

Ergot

in Small Grains

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Ergot (caused by *Claviceps purpurea*) occurs every year in North Dakota and can be found on small grains and other grass hosts. Ergot has a large host range, including all small grains in North Dakota (rye is the most susceptible), and common weeds such as quackgrass and smooth brome grass (Figure 1).

Ergot commonly is associated with cool temperatures (60 to 80 F) and wet conditions at the flowering growth stage in small grains. It most commonly is found on field edges.



Figure 1. Ergot has several grass host species, including (left to right) quackgrass, brome grass, winter wheat, spring wheat, durum, six-row barley and two-row barley. (Andrew Friskop, NDSU)

Symptoms and Signs

- First sign of an infected spike - the presence of “honey dew” on the grass spike. The yellow to cream-colored honey dew is a sugary excretion with fungal spores (Figure 2a).
- Most recognized feature of this pathogen - irregularly shaped dark purple to black sclerotia (ergot bodies)
- Sclerotia replace kernels in grass spikes - signs are fairly obvious when the plant nears physiological maturity (Figure 2b)



Figure 2. (a) Honeydew protrudes from the floret of an infected floret. (Grant Mehring, Bayer CropScience)
(b) Black-purple ergot sclerotia protrudes from a floret. (Andrew Friskop, NDSU)

Disease Cycle

- Sclerotia fall to the soil surface (dislodged at harvest) and overwinter.
- In the spring, cool, wet conditions will cause the sclerotia to germinate, producing tiny mushroomlike bodies (stroma) that house sexual spores. Spores are shot into the air and carried by wind to infect grass hosts.
- The spores will land on the featherlike stigma of grass flowers and colonize the ovary tissue of the developing kernel (embryo).
- Yellow-white sugary honey dew will be observed a few days after infection and attract insects. Insects coming into contact with the honey dew will carry spores onto grass hosts. The grass hosts remain susceptible as long as florets stay open and ovaries remain unfertilized.

Importance of Ergot

Ergot sclerotia (hard fungal bodies) contain powerful alkaloids that are toxic to livestock and humans. These alkaloids include ergotamine, ergovaline, ergocryptine, ergocornine and ergocristine.

Consumption of ergot can lead to harmful health effects in humans. These include constriction of blood flow to extremities, gangrene, hallucinations, muscle spasms and vomiting.

Ergot thresholds (United States Standards for Grain) are determined as a proportion of sclerotia weight per grain weight. Thresholds are 0.05 percent for wheat, 0.1 percent for barley, 0.1 percent for oats, 0.1 percent for triticale and 0.3 percent for rye. For example, this can be as little as 10 to 15 ergot bodies per kilogram (2.2 pounds) of wheat seed.

Management

- **Crop rotation** – Rotate a broadleaf (nonhost) crop on last year's small-grain ground. The sclerotia do not survive for more than one year, and successive nonhost crops will help reduce in-field inoculum.
- **Tillage** – Incorporating and burying ergot sclerotia at least 1 inch in the soil will reduce sclerotia germination and spore release.
- **Managing grassy weed hosts** – Mowing or preventing wild grasses from heading in ditches and along field margins will reduce the spread of spores into a field.
- **Use of ergot-free seed** – An ergot-free seed source will help prevent re-introduction of the pathogen into the field. However, it won't eliminate ergot problems due to the availability of grassy weed hosts.
- **Fungicide use** – Fungicide seed treatments belonging to the DMI class (triazoles/FRAC 3) have been shown to suppress and delay germination of sclerotia. Foliar applications have not been shown to suppress ergot in small grains.
- **Varietal resistance** – Resistant varieties are not known to be available in North Dakota. Varieties with shorter flowering periods may be less susceptible to ergot.
- **Harvest strategy** – Ergot incidence often is higher near field edges. Harvesting and separating ergot sources in the field will help reduce seed contamination.
- **Cleaning ergoty seed lots** – Cleaning can help reduce ergot levels because sclerotia tend to be lighter and can be removed with gravity-type cleaners (Figure 3). However, cleaning should not be expected to separate all ergot sclerotia.



Figure 3. A hard red spring wheat lot has ergot bodies. (Karl Hoppe, NDSU)

Effect of Ergot on Livestock

Ergotism in Animals

The alkaloids contained in ergot bodies are potent vasoconstrictors (reduce the blood flow). Reduced blood flow to the extremities can cause loss of hooves, tails and ears. Decreased fertility or abortion, and poor cattle performance are other symptoms.

Vasoconstriction can lead to poor thermoregulation and cause clinical signs of “summer slump” in animals (seeking shade, standing in water, decreased feed intake, and lower weight gain and milk production). In the winter, reduced blood flow to the extremities can lead to frostbite.

The gangrenous form of ergotism typically involves initial swelling of tissues at the coronary band above the hoof and subsequent lameness, necrosis and sloughing of the hoof if the animal continues eating ergot-contaminated feed (Figures 4 and 5). Necrosis of the hooves, ears and tail, and tip of the tongue (in sheep) particularly occur during cold temperatures.

The concentration of ergopeptine alkaloids in ergot bodies capable of causing ergotism in livestock depends on multiple factors. The duration of exposure, daily doses of ergot alkaloids and physiological status of the animal (species, breed, age, gender and reproductive status) play a role in susceptibility.

No antidote is available for ergotism. Here are ways to reduce its impact:

- Recognize early the adverse effects, particularly hindleg lameness and redness and swelling, at the coronary bands above the hooves.
- Remove the animals from the ergot alkaloid feed source,
- Monitor grass in pasture or in hay for sclerotia in the seed heads.
- Avoid feeding ergoty feed and ergot screenings to animals.



Figure 4. Tissue necrosis (death) occurs near the ear of a heifer with ergotism. (Michelle Mostrom, NDSU)



Figure 5. Cutaneous ergotism is visible on the hoof of a heifer exposed to ergot sclerotia in a grass pasture. (Michelle Mostrom, NDSU)

Feeding an Ergoty Seed Lot

Feeding ergoty grain to feedlot cattle will lead to depressed feed intake and digestibility. Here are strategies for feeding ergoty feed:

- Limit feeding to less than 0.1 percent ergot bodies by weight in cattle rations. Get the feed analyzed for ergot alkaloid content rather than relying on a visual assessment.
- Be extremely vigilant with grain screenings because ergot may be concentrated.
- Do not feed ergot to pregnant cattle because it can lead to abortion, low birthweights and reduced milk production.

Ergot alkaloids are confined to the sclerotia bodies and will not be systemic in the plant.

Testing for Ergot Alkaloids

The NDSU Veterinary Diagnostic Lab (www.vdl.ndsu.edu) analyzes cereal grains and grasses for ergopeptide alkaloids (ergotamine, ergosine, ergocristine, ergocryptine and ergocornine, and their diastereomers the ergopeptinines). This test does not analyze for ergovaline found in fescue grass.

Lab staff need about a ½- to 1-pound sample of the suspect feed or grass hay with seed heads attached for analysis. No diagnostic test is available for ergot alkaloids in animal tissue.

Ergopeptide alkaloid concentrations of 200 to 800 micrograms per kilogram total ration (or 0.2 to 0.8 part per million) is a general threshold of effect in livestock.

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