Development of FHB Resistant Spring Wheat in the Northern Great Plains

K.D. Glover - SDSU
J.A. Anderson - U of M
M. Mergoum - NDSU

Introduction

- ‘Alsen’, released in 2000, was first regionally adapted HRSW cultivar known to possess *Fhb1*.
- ‘Steele-ND’, released in 2004, was first regionally adapted HRSW cultivar known to possess resistance from *T. dicoccoides*.
- Since then, more released cultivars possessing *Fhb1* have been made available (i.e., ‘Faller’, ‘Freyr’).
- Additional experimental lines possessing *Fhb1* are slated for release (i.e., SD3851, MN03358-4, ND806, and ND809).
- Unfortunately, even under optimal conditions, none provide complete resistance.

Introduction

- Evaluation of FHB resistance through germplasm screening is therefore a necessity for at least the following reasons:
  - Identification of new resistance sources
  - Localizing new genes and / or QTLs
  - Combining known and new resistance genes and / or QTLs
  - Validating known and new resistance genes and / or QTLs

FHB Resistance Screening (SD)

- Three trials are conducted each year
  - Brookings
  - Two greenhouse tests
- Brookings
  - Inoculation
    - Grain spawn and Conidial spray - Mist irrigated
  - Approx. 3,700 rows evaluated annually
    - Early-generation populations (about 3,000)
    - Replicated trials (PYT, AYT, URN, URSN, CPT; about 700)
  - Some early-generation populations replicated
    - Data considered are DI, TW, and VSK
  - Other trials are three rep tests
    - Data considered are DI, VSK, TW, and DON

FHB Resistance Screening (SD)

- Greenhouse tests
  - Inoculation
    - Grain spawn and Conidial spray - Mist irrigated
  - Approx. 2,300 hills evaluated in each cycle
    - Early-generation populations (about 2,000)
    - Replicated trials (PYT and AYT; about 300)
  - Early-generation populations replicated
    - Selected heads from fall provide seed for spring cycle
    - Selected heads from spring provide seed for field
    - Data considered are DI and VSK
  - Other trials are three rep tests
    - Data considered are DI and VSK

FHB Resistance Screening (MN)

- Three field trials are conducted each year
  - No greenhouse tests
  - St. Paul, Crookston, and Morris
- St. Paul and Crookston
  - Inoculation
    - Conidial spray at St. Paul - Mist irrigated
    - Grain spawn at Crookston - Mist irrigated
  - Approx. 2,500 rows evaluated annually
    - Early-generation populations (about 1,700)
    - Replicated trials (EYT, PYT, AYT, URN, URSN; about 800)
  - Early-generation populations not replicated
    - Data considered are DI and VSK
  - Other trials are three rep tests
    - Data considered are DI, VSK, 30 SSW, and DON

FHB Resistance Screening (MN)

- Morris
  - Inoculation
    - Grain spawn - Mist irrigated
  - Approx. 800 rows evaluated
    - Replicated trials (EYT, PYT, AYT)
  - Trials are three rep tests
    - Data considered are DI, VSK, 30 SSW, and DON

FHB Resistance Screening (ND)

- Three field trials are conducted each year
  - Prosper, Carrington, and Langdon
  - Greenhouse tests
- Prosper
  - Inoculation
    - Grain spawn - Mist irrigated
  - Approx. 12,000 rows evaluated annually
    - Early-generation populations (about 9,000)
    - Replicated trials (EYT, AYT, IYT, PYT, URN, URSN; about 3,000)
  - Early-generation populations not replicated
    - Data considered are DI
  - Other trials are replicated tests
    - Data considered are DI, VSK, and DON

FHB Resistance Screening (ND)

- Carrington and Langdon
  - Inoculation
    - Conidial spray and grain spawn - mist irrigated
  - Approx. 3,000 rows evaluated annually
    - Replicated trials (EYT, AYT, IYT, PYT, URN, URSN; about 3,000)
  - Trials are replicated tests
    - Data considered are DI, VSK, and DON

FHB Resistance Screening (ND)

- Greenhouse tests
  - Inoculation
    - Conidial spray - Mist irrigated
  - Approx. 400 hills evaluated in each cycle
    - Replicated trials (EYT and AYT)
  - Trials are three rep tests
    - Data considered are DI and VSK

Challenges

- We are not really *screening* for DON resistance
  - Many tests are required for accurate assessment
    - Sampling methods need assessment and optimization
    - Capacity needs to be increased
- Resistance genes
  - “Low fruit” analogy

Summary

- Among the three programs, early-generation screening procedures are somewhat dissimilar.
  - Mostly because of dissimilar program operations
  - However, data collected and used for selection are similar
- Procedures and data collected from replicated trials are quite similar.
- As *Fhb1* and other QTLs become more widely utilized, germplasm screening will remain necessary for continual advances in resistance.
- Screening for DON resistance should be further emphasized.