluated in preliminary yield plots in the 2-23-24 season and seed of these were shared with all other VDHR-SWW breeders for evaluation and potential release as cultivars.

What were the significant results?

Obj 1) The DH LA16020-LDH22 was released as AGS 3022 in 2021, only six years after the initial cross, showed excellent FHB resistance and was the highest-yielding variety across south Louisiana for the past two years. It has excellent yield and very good FHB resistance.

Obj 1) The DH LA18003-NDH119 has very strong FHB resistance, along with being a carrier of Fhb1, as well as strong resistance to rust, powdery mildew, and Hessian Fly. LA18003-NDH119

was the top-yielding *Fhb1* line in the 2024 Uniform Southern Nursery and has broad adaptation across the Southeastern United States and is a likely cultivar release for 2024.

Obj 2) The new DHs evaluated each year come from all of the participating VDHR-SWW program. Obj 3) New DHs are shared with all VDHR-SWW breeding programs with the understanding that each program has the ability to select, advance, and release DHs from other programs as long as the originating program does not plan to release that DH.

List key outcomes or other achievements.

Obj 1) Release of LA18003-NDH119 provides Southeastern US producers with a greater choice of FHB resistant varieties in the seed market and is key to reducing DON presence within the national wheat supply chain. Obj 3). Sharing selected DHs across the entire VDHR-SWW is a new initiative that should increase impact of investment and result in release of additional FHB resistant varieties.

The use of off-season nurseries and DHs have substantially decreased the length of the variety development cycle. For example, AGS 3022 (LA16020) was released in six years through the DH channel of the breeding program. Sharing of DHs improves the efficiency of all VDHR-SWW programs and maximizes return from investment.

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

Three graduate students were involved in setting up mist systems, inoculating nurseries, and rating field symptoms for FHB. Graduate students rated FDK in the lab, collected tissue for sequencing.

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

Seed from all DH lines that were advanced and harvested by each VDHR-SWW breeding program will be shared to every member. Three to five grams of seed per DH line will be shared to allow each breeder to grow DH lines in headrows, including their respective FHB nurseries. This is a valuable collaborative effort that helps to maximize the return on investment by enabling more breeders a chance to look at many more DH lines, which is beneficial given that a DH line may perform better in a given region than elsewhere. A Wheat Field Day held at the Macon Ridge Research Station in Winnsboro on April 23, 2024, highlighted variety resistance, FHB screening, the breeding program, and fungicide control of FHB. The SunGrains breeders tour visited the LSUAC wheat breeding program on April 26, 2024, and spent substantial time discussing FHB resistance and germplasm evaluation.

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

Given that the USWBSI funding to the VDHR-SWW was eliminated, activities will be significantly curtailed. There will be new DHs received in October 2024 from Heartland Plant Institute from crosses submitted in summer 2023 and these will be handled as normal. There will be no new crosses submitted to HPI for DH development and therefore no new DHs in October 2025. Seed of new DHs harvested as headrows in May 2024 will be shared with other VDHR-SWW breeders.