

Progress Report to NC Small Grain Growers Association, 2019-20
Improving Small-Grain Disease Management in North Carolina -- C. Cowger, USDA-ARS

Christina Cowger, USDA-ARS Research Plant Pathologist, appreciates the funds provided to our program for small-grain disease research and education to benefit the North Carolina small-grain industry in 2019-20. Funds were used as follows:

(1) Supported the North Carolina Small Grain Industry

Our program supported the industry with education, diagnostics, and decision support. This past year, we provided:

- **research-based advice** to county agents, agronomists, crop consultants and growers;
 - Sent out 3 timely updates on scab risk via Small Gains Extension Portal (April 2, 9, 17)
 - Assisted with stripe rust alert & recommendations (May 1)
 - Provided diagnosis and decision support by phone, email and in person to ~20 county agents, NCDA specialists, and private crop consultants regarding biotic and abiotic problems, fungicide & other management decisions for specific farms and fields across the state
- **talks at field days and agent trainings** on small-grain disease management;
 - Spoke at NE Ag Expo, Hobbsville on scab fungicide decision-making (Feb. 19)
 - Answered questions from specialists and county agents at Grains Agronomic Program Team Zoom Meeting on black chaff, scab (May 19)
- **diagnosis and recommendations** to clients of the NCSU Plant Disease & Insect Clinic (PDIC).
 - Diagnosed 32 wheat, barley, oat and rye samples submitted to PDIC, provided management recommendations
 - Used those samples to train two grad students (Reese and Adhikari) in small grains diagnosis

(2) Screened advanced wheat and barley breeding materials for resistance to Fusarium head blight (FHB, or scab) and Septoria nodorum blotch (SNB).

- Provided Drs. Murphy, Marshall, Griffey (Virginia Tech) and Baenziger (Nebraska) with scab severity data and DON ratings for advanced experimental wheat and barley lines under misted, inoculated conditions.
- Provided SNB resistance ratings for 360 advanced experimental lines from wheat breeding programs in NC, VA, SC, GA, and surrounding states.

(3) Provided growers and crop advisors with data on efficacy and timing of fungicides for reduction of Fusarium head blight in wheat and barley.

- Successfully conducted a third year of a field experiment to compare the new product Miravis Ace to Prosaro and Caramba at the same timings. Miravis Ace provides equivalent scab symptom and DON reduction to Prosaro or Caramba in barley at early full spike emergence, and also at 6 days after early full spike emergence. However, none of the fungicides reduced FHB and DON as well when applied early, at 50% spike emergence. National research shows similar results in wheat.
- Presented poster on these research results at Joint Crops meeting (Jan. 8-10).

(4) Advanced our ability to combat Pythium root and crown rot of wheat.

- We have found that the soilborne fungus *Pythium* can cause severe rotting of roots and crowns especially when wheat plants are subjected to prolonged soil saturation.
- We have determined that 3 particular species of *Pythium* are most frequently infecting stunted plants
- A graduate student has developed a protocol for infecting wheat in growth chamber or greenhouse conditions with those three species of *Pythium*
- We have obtained seed of Pacific Northwest wheat varieties believed to have tolerance or resistance to *Pythium*, to serve as controls for screening North Carolina wheat lines

(5) **Management of wheat powdery mildew with fungicides and wheat resistance genes**

- By studying the powdery mildew fungus' response to fungicides, we have learned:
 - Triazoles: there is some loss of efficacy against wheat powdery mildew in the eastern U.S. compared to the central U.S., but the key mutations that make the fungus highly resistant to triazoles in the UK and Europe are still absent here. We now understand what those key mutations are and can monitor for them.
 - Strobilurins (QoIs): the key mutation that makes wheat powdery mildew completely resistant to strobilurins in the UK and Europe is still absent from the U.S. mildew population. However, U.S. wheat powdery mildew does vary in strobilurin sensitivity, making it important not to further push it toward resistance by over-using this chemistry.

- We continue to study the mutation that allowed powdery mildew to overcome the resistance gene Pm1a in DG Shirley. This is an important case because when that resistance gene is removed from use in our agricultural landscape, the mildew strains that can overcome it appear to die out. We are identifying the mutation and want to learn whether Pm1a is a special gene that can be periodically reintroduced into wheat varieties because strains that can overcome it are weakened and do not persist in the population.