

Diseases Can Bewitch Durum Millers

Fusarium head blight, ergot, and black point are the most common wheat-related fungi

In 1692, eight girls from Salem, MA, exhibiting symptoms of hallucinations, convulsions, delirium, and odd skin sensations, accused their fellow villagers of bewitching them.



The resulting witchcraft trials, which ended with 20 executions and five prison-related deaths, are remembered as a gruesome chapter in American history.

Three centuries later, some experts suggest there is a relationship

between the Salem witchcraft trials and a grain fungus called ergot.

Ergot often infected grain that grew in the early American colonies. Ingestion of infected grain can cause ergotism that, in severe cases, results in symptoms such as those exhibited by the girls in Salem.

Fortunately, today's durum wheat is less troubled by disease, thanks to the evolution of crop-breeding programs, improved pesticides, and a better understanding of science.

Effects of Disease

Disease may or may not cause problems for millers. Some diseases attack a durum plant and kill it before it can produce grain. Obviously, farmers will not harvest this durum.

Other diseases attack the grain later in the growing season and cause damage to

the kernels. Depending on the amount of damage, this durum may be on the market.

"The diseases that adversely affect milling quality are going to be those that change test weight, kernel size, color, or protein content," explains Brian Sorenson, technical director at Northern Crops Institute.

"When you have a shrunken or shriveled kernel, you have more bran and less endosperm. It is not going to mill properly. It will have more bran specks, and you will have less milling yield. If the kernels are shriveled too much, the durum will end up in the cleaning house," he says.

Some fungi can produce toxic substances or mycotoxins.

"Mycotoxic molds generally attack the kernels of grain, robbing them of nutrients and lowering their fat, protein, and vitamin content," according to the USDA Grain Fungal Diseases and Mycotoxin Reference.

The most common mycotoxin in wheat is deoxynivalenol or DON (vomitoxin), associated with Fusarium head blight (FHB)-infected grain. DON's common name is vomitoxin, because it can cause vomiting and feed refusal in non-ruminant animals.

The presence of FHB in grain does not automatically mean mycotoxins have developed. However, in recent years, high levels of scabby kernels in harvested grain generally meant high levels of vomitoxin also were present, according to the NDSU Extension Service.

Fusarium Head Blight

Infection from Fusarium head blight or scab (*Fusarium graminearum*) usually occurs when the wind blows spores into the wheat heads, where germination and infection take place during warm, moist weather.

Scab causes the formation of shriveled, light test-weight kernels, and it may cause the head to appear bleached. The severely scab-infected kernels that appear chalky or opaque are referred to as "tombstones."

Scab can significantly impact final product quality. The shrunken kernels result in a loss of milling yield. Scab produces enzymes that break down proteins and reduce the gluten strength, which reduces pasta quality.

Damaged kernels also can impact milling yield and semolina quality (semolina may have specks). Also, pasta may have reduced color and cooking quality.

"For vomitoxin, the FDA advisory level for finished food products is less than 1 part per million (ppm)," says Marcia McMullen, North Dakota State University Extension plant pathologist. "If processors or millers want to achieve that level or get it lower, they will have to source non-contaminated grain or use costly cleaning processes to remove damaged kernels."

When the grain is processed into flour or feed, the visible mold may be removed, but the majority of toxins are not and can still cause poisoning, according to the USDA Mycotoxin Reference.

FHB-infected grain also can cause allergy and breathing problems. Hence, millers must take extra precaution to source clean grain and remove any infested kernels through the cleaning process.



Durum wheat with black point.



Durum wheat with scab.



Durum wheat with ergot..

Ergot

Ergot (*claviceps purpurea*) is a fungus that infects durum and other wheat, rye, barley, and grasses. The disease begins when the flowering grain head discharges a honey dew mucus that contains fungal spores. Insects spread the spores, which grow in the grain kernels. Eventually, the fungus replaces the kernels with purplish-black sclerotia that resemble black grain kernels. Usually two to five ergot bodies occur per head.

“Durum that is more than 0.05% by weight of ergot sclerotia is considered ‘ergoty,’” says McMullen. “Most of the sclerotia can be removed from ergoty grain with modern cleaning machinery, unless broken pieces are present, or the sclerotia are similar in size to the grain.

“However, it is costly and often difficult to remove enough sclerotia to meet the legal standards, and traces that have proven toxic to livestock are left.”

Ergot contains potent chemicals called

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alkaloids. One alkaloid called ergotamine is used in medicine to treat migraine headaches. The street drug LSD is made from another alkaloid called lysergic acid.

Black Point

Black point fungus (*Helminthosporium*) is a non-mycotoxic fungus that attacks wheat and barley.

“Black point results when you have fungi move in during wet weather as the crop is maturing,” says McMullen. “You get infection on the embryo end of the kernel.”

Shriveled kernels will reduce yields. In later stages of kernel development, the mold may cause an odor in the grain that will result in market discounts. McMullen’s advice for avoiding black point sounds simple: source non-black point grain, clean the fungus out of the grain, or dilute it so it is present in very small percentages.

“Black point is the one that has no adverse health effects,” she says. “It’s mostly just cosmetic.”

Minimizing the Effects

How can millers minimize the

effects of disease in durum?

First, buy the best grade of grain available—No. 1. The Federal Grain Inspection Service’s grain grading tests for damaged kernels includes disease, heat, sprouting, and mold. Each grain grade has a regulated limit on damaged kernels. If you cannot source high quality No. 1 grain, you will have to clean it and absorb that cost.

“One thing we always need to remember is that, in any year, disease impacts only a small percentage of our region’s crop,” says Sorenson. “Our farmers work hard to

produce a healthy crop, and plant breeders travel around the world to find germplasm that contains resistance that they can incorporate into new varieties for our region.

“Grain buyers and millers need to be diligent about ensuring that the grain they buy meets their quality needs,” he concludes.

Sally Sologuk is a public relations/communications specialist for Northern Crops Institute at North Dakota State University, Fargo, ND. She can be reached at 701-231-6538 or sally.sologuk@ndsu.nodak.edu



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