Corn Silage: Fungal Disease, the Silent Killer?

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Fungal disease of corn can cause a multitude of problems, including yield loss, mycotoxin contamination, and decrease in plant quality for animal feed. In 2012, fungal disease caused a 10% loss in corn yield, and 24.4% of grain harvested was infected with mycotoxins. These diseases can increase lignin content, which can be influenced by plant stress as a response to drought, cold, or other disease such as fungal infestation. Researchers observed in white clover drought stress does not decrease plant biomass but can lead to an increase in overall lignification by causing an increase in enzymes responsible for lignification. Cold and heat stress can also cause an increase in phenolic compounds. In corn seedlings, it was reported that root infestation by an endophyte caused increased plant rigidity, increasing the plant structural components. This may be due to the plant attempting to protect itself from further infection. The increase in lignin can cause a decrease in NDF digestibility (NDFD). In corn silage this becomes even more important, as it is ~70% fiber. Studies have found that increasing NDFD of corn silage by 2% caused cows to eat more (11 lbs/day) and produce more milk (13 lbs/day). Fungal infection in corn can also cause a competition for nutrients, which can decrease nonfiber carbohydrates (NFC) such as sugars and starch. It can also decrease fat content in plants.

There are many different methods of controlling fungal diseases, including hybrid selection, management practices (i.e., crop rotation, tillage), and chemical control (i.e., fungicides). There are benefits and disadvantages to each and all methods can be used in combination with others to help mitigate disease. Hybrids are the most common method for disease control; however, technology is still being developed for some diseases. Hybrids do not completely eliminate disease risk. In some cases, resistance may be decreased or eliminated when insect infestation occurs. Crop rotation may be a helpful tool, but may not be possible in some systems (i.e., tillage due to the farm bill). Chemical control (i.e., seed or foliar fungicide) may also be a helpful tool to be used alone or in combination with other methods.

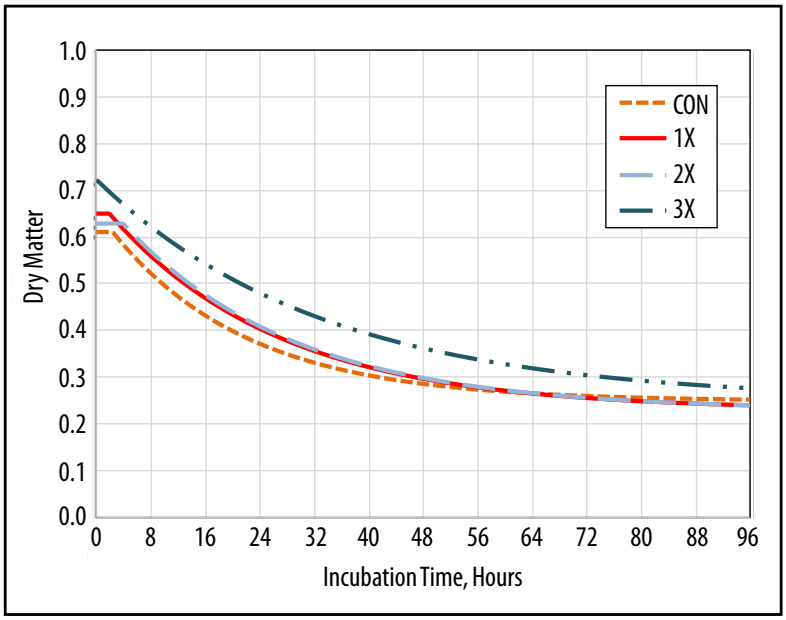
Fungicides may control growth of an already present fungal infection or help prevent a possible one. Different types of foliar fungicide may be used depending on your goals. Two of the most common classes of foliar fungicides are triazoles and strobilurins or a combination of both. Stobilurins may also have positive plant health effects outside of preventing and treating disease. Researchers reported in 2011 an average increase of 4.5 bu/ac of grain yield with pyraclostrobin fungicides. However, grain yield response was higher when disease severity was higher, and return on investment was higher when crop prices were high. Although positive results were seen, researchers concluded corn yield increase did not always make up for fungicide cost based on yield alone. Foliar fungicides allow producers to be flexible depending on environmental conditions and other variables influencing the return on investment.

University of Wisconsin (UW) Extension and University of Minnesota Extension studies examined potential benefits of foliar fungicide on corn silage quality and yield. One study reported foliar fungicides on corn silage significantly increased corn silage output by 0.7 ton dry matter (DM) per acre compared with the untreated control. Fungicides also led to a numerical increase in nutrients (i.e., crude protein, starch), while also significantly decreasing NDF and increasing NDFD. Milk was also increased ~75 lbs/ton and 2,500 lbs/ac of silage (UW MILK 2006 system). Plants also showed less premature death as well as decreased disease. A 2011 UW Extension study analyzed foliar fungicide use at the R1 and V5 stages of corn crop growth. Headline AMP® (BASF) applied at the R1 stage had the highest yield and lower disease severity when compared to untreated silage in one of the three counties. A 2013 study showed no significant difference in nutritive value, DM yield, milk per ton, or foliar disease scores at harvest for corn treated with various types of fungicide when compared with untreated corn silage. So, results were variable between the two studies.

Recently, we treated corn with various foliar fungicide applications and looked at silage quality and in situ digestibility effects. We concluded corn treated with one (1X; at V5), two (2X; at V5 and R1), or three (3X; at V5, R1, and R3)

applications had higher sugar and fat contents when compared with the untreated control (1.21 sugar and 2.89 fat vs. 0.72 and 2.71% DM, respectively). The concentration of fat and sugar increased as the number of applications increased. There was also a decrease in fiber (ADF and NDF) in the treated silages when compared with the control (27.72 vs. 29.24% for ADF and 45.52 vs. 47.32% for NDF, respectively). The ADF decreased as the number of treatments increased. When the silage was fed to lactating Holstein cows, the cows receiving treated silage tended to have higher fat-corrected milk (FCM) and energy-corrected milk (ECM) feed conversion when compared with the control (1.65 vs. 1.47 for FCM/DMI and 1.60 vs. 1.43 for ECM/DMI).

Figure 1. In situ digestion kinetics for proportion of feed fractions remaining after ruminal incubation of corn silages CON (no fungicide application), 1X (1 fungicide application), 2X (2 fungicide applications), and 3X (3 fungicide applications) for dry matter.



Corn silage treated with the foliar fungicide had higher aerobic stability when compared with the control (87.3°F vs. 90.9°F), measured as temperature 38 hours post aeration. Aerobic stability can be an indicator of the presence of fungi since fungi and mold are the main organisms responsible for silage heat spoilage. Having higher aerobic stability (lower temperatures) can help maintain good quality forage at the face of the bunk leading to a more palatable feed and decreasing shrink associated with spoilage.

Additionally, we evaluated in situ digestibility of treated corn silage. Fungicide application of corn resulted in higher DM digestibility and tended to have a lower Kd (rate of digestibility) as well as linear treatment effects for decreasing DM solubility, increasing rumen degradable DM, and decreasing Kd of corn silage DM (Figure 1). Fungicide application on corn for silage seems promising as changes in digestibility may increase efficiency in ruminant animal production systems.