NDSU Greenhouse Studies Yield More Tips for

Improved Fungicide Spraying

for Wheat/Barley Head Scab Control

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Introduction

A new semi-permanent greenhouse was built on the NDSU campus in the fall of 1998 for the purpose of learning more about optimizing spray techniques to improve fungicide application and control of head scab of wheat, durum and barley. The greenhouse structure was funded through federal dollars obtained, in part, with the aid of regional wheat and barley groups. The materials, supplies and labor for operating the greenhouse were funded by North Dakota and Minnesota wheat and barley commodity groups, private agricultural crop protection companies, the NDSU Research Foundation and the North Dakota State Board of Agriculture Research.

Previous studies among a team of researchers in North Dakota indicated that fungicide treatments were most effective if sprays were directed at an angle more perpendicular toward the wheat and barley heads, rather than directed straight down. Also, previous work had indicated that the flowering stage was the optimum time to apply fungicides to wheat, and efficacies of available fungicides had been evaluated. Additional work was needed on understanding optimum spray nozzles, sprayer pressures, gallons per acre (gpa), adjuvant effects, and timing of application for barley.

Methods

Russ hard red spring wheat, Robust barley, and Munich durum were seeded in the greenhouse and were in the full heading stage by the end of February. Over 40 different trials were done on these headed plants to evaluate percent head coverage with the spray and disease control with fungicides. Sprays were applied with a track sprayer designed by Agricultural and Biosystems Engineering personnel.

Percent head coverage was measured using an indicator orange day glo dye and a digital analysis system, also designed by Agricultural and Biosystems Engineering. In addition, fungicides were applied in some trials to determine efficacy against head scab, following inoculation and misting of plants to create a growth environment conducive for scab.

Spray Variables Studied

The following spray parameters were evaluated:

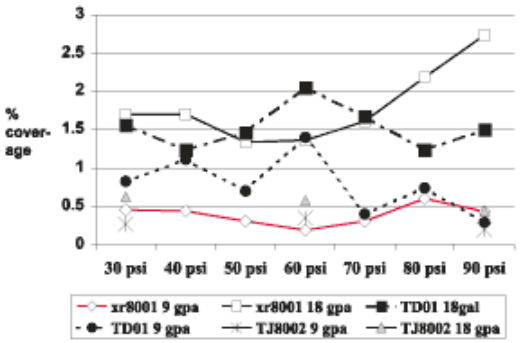
a. Spray pressure: 30 psi to 90 psi in 10 psi increments.
b. Spray nozzles: XR8001 flat fans oriented forward and backward in a double swivel body; TD01 turbo drop nozzles oriented forward and backward in a double swivel body; TwinJet TJ8002 nozzles oriented vertically; experimental Air Assist oriented vertically, and a dual set oriented forward/backward.
c. Gallons of water per acre (gpa); 9 to 54 gpa.
d. Growth stage of barley at inoculation and at time of fungicide application.
e. Adjuvants

General Conclusions

Optimum conditions varied across crops as well as with nozzle type. For each small grain, the following was found:

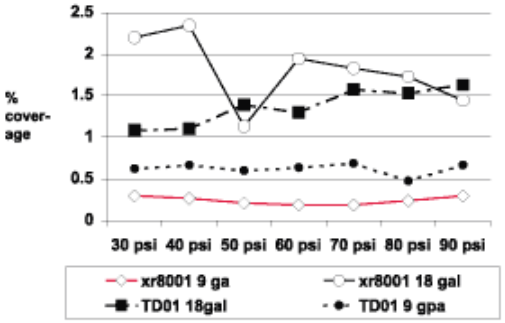
Hard red spring wheat — Although the TwinJet TJ8002 nozzle costs less than the forward/backward arrangements, this nozzle generally provided less head coverage as compared to the forward/backward orientations of the XR8001 flat fans or the forward/backward oriented TD01s (Figure 1). For the XR8001 nozzles, the best coverage occurred at 30-40 psi, or at 80-90 psi at 18 gpa, and lowest head coverage occurred at 50-60 psi at 9 gpa. TD01 nozzles performed optimally at 60 psi at 18 gpa in these tests.

Figure 1. Effect of pressure and gpa on head coverage of Russ HRSW with forward/backward XR8001 or TD01 nozzles, and vertical TJ8002 nozzles.



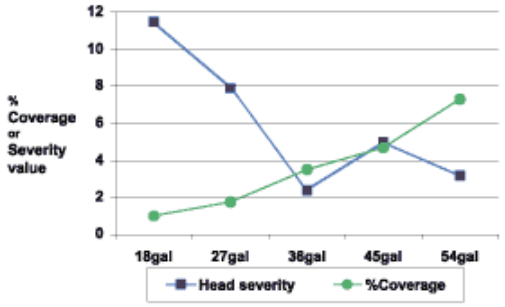
Durum wheat — Increased water volume improved head coverage of both the XR8001 and the TD01 nozzles on Munich durum (Figure 2). The XR8001 with 18gpa at 40 psi provided the best percent head coverage in this trial.

Figure 2. Effect of pressure and gallonage on coverage of heads of Munich durum with forward/backward XR8001 and forward/backward oriented TD01 nozzles.



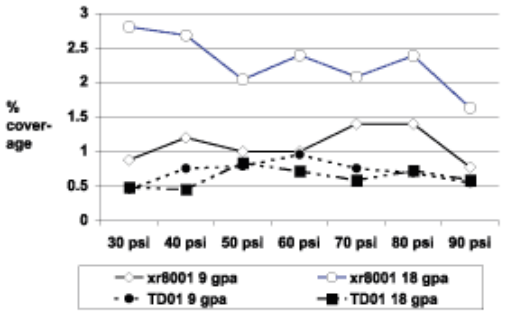
For Munich durum, increased water volume was essential for improved head coverage and disease control (Figure 3). Head coverage increased steadily with increased gpa, but disease severity decreased only up to the 36 gpa volume.

Figure 3. Comparison of coverage data to scab head severity with Folicur applied to Munich durum with forward/backward XR8001 nozzle at 90 psi at various gpa.



Barley — The percent head coverage on barley was consistently better with the forward/backward XR8001 flat fans than the forward/backward TD01 nozzles at both 9 and 18 gpa and across psi's, with 30-40 psi giving the best coverage (Figure 4). Increased gpa also improved head coverage, but in an inoculation experiment, increased gpa only slightly reduced disease severity.

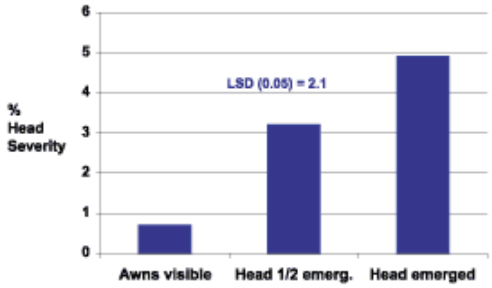
Figure 4. Effect of pressure and gallonage on coverage of heads of Robust barley with forward/backward oriented XR8001 & TD01 nozzles.



Treatment timing on barley — A timing-of-inoculation study showed that head scab did not develop substantially when barley was inoculated when awns were just showing but became

severe when fully emerged heads were inoculated (Figure 5). Fungicide application also was more effective when the fungicide was applied before inoculation than after inoculation. These results indicate that application of a fungicide should be in early head emergence or very soon after head emergence, when environment is favorable for the disease.

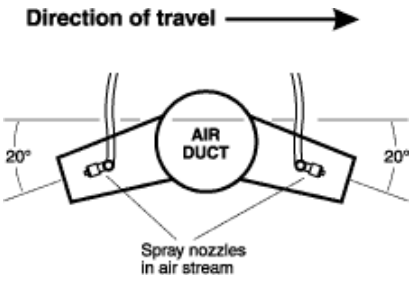
Figure 5. Head severity of scab in barley when crop inoculated at different growth stages.



Adjuvants — Tests with Folicur and Tilt fungicides indicated that the addition of an appropriate adjuvant generally increased head coverage and disease control.

Other comments — An experimental air-assist was built to be used in the greenhouse. Some initial experiments indicated that a downward orientation did not provide as much coverage as compared to a dual air assist system mounted both forward and backward toward the grain heads. A diagram of this experimental forward/backward mounted dual assist sprayer is provided in Figure 6. More work is planned during the growing season with this experimental air assist mounted to a tractor sprayer.

Figure 6. **Experimental** dual air assist configuration.



Summer Research — Some new experimental fungicides will be evaluated this summer for control of head scab and leaf diseases of wheat, durum, and barley. In addition, refinement of application pressures and gpa will be studied, and further study on air-assist spraying will occur at Fargo and Langdon. Several trials with aerial application at different spray volumes are planned as well.

Summary Recommendations

- Angle spray towards grain head using forward and backward mounted nozzles
- Use 40 psi for XR flat fan tips or 80-90 psi with 18 gpa; If use Turbo TD01 nozzles, need higher pressures (60 psi)
- Increase spray volume to improve head coverage
- Spray hard red spring wheat and durum at early flowering (Feekes 10.51)
- Spray barley at early heading (Feekes 10.3-10.5)
- Use appropriate adjuvant for fungicide used
- When using ground equipment, spray in evening, prior to heavy night dews
- When using aerial application, spray in evening or early morning, when dew present, and increase water volume (7.5 gpa as compared to 5 gpa)

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