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<i>1. Loose smut on wheat: Causes and treatments</i>	<u>1</u>
<i>2. Impact of Best Management Practices on water quality in Cheney Watershed</i>	<u>3</u>
<i>3. Head scab on wheat in Kansas</i>	<u>4</u>

1. Loose smut on wheat: Causes and treatments

There have been several reports this year of loose smut in wheat. It is not uncommon to find low levels of loose smut in wheat fields, but the disease does appear to be occurring at above normal levels this season.

It is easy to pick out plants with loose smut in a field. The spikelets of infected heads are completely black and sooty instead of the normal, healthy color. There is no grain. Instead, infected heads consist entirely of a mass of fungal spores.



Loose smut in wheat. Photo from May 29, 2009 CropWatch, University of Nebraska-Lincoln:
http://cropwatch.unl.edu/archives/2009/crop14/wheat_loose_smut.htm

Loose smut is a seedborne disease that is caused by the fungus *Ustilago tritici*. The fungus that causes loose smut survives as dormant mycelia within the embryo of an infected wheat seed. When the seed germinates, the fungus becomes active again. The fungus develops within the growing point and moves into the developing grain tissue as the wheat plants grow.

When the head emerges, there are masses of black spores on the spikelets instead of flowering parts. By harvest only an erect bare rachis remains. The spores are released into the air and can be blown onto healthy wheat heads where infection takes place at flowering or the early stages of kernel development. If the infection is successful, the fungus begins to grow within the developing wheat seed embryo.

Newly infected grain appears healthy in every way, but when it germinates the following season, the plant that grows from the infected seed will produce nothing but a dark mass of spores instead of healthy grain. The yield loss on infected heads is total. On a field-wide basis, the amount of yield loss is proportional to the percentage of infected heads.

Cool (60-70 degrees), humid weather accompanied by light showers or heavy dews is most favorable for infection. Under favorable weather conditions, the wheat produced from a field with only one percent of the heads infected, can have seed with 10 percent or more infection of loose smut.

Once loose smut becomes evident in the field, it is far too late to control the disease. The best option at that point is seed treatment. If producers have a field that is infected with loose smut and plan to keep some of the grain back for seed, they should be sure to have the seed commercially treated with a systemic fungicide seed treatment such as Charter (triticonazole), a Dividend (difenoconazole) product, a Raxil (tebuconazole) product, or RTU-Vitavax (carboxin)-Thiram. These fungicides provide excellent control of loose smut, but good coverage of the seed is very important to ensure that the maximum benefit of the treatment is realized.

Another option is to sell all the wheat from the infected field as grain and buy certified seed to plant in the fall. Certified seed in Kansas is allowed to have as much as 10 heads in 1,000 (or 1 percent) that are infected with loose smut. There is no requirement that this seed be treated in order to qualify as certified seed by the Kansas Crop Improvement Association, but it would be a good idea to buy treated seed. The cost of having seed treated with a standard low-rate fungicide seed treatment for loose smut is relatively low. Costs are higher if the seed treatment also includes an insecticide, such as Cruiser or Gaucho.

There are no varieties are highly resistant to all races of loose smut.

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2. Impact of Best Management Practices on water quality in Cheney Watershed

In recent years, considerable effort has been put into developing conservation practices designed to protect or improve water quality, and encouraging the adoption of these practices. Once these practices have been adopted by producers and landowners, the next stage is to find out how much impact these practices are having on water quality in a given watershed.

Determining the impact of conservation practice implementation is the focus of an intensive K-State research project in the Cheney Lake Watershed, which is a source of drinking water to Wichita. A team of research personnel from a range of disciplines within K-State, including a rural sociologist and an agricultural economist, is studying the effects of past conservation practices implementation on water quality. We are also working to determine the best methods to target future practices in the watershed.

Cheney Lake Watershed is one of 38 watersheds in the nation involved in the Conservation Effects Assessment Project (CEAP), a cooperative program through multiple agencies within the USDA. Three major questions involved in the Cheney Lake Watershed CEAP are:

- * Have conservation practices improved the quality of water entering the lake?
- * How can we maximize the water quality improvement from additional conservation practice implementation?
- * What social and economic factors influence conservation practice implementation?

To answer the third question, a rural sociologist and an agricultural economist from K-State are part of the team.

One of our overall goals is to see if we can find a strategic approach to implementation of conservation practices. The plan is to figure out what motivates producers to implement practices and which practices they choose, such as converting to no-till or building terraces. This information will be useful to future watershed improvement efforts.

So far, we have found that, of the conservation practices implemented in the watershed, putting land into the Conservation Reserve Program (CRP), converting to no-till, and building terraces have had the largest positive effect on water quality.

Phosphorus and sediment loading have been found to be the most harmful threats to water quality in the watershed. We are using Geographic Information System (GIS) methods to determine which specific areas in the watershed are most likely to generate nonpoint source pollution. Computer models are used to estimate the effects of past management practices in the region. With the model representing the current state of the watershed, all current conservation practices can be “removed” on computer, showing what the water quality would be like now if those practices had not been implemented.

Preliminary data from the modeling in the Cheney Lake Watershed shows that the conservation practices that have been implemented in the last 15 years reduce annual sediment inputs to the

lake by approximately 20 percent and reduce annual phosphorus inputs to the lake by about 25 percent.

Changes in water quality are more difficult to observe through actual, regular monitoring because of the variability in weather patterns and discontinuous water quality data. However, water quality monitoring and analysis are important parts of the project. It will take at least another year and a half to determine if we'll be able to detect declining trends in sediment and phosphorus loading to Cheney Reservoir with monitoring data.

What we learn will be applied to other watersheds. Knowing the right method to target appropriate conservation practices in the beginning of a water quality project will be most helpful.

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3. Head scab on wheat in Kansas

Some areas of Kansas are reporting above normal levels of head scab again this year. The disease is most common in the southeastern corner of the state, but can also be found at low levels in parts of south central Kansas. The symptoms of head scab include large tan or white lesions that encompass one or more spikelets. Heads infected by scab will often have a brown discoloration of the rachis (central stem of the wheat head) and the developing kernels will have a white chalky appearance. The base of diseased spikelets may also have a small pink mass that is produced by the fungus that causes head scab.



Head scab on wheat. Photo by Jim Shroyer.

Now is the time for producers to be scouting their fields for head scab. The symptoms of head scab become most obvious as the wheat moves into late milk and early dough stages of development. It will be important to check multiple times during the grain filling period because the symptoms of head scab can change rapidly in just a few days. It is common to see the incidence of scab symptoms increase dramatically in a 3- to 5-day period.

Nothing can be done at this point to prevent the disease. The infection typically takes place during flowering and the early stages of grain fill, and would require fungicide applications of products like Folicur, Prosaro, or Caramba (all newly labeled products) to suppress the disease. Producers should also avoid using the most susceptible varieties and avoid planting wheat after corn, which is also a host of the fungus.

Cropping systems and tillage systems have an effect on the development of head scab in wheat. The head scab fungus, *Fusarium graminearum*, also causes stalk rot and ear rot of corn, and can infect other grasses. Corn residue and infected wheat residue are prime sources of head scab infections in the spring near flowering time.

Wheat planted into or near corn residue, or continuous wheat planted into fields with infected wheat residue or infected wheat seed, is often more likely to have head scab infections than wheat planted after a broadleaf crop, grain sorghum, or on fallow ground. However, wheat planted after a broadleaf crop or grain sorghum may still get infected with head scab some years since the *Fusarium* fungus is airborne and may travel great distances from the original source of inoculum (corn, wheat, or grass residues).

Broadleaf crops such as soybeans, sunflowers, canola, and cotton are not hosts of the *Fusarium* head scab fungus. Where scab has been a problem, producers may want to rotate to one of those crops the following year.

It is important to scout fields now to know which fields have the most damage. The disease incidence can be determined by simply counting the number of infected heads in 5 groups of 20 heads (100 total). The number of infected heads will give you a good estimate of the disease incidence. Fields with less than 2% incidence should not have significant yield losses, however, the likelihood of yield losses increases when incidence is greater than 10%. The diseased grain may have a reduced test weight and some of the kernels will likely be light colored.

At harvest, check the quality of the grain periodically. Although combines are not great at separating the grain by kernel density, it may be possible to remove some of the most heavily damaged grain by slightly turning up the air speed on the combine. Severely damaged grain may be subject to price discounts upon delivery and the most severely damaged loads may also be rejected.

At the elevator, grain inspectors will look for scab-damaged kernels and treat them the same as any other kind of damaged kernel. Wheat can have up to 2 percent damaged kernels and still grade No. 1; up to 4 percent to grade No. 2; and up to 6 percent to grade No. 3. Beyond that, however, elevators and other grain buyers may choose to have the wheat tested for DON (vomitoxin) levels. This is not a requirement, but the Kansas Grain Inspection Service can perform this test at the elevator if requested. Flour mills are often concerned about DON levels in wheat, and do not typically want more than 2-3 parts per million DON in the wheat. This may affect whether an elevator will accept scabby wheat, depending on whether a load of scabby wheat with high DON levels can be blended with clean wheat to reduce the overall concentration of DON.

Producers should begin developing a plan now to deal with the diseased grain, and it might be wise to dedicate a portion of the on-farm storage or equipment shed just in case a load of grain is rejected and needs to be handled separately in the middle of harvest. It may still be possible to use this damaged grain as part of a cattle ration, or clean the grain to improve the test weight using seed cleaning equipment. Nothing is more frustrating than losing time during the grain harvest, and a little preparation may help you make good marketing decisions.

Cleaning for seed. Head scab can create an issue for wheat intended for seed. The first priority is to separate the seed lots with the worst damage from those with less damage. Use the best quality grain to meet your seed needs. Plan to clean the grain heavily to remove the damaged kernels. Commercial seed cleaning equipment should be able to remove most of the diseased kernels, because the diseased kernels are smaller and lighter in weight than the healthy kernels. Most elevators in Kansas have a scalper to take out large foreign material, but this will not remove scabby kernels. The first level of cleaning for scabby wheat should be screening and aspiration. This is the primary cleaning method, and can take out much of the lighter-weight, scabby kernels, depending on the level of cleaning desired. The limitation of this method is that quite a bit of non-scabby wheat may also be removed, resulting in very high cleanout rates in some cases.

Another option is to have the grain cleaned with a gravity table. Fewer seed cleaning operations have this equipment, but it can be very efficient at removing light-weight kernels. A gravity table will take out low-test-weight wheat with relatively low cleanout.

After cleaning to increase the test weight to at least 56 lbs per bushel, and germination to at least 80 to 90 percent, the grain can be used as seed if desired. This seed should be treated with a fungicide seed treatment, however, since the scab fungus can also cause seedling blight the following growing season.

* Livestock feed. Scabby wheat, or even the cleanout from scabby wheat, can be used as livestock feed. The following information is from the “Wheat Scab” Fact Sheet from Extension Plant Pathology (<http://www.plantpath.ksu.edu/DesktopDefault.aspx?tabid=533>):

The relative feed value of scabby wheat is often very good. However, scabby wheat may contain the mycotoxins DON (vomitoxin) and zearalenone (an estrogen analog). Neither of these toxins is considered carcinogenic or highly toxic, but they both can reduce the performance of livestock. Wheat should only be a small portion of the total feed ration and use caution when feeding animals severely damaged wheat.

Since the mycotoxins are concentrated in the grain, baled wheat straw from affected fields should be safe for most uses. However, it should probably not be used for breeding livestock.

Livestock are very in sensitivity to these mycotoxins. Swine are most sensitive to scabby wheat mycotoxins. As little as 1 ppm of DON can significantly reduce daily weight gains in pigs. Higher concentrations result in feed refusal and vomiting. Swine reproduction is also sensitive to disruption by the zearalenone mycotoxin. Non-breeding cattle and poultry seem to tolerate both toxins better than swine. If scabby wheat is used as feed, it should be tested for both DON and zearalenone content.

Testing is available through the Comparative Toxicology Lab, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506. Phone (785) 532-5679. Submit at least 1/2 pound of a representative sample. Both grain and straw can be tested. It’s best to take as many subsamples as possible and bulk them. The lab can make recommendations for appropriate dilution of feed which has high toxin levels.

You can also ask the lab about the availability of an inexpensive strip test, which can be used to give a quick indication of whether DON is present in a sample. This strip test will not measure exact amounts of DON, but will let you know whether there is a potential problem that might require further testing. You can buy the strip test from the lab.

Guidelines for Avoiding Mycotoxin Problems When Feeding Scabby Wheat

	Maximum* Concentration in Total Diet Should Be No More Than	
Animal Species	Zearalenone (ppm)	Vomitoxin (DON) (ppm)
Sheep and Beef Cattle during breeding	3	5
Sheep and Beef Cattle bred females	5	5
Sheep and Beef Cattle growing and finishing	10	10
Dairy replacement heifers	5	10
Dairy lactating cows	2	2
Dairy dry bred cows	5	5
Swine breeding herd	0.5	1
Swine growing and finishing	1	1
Poultry chicken	5	5
Poultry turkeys	2	5

* Due to variability in both sampling methods and mycotoxin assays, test results are inherently variable. Therefore, allow a margin of error when interpreting test results.

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