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Application of Fungicides for Suppression of Fusarium Head Blight (Scab)

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The Fusarium head blight (FHB) disease, also known as scab, cost wheat and barley growers in North Dakota and northwestern Minnesota close to $3 billion dollars from 1993-2000. This disease has the potential to cause serious yield and quality losses whenever wet weather coincides with heading and flowering of these crops. One method for reducing the risk of this disease is to apply fungicides to the grain head. Standard fungicide application practices, developed primarily for leaf disease control, have generally provided around 50 percent reduction of FHB. Research has focused on improving the efficacy of labeled fungicides through various application techniques and timing.

Previous studies among a team of researchers in North Dakota indicated that fungicide treatments were most effective if sprays were directed at an angle toward wheat and barley heads rather than directed straight down. Also, previous research had indicated that the flowering stage was the optimum time to apply fungicides to wheat, and efficacies of available fungicides had been evaluated. These results are summarized in the previous edition of this circular (June 1998) and in NDSU Extension Report 56 (Improved Fungicide Spraying for Wheat/Barley Head Scab Control, June 1999). This update of Extension Circular AE-1148 provides information from continued research in the field in 1999 and from the greenhouse in 1999-2000 on fungicide application techniques for improving fungicide suppression of FHB.

Application Trials

Ground application studies in 1999 were done at Fargo, Carrington, and Langdon on several varieties of spring wheat, durum, and barley. Field tests evaluated spray volume, spray pressure, timing of application, rates of fungicide, adjuvants, and sprayer type. In the field, plots were generally dryland, with *Fusarium* inoculum either occurring naturally in the field or added with infected grain spawn. Plots were sprayed either with a hand held boom sprayer or with a tractor mounted sprayer. Similar tests were done in a greenhouse environment in the winter of 1999-2000 on Grandin spring wheat, Robust barley, and Munich durum. In the greenhouse, plants were sprayed with a track sprayer. Plants were inoculated with an atomizer delivering spores of the *Fusarium graminearum* fungus to the grain head, and then plants were placed under a mist system for three days. Two fungicide trials also were done on hard red spring wheat in cooperation with aerial applicators in 1999.

General Conclusions from Ground Application Trials and Greenhouse Tests

Across all crops and nozzle arrangements, spray angled toward the grain heads outperformed a vertical orientation, for head coverage and disease control. However, optimum spray pressures and water volume varied among crops.

Hard Red Spring Wheat

Nine gallons of water per acre applied by ground was consistently adequate to provide control of FHB for hard red spring wheat (Most fungicide labels require a minimum of 10-15 gpa by ground, 5 gpa by air). A range of 40-90 psi gave good control. Lower spray pressures reduce the risk of spray drift, but under calm conditions, the 90 psi gave good control as well. XR8001 flat fan nozzles oriented both forward and backward generally provided slightly better disease control or spray coverage than TwinJets, Hollow Cone, or XR11001 nozzles. The optimum timing of application for FHB control in spring wheat is early flowering, at Feekes growth stage 10.51 (Table 1).

Durum Wheat

Water volume is important for disease control in durum, because the grain heads are very difficult to wet. Eighteen gallons of water per acre gave better disease control than 9 gpa. With XR8001 nozzles and 18 gpa, 90 psi gave slightly better disease control than 40 psi under calm field or greenhouse conditions. Optimum timing of application for FHB control in durum is early flowering, Feekes 10.51 (Table 1).

Table 1. Effect of timing of application of Folicur (4 fl oz/acre) on field severity of FHB in greenhouse, 1999.

Application Growth Stage (Feekes)*	FHB Field Severity (Field Severity = Incidence x Head Severity) Grandin HRS	Munich Durum	Robust Barley
10.3	1.6	16.4	1.5
10.51**	0.5	3.5	1.3
10.54	7.0	22.5	1.9
Untreated	7.0	32.1	3.2

* Feekes growth stage 10.3 = 50% head emergence; 10.51 = early flowering; 10.54 = kernel water ripe

** Barley sprayed at Feekes 10.5 = head fully emerged

Table 2. Effect of Folicur rate on field severity of Fusarium head blight (FHB) in Grandin wheat, field and greenhouse.

Folicur Rate	FHB Field Severity in Fargo Field	FHB Field Severity in Greenhouse
6 fl oz	—	5.2
4 fl oz	1.6	4.5
3 fl oz	4.3	7.9
2 fl oz	7.4	11
Untreated	—	8.0

Barley

Increased water volume also has improved FHB control in barley, with 18 gpa providing better disease control than 9 gpa. At 18 gpa, the 90 psi with the XR8001 flat fan nozzles has resulted in improved control in barley under calm conditions. In barley, the optimum timing of application is at early, full head emergence (Table 1).

Fungicide Rate

A full label rate of Folicur (4 fl oz) provided better control of FHB than lower use rates, both in the field and in the greenhouse (Table 2).

Spray Air

An experimental air assist sprayer was provided by Spray-Air for field tests, and a prototype was built for the greenhouse by NDSU ag. engineers. An angled spray rather than a vertical spray by this air assist technology also provided improved spray coverage and disease control. No differences were seen in disease control between a 25 mph and 40 mph air delivery speed. Further work with air assist sprayer technology is needed and will be continued in summer work in 2000.

Surfactants

Surfactants, such as Induce or Silwet added to fungicides at very low volumes (0.03 to 0.06% v/v), improved fungicide performance for FHB control.

Labeled Fungicides

Five products are currently labeled for heading application for wheat, via full federal registration, a Section 18 Emergency Exemption, or a 24C state label. Benlate, various mancozebs, and Quadris have full registration for heading application to wheat. The mancozebs also are registered for barley. Folicur has a Section 18 emergency exemption for use on wheat and barley for FHB suppression. Tilt has a 24C state label for use on wheat at heading for FHB suppression.

Summary Recommendations

- For ground application, angle spray toward grain heads, using forward and backward mounted XR8001 nozzles or nozzles that have a two directional spray, such as Twinjet nozzles.
- When using XR flat fan tips, use 40 psi with 9-10 gpa, and 90 psi with 18 gpa.
- Increase spray volume for durum and barley to improve head coverage and disease control.
- Spray hard red spring wheat and durum at early flowering (Feekes 10.51).
- Spray barley at early heading (Feekes 10.3-10.5).
- Use a good adjuvant.
- Use dew as additional water.
- When using aerial application, spray in evening or early morning to capture dew as extra water volume, and use a small droplet size.
- Use NDSU's disease forecasting system *(http://www.ag.ndsu.nodak.edu/cropdisease/)* for determining need for fungicide application, or use general guidelines based on yield potential, price of crop, disease presence, past week's weather and two-week weather forecast.

- **NOTE: Above recommendations also have given good control of leaf spot diseases and leaf rust.**

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