

FY23 USDA-ARS/USWBSI Project Summary of Progress & Requested Changes

Principal Investigator:	Steven Xu
PI Institution:	USDA-Agricultural Research Service
Project Title:	Development of elite spring wheat germplasm with Fusarium head blight resistance
Project ID:	FY22-SP-010

As the Principal Investigator on this request, I confirm that all provided information, including the budget documentation, is accurate. My required signature is included here as validation.

Principal Investigator Signature (required):	STEVEN XU	Digitally signed by STEVEN XU Date: 2022.09.21 11:04:23 -0700'
Date Signed:	September 21, 2022	

Summary of Progress

Include a brief summary of the overall progress achieved to date (since receipt of FY22 funding, May-September 2022) on this project by responding to the following items.

Report on progress relative to approved goals, objectives, and approach along with key accomplishments since receipt of FY22 funding.

- A total of about 900 BC₁F₅ lines derived from 18 BC₁F₁ populations from backcrossing the synthetic hexaploid wheat (SHW) lines SW93, SW183, and SW187 to hard red spring wheat (HRSW) varieties 'Glenn', 'Barlow', 'Vitpro', 'Grandin', 'Linert' and 'Bolles' and breeding lines ND828, NDHRS16-1436, and NDHRS16-13-89 were evaluated in the FHB nurseries in Fargo and Prosper, ND in summer (May – August) of 2022. Many lines with good agronomic characters showed higher FHB resistance than their HRSW parents. More interestingly, a number of these SHW-derived lines also showed high levels of resistance to the bacteria leaf streak (BLS, caused by *Xanthomonas translucens*), which had a serious outbreak in the spring wheat region this year.
- Conducted yield trials to evaluate yield and quality of the 12 elite HRSW lines with improved FHB resistance derived from PI 277012 in two locations (Prosper and Thompson, ND) during the summer season (May – September) in 2022. As a result, these lines have been evaluated in two locations for three years (2020 – 2022).
- A large population of over 10,000 BC₁F₂ individuals derived from 113 BC₁F₁ plants (15FAR1157-1/2*ND Frohberg), which were heterozygous for PI 277012 derived 5AL QTL and homozygous for *Fhb1*, and 15 DH lines (15FAR1157-1/ND Frohberg) have been developed.
- About 1,500 BC₂F₁ individuals (Wanshubai/3*ND Frohberg) have been developed.
- The F₁ hybrid seeds between ND Frohberg and a wheat-*Th. elongatum* 7B/7E introgression line XWC14-255-13-1 (WGC002) carrying new *Fhb7* allele *Fhb7*^{the2} have been produced.

Describe any difficulties/problems encountered and actions to overcome in achieving planned objectives.

A postdoc researcher (Krishna Acharya) was hired to work on this project on October 1, 2020. Before he received his key card to access USDA-ARS facility, the application and approval for foreign visitors to access to federal facilities was temporally on hold. Therefore, he was unable to work in PI's laboratory and resigned on May 30, 2022. Therefore, the genotyping the large population of 10,000 BC₁F₂ individuals derived from 113 BC₁F₁ plants (15FAR1157-1/2*ND Frohberg) for PI 277012 derived 5AL QTL have been



delayed. The BC₁F₁ individuals (Wanshubai/2*ND Frohberg) were not genotyped using the markers for *Fhb1*, *Fhb2*, *Fhb4*, and *Fhb5*. To achieve planned objectives, we have made the large number of backcrosses to generate about 1,500 BC₂F₁ seeds (Wanshubai/3*ND Frohberg) by using as many as BC₁F₁ plants that were not genotyped. Meanwhile, we have hired a new postdoc researcher (Anil Karmacharya) to work on this project. All the delayed tasks can be completed as described in the Plan of Work.

Requested Changes/Project Plan for FY23

Include a brief request and rationale for any changes needed in FY23 to the project plan. If no changes necessary, simply indicate that is the case. Any requested changes noted here should also be reflected in your Project Description file.

Provide a rationale for any requested changes in approach and strategies for the FY23 project plan compared to what was outlined in the FY22 approved and funded award.

Because the postdoc researcher (Krishna Acharya) was unable to work in PI's laboratory and resigned on May 30, 2022, the task for marker development and genotyping for the large BC₁F₂ population have been delayed from summer to Fall and winter 2022. Therefore, the projected FY23 timeline for project implementation have been modified to reflect the changes.

Include a projected FY23 timeline for project implementation.

May – August 2023

1. Evaluate BC₁F₄ lines (15FAR1157-1/2*ND Frohberg) homozygous for *Fhb1* and 5AS/5AL QTL in the field FHB nurseries.
2. Evaluate BC₁F₇ lines derived from SHW lines in the field FHB nurseries for the 2nd year.
3. Develop BC₃F₁ seeds from backcrossing Wangshuibai and *Fhb7* introgression lines with ND Frohberg and newer variety or breeding lines carrying two PI277012-derived 5A QTL.

September – December 2023

1. Select, evaluate, and increase ~100 elite HRSW lines (15FAR1157-1/2*ND Frohberg, BC₁F₄) homozygous for *Fhb1* and 5AS/5AL QTL.
2. Evaluate and increase BC₁F₈ lines derived from SHW lines in the greenhouse.
3. Develop BC₄F₁ hybrid seeds from backcrossing Wangshuibai and *Fhb7* introgression lines with ND Frohberg and newer variety or breeding lines carrying two PI277012-derived 5A QTL.

January – April 2024

1. Develop BC₅F₁ hybrid seeds from backcrossing Wangshuibai and *Fhb7* introgression lines with ND Frohberg and newer variety or breeding lines carrying two PI277012-derived 5A QTL.
2. Prepare yield trials to evaluate ~40 elite HRSW lines homozygous for *Fhb1* and 5AS/5AL QTL and ~40 elite lines derived from SHW lines in two locations.

