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Fusarium Head Scab Management in Wheat

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Introduction

Scab or Fusarium head blight is an increasingly important and damaging disease of wheat in the U.S. While heaviest disease-related losses occur in the Midwest, damaging scab outbreaks are seen in Alabama wheat, primarily in the Tennessee Valley. Losses are not only due to sizable reductions in the germination, numbers, and test weight of seed from scab-blighted heads but also to the production of mycotoxins by the causal fungus in diseased seed. Other cereal hosts of the above causal fungus are barley, corn, and grain sorghum. Given favorable weather patterns, wheat drilled behind no-till corn is at highest risk for a destructive scab outbreak.

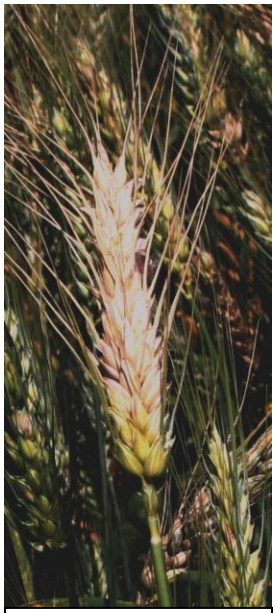

Figure 1. Partially bleached head can have slight pink cast.

Moist weather patterns during flowering through early kernel fill are required for scab development. Severe scab outbreaks are likely when 3 to more rain or irrigation events occur from the start of flowering (anthesis) through 3 to 5 days post-bloom, particularly on the scab-susceptible wheat varieties grown in Alabama. Extended post-flowering rains also contribute to increased disease severity and elevated mycotoxin contamination. Conversely, dry weather patterns during flowering will suppress scab development. Scab forecasting models, have been developed to help predict the risk of the disease as wheat becomes vulnerable to attack and provide guidance concerning fungicide use (http://www.wheatscab.psu.edu/index.html). Consult the scab model daily starting a week or two before flowering until flowering is completed.

Survival sites for the causal fungi of which *Fusarium graminearum* (sexual stage = *Gibberella zea*) predominates includes fungus-infested seed and host crop residues. No- or minimum-till production systems that leave *Fusarium*-colonized corn stalks and other crop residues on the surface greatly increase the risk of destructive scab outbreaks in the following wheat crop. Causal fungi attack spikelets

in the seed head during flowering, thereby killing the seed embryo. Further colonization and eventual gridling of the rachis by *F. graminearum* will result in the premature death of a portion or the entire seed head along with poor grain fill. Low test weight, scab-damaged seed typically has a low germ and produces unthrifty seedlings with a poor survival rate.

Figure 2. Typical bleached seed heads associated with scab in wheat.

Scab is easily recognized in maturing wheat by the appearance of bleached or partially bleached heads several weeks after their emergence (Figures 1 and 2). Often, a light pink to salmon-colored fungal mycelial mat and spore mass may be seen at the base of the bleached spikelets as well as masses of pepper seed sized, black fruiting bodies of the causal fungus *Gibberella zea*) along the edge of the glumes on diseased seed heads. Shriveled, scab-damaged seed has a chalky white to pink cast (Figure 3).

Toxins and Testing

The fungus *Fusarium graminearum* produces the mycotoxin vomitoxin [deoxynivalenol (DON)] and zearalenone that concentrate in the scab-damaged grain. Vomitoxin can cause reduced feed intake and lower weight gain in animals at levels as low as 1–3 ppm with swine and other non-ruminant animals being most sensitive. Vomiting and feed refusal can occur when vomitoxin levels exceed 10 ppm. Vomitoxin may be involved in the human disease alimentary toxic aleukia, so FDA has recommended that toxin levels not exceed 1 ppm in food (Table 1). Chickens and adult ruminant animals (non-lactating dairy and beef cattle) are less sensitive to the toxin than swine and can be safely fed grain containing up to 10 ppm vomitoxin as a portion of their daily ration. Maximum vomitoxin concentration for pregnant or lactating dairy cattle in grain is 5 ppm. Straw of scab-damaged wheat may be contaminated with vomitoxin but may be used as bedding from all livestock except for swine. Zearalenone has estrogenic properties and produces

Figure 3. Scabby kernels. Note pink discoloration of kernels due to mycelia and spore mass of causal fungus (KSU, Photo by Bill Willis).

reproductive disorders at concentrations of 1-5 ppm such as infertility, spontaneous abortions, and uterine prolapse (hyperestrogenism) in swine and to a lesser extent in feeder (immature) cattle and sheep. In Kentucky, suggested maximum concentration of zearalenone in swine rations should not exceed 1 to 2 ppm and 0.5 ppm for sheep. In contrast, poultry are fairly tolerant of zearalenone.

Producers concerned about mycotoxin contamination should have grain tested prior to feeding to animals. A list of commercial laboratories that will conduct mycotoxin tests on grain and feed samples can be found in **Table 3.** In cases of **suspected mycotoxin poisoning in livestock in Alabama,** samples of raw grain, formulated feed, or grain byproducts can be sent for testing for vomitoxin and zearalenone to:

Thompson Bishop Sparks State Diagnostic Laboratory
890 Simms Rd./P.O. Box 2209
Auburn, AL 36831-2209
Phone: (334)844-4987 Fax: (334)844-7224

The sample submission form can be downloaded at http://www.labs.alabama.gov/uploads/95/7c/957c4667b56e1050873ca28230ade298/CF.ACC.1.2Auburn-General-Submission-Form.pdf.

NOTE: The State Veterinary Diagnostic Laboratory at Auburn University **does not do** routine mycotoxin analysis of grain samples or feed for farm clientele or grain elevators. Commercial laboratories that will conduct mycotoxin analysis on grain are listed in **Table 3.**

Table 1. FDA Advisory levels for vomitoxin in food and feed.

Host	**Vomitoxin** ***Concentration at which regulatory agency urges caution***
Humans - Wheat, Barley (including finished products)	1 ppm
Cattle and chickens (above grains and grain byproducts)	10 ppm, not to exceed 50% of diet
Swine (above grains and grain byproducts)	5 ppm, not to exceed 20% of diet
Other livestock	5 ppm, not to exceed 40% of diet

Scab Control

A variety of control strategies can be employed to prevent scab outbreaks in production fields as well as minimize the risk of contamination of stored wheat and subsequent exposure of livestock to mycotoxins.

Preventive measures:

1. Purchase registered or certified, fungicide-treated wheat seed or apply a hopper box fungicide seed dressing to bin-run wheat seed. See IPM-458, Small Grain Insect, Disease and Weed Control for list of fungicide seed dressings (http://www.aces.edu/pubs/docs/A/ANR-0500-A/VOL1-2010/smallgrains.pdf). Raxil + Thiram may be best choice for a fungicide seed dressing.

2. Avoid sowing wheat directly behind corn or grain sorghum. Plant wheat after a non-host crop of the scab causal fungus such as cotton, peanut, or soybean.

3. The scab risk is higher for a no-till compared with conventional till wheat cropped behind corn or grain sorghum, so plow under or burn stubble and other surface debris associated with either of these crops.

4. Early wheat has increased risk of scab.

5. Make a protective fungicide treatment at full seed head extension or flowering. See list of fungicides recommended for scab control in wheat in **Table 2.**

6. While considerable advances in the selection of scab-resistant soft winter wheat varieties and breeding lines have been made, none are currently available to Alabama producers. Hopefully, such disease resistant varieties will be released in the near future.

7. Plant rye, oats, or a winter legume as a winter cover crop in place of wheat to reduce the risk of scab as well as take all in subsequent wheat crops.

For scab-damaged wheat:

1. Separately harvest and handle seed from portions of fields with highest level of scab-damaged heads.

2. Choose higher combine air speeds to blow out the small, shriveled, mycotoxin-contaminated kernels and chaff. At a minimum, 'scabby' wheat will be heavily discounted by elevators.

3. Dry harvested grain quickly to 13% moisture to prevent further fungal growth and mycotoxin concentration.

4. Post-harvest cleaning of scab-damaged wheat to remove low-test weight, mycotoxin contaminated kernels.

5. Test wheat grain samples from scab-damaged fields for vomitoxin and zearalenone. See list of commercial labs that test for mycotoxins in grain and feed products in **Table 3.**

Table 2. Fungicides labeled for suppression or control of Fusarium scab on wheat.

Fungicide	Rate/A	Comments
Metconazole CARAMBA	13-17 fl oz	For optimum suppression of Fusarium scab, apply at early flowering (Feek's Growth Stage 10.51). Do not make more than two applications of Caramba or other DMI (Group 3) fungicides per year to wheat. May also be applied to barley for scab control.
Propiconazole PROPIMAX 3.6E TILT 3.6E	4 fl oz	Apply at 50 percent flowering (Feeke's Growth Stage 10.52). Do not apply more than 8 fluid ounces for wheat harvested as grain.
Tebuconazole ORIUS 3.6F TEBUSTAR 3.6F TEBUZOL 3.6F MONSOON MUSCLE 3.6F	4.0 fl oz	Apply at early flowering (Feek's Growth Stage 10.51) for Fusarium scab suppression. A maximum of 4 fl oz/A may be applied per year for wheat harvested as grain. May also be applied to barley for scab control.
Tebuconazole + prothioconazole PROSARO 421SC	6.5-8.2 fl oz	Apply at early flowering (Feek's Growth Stage 10.51) for Fusarium scab suppression. Spray equipment must be set to obtain good coverage of the heads. A maximum of 8.2 fl oz/A of Prosaro 421SC may be applied per year. Apply a minimum of 5 gallons of spray volume/A. May also be applied to barley for control of scab.

Table 3. List of commercial laboratories that do mycotoxin analysis for farm and agribusiness clientele.

Laboratory	**Mycotoxin**	**Fee**
Waters Agricultural Laboratories P.O. Box 382 257 Newton Highway Camilla, GA 31730 229-336-7216 229-336-7967 fax Keith Dominey www.watersag.com	Alfatoxin T-2 Vomitoxin Zearalenone Fumonisin	$30 $48 $48 $48 $48
Waters Agricultural Laboratories 2101 Calhoun Rd. Hwy. 81 Owensboro, KY 42301 270-685-4039 kyinfo@watersag.com		
Eurofins Scientific 2200 Rittenhouse St., Ste 150 Des Moines, IA 50321 Phone: (515) 265-1461 Fax: (515) 266-5453	Alfatoxin T-2 Zearalenone Deoxynivalenol Fumonisin Ochratoxin	$31 (ELISA) $125 (HPLC) $57 for one sample $38 for additional samples in same series