

Foliar Fungicide Effects on Corn

Caroline Kalebich & Phil Cardoso, University of Illinois



Midwestern farmers tend to include corn silage in dairy cattle diets at 30-60% of the total mixed ration. Depending on nutritional management preferences, corn silage can be the main forage. Farmers favor corn silage due to the heterogeneous fiber and energy content, storage ease, and palatability. In 2014, USDA reported 89.4% of dairy operations included corn silage in lactating cow diets. Cows' potential dry matter (DM) intake and energy content are limited by the amount of forage fiber. Fibrous corn silage increases dietary bulk in the rumen, preventing cows from eating more, and yielding less milk. When evaluating quality, nutritionists focus on four chemical tests for fiber indication as a DM percentage: neutral detergent fiber (NDF), acid detergent fiber (ADF), lignin, and neutral detergent fiber digestibility (NDFD, % of NDF). NDF measures total cell wall in dietary fiber, including cellulose, hemicellulose, and lignin. ADF measures fermentable cellulose and lignin available as energy content. NDFD (*in vitro* test) measures forage ruminal digestibility, a function of total NDF content. Ideal results are low in NDF, lignin, and ADF content, and high in NDFD. University of Wisconsin (UW) researchers have shown increasing NDFD of corn silage by 2% allows cows to eat more (11 lbs/day) and produce more milk (13 lbs/day).

Corn fungal disease (i.e., Northern Leaf Blight, Gray Leaf Spot) can cause yield loss and decreased feed quality. In 2013, 7.5% of corn bushels were lost to disease. When conditions favor disease (i.e., wet, humid weather), pathogens create leaf lesions reducing the area available for photosynthesis. Lesions develop earlier with cool, wet summers. Plants use increased cell wall lignification to defend against pathogens. It is hypothesized increased lignin acts as a barrier to protect plants from further damage. Increases in lignin's cell wall can cause decreases in NDFD, and increases in NDF and ADF, affecting diets since corn silage is ~70% fiber and 30% starch. Once disease invades, pathogens compete with the plant for starch, non-fibrous carbohydrates, and sugars, potentially decreasing plant sugar content.

Scout weekly for signs of disease; when conditions favor disease, pay greater attention. One of the tools to control and prevent disease is to apply fungicides at various stages of development. A UW study evaluated effects of pyraclostrobin (PYR) (Headline[®], BASF Corp.) foliar fungicide on corn silage quality and yield. Researchers reported PYR decreased diseased plant and foliage tissue by 5% compared to control, and decreased stalk rot by 16%. It also significantly reduced NDF by 1%, and increased NDFD and starch compared to control.

In 2014, University of Illinois researchers fed dairy cows corn silage treated with PYR or a mixture of PYR and metconazole (PYR+MET) (Headline AMP[®] fungicide, BASF Corp.), looking at silage quality, and *in-situ* digestibility. One of three treatments was applied: one PYR (1X), one PYR and one PYR+MET (2X), or one PYR and two PYR+MET (3X), and control. It was determined fungicide applications on treated corn decreased fiber content (NDF and ADF) compared to control. As applications increased, ADF content decreased. Applications resulted in increased DM digestibility when evaluated *in-situ*. Cows receiving fungicide treated diets had greater feed conversion (feed required to make one pound of milk) compared to control; suggesting a higher energy forage.

It was concluded fungicide applications may positively affect corn silage quality. In 2015, Illinois researchers wanted to find where nutrients were changing within the growing plant and determine the most efficacious application timing. One of three treatments was applied: one mixture of fluxapyroxad (FLUX) and PYR (Priaxor[®] fungicide, BASF Corp.) at corn vegetative stage five (V5), when 5 visible leaf collars can be seen (1X); one FLUX + PYR at corn stage V5, and one PYR+MET at corn reproductive phase one (R1), when silks are visible on the outside of husks (2X); one PYR+MET at R1 (1X); and control. Evaluation at R1 and reproductive phase three (R3), when kernel is yellow outside and inner fluid is now milky due to starch accumulation, showed while <5% of total sampled corn had no signs of disease at R1, 20% had signs at R3. Treatment V5 at R3 evaluation was most affected by Gray Leaf

Spot (15%). Northern Leaf Blight was also found with the highest percentage being in the control (10%) and least in V5+R1 (1.63%).

At R1 and R3, plants were removed and separated into leaves, stalks, ears, and flag leaf for wet chemistry analysis (Table 1). Additionally, we analyzed treatment effects on leaves from two collection time points (Figure 1). Fungicide applications on corn seem to alter the fiber content the most in the leaves and stalks. Decreasing NDF, ADF, and lignin content of corn plants may increase NDFD of corn silage when fed to dairy cows. By increasing ruminal digestibility of corn silage, diets may increase conversion of feed to milk, making dairy production more efficient.

Figure 1. Leaf treatment effects from two collections.

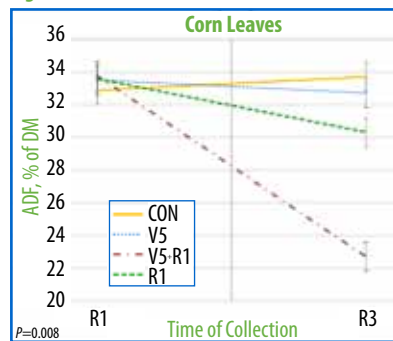


Table 1. Fungicide applications at various stages of corn plant development.

	Treatment ¹				SEM	P-value Fixed Effects ² TRT
	CON	V5	V5+R1	R1		
Ear Composition						
DM, %	26.85	27.03	26.40	28.33	1.00	0.61
ADF, % of DM	11.35	11.98	12.03	11.75	0.42	0.68
aNDF, % DM	19.60	19.30	18.50	19.58	0.80	0.75
Lignin, % of DM	2.75	1.18	1.70	1.08	0.86	0.52
Stalk Composition						
DM, %	15.95	16.25	15.77	16.15	0.65	0.95
ADF, % of DM	44.88	47.85	48.85	47.13	1.13	0.23
aNDF, % DM	64.58	66.68	67.35	67.95	1.58	0.53
Lignin, % of DM	4.55 ^b	5.58 ^{ab}	6.40 ^a	5.03 ^b	0.27	0.03
Leaf Composition						
DM, %	19.60	20.18	19.30	19.40	0.41	0.50
ADF, % of DM	33.30 ^a	33.13 ^{ab}	28.28 ^d	31.98 ^{abc}	0.62	0.01
aNDF, % DM	56.88 ^{ab}	58.40 ^a	52.35 ^d	55.43 ^{bc}	0.74	0.02
Lignin, % of DM	1.95	1.75	1.78	1.68	0.18	0.81
Flag Leaf Composition						
DM, %	27.38	29.75	29.18	26.80	1.15	0.34
ADF, % of DM	35.50	35.25	36.78	36.03	0.66	0.44
aNDF, % DM	59.50	58.03	59.30	59.63	1.57	0.86
Lignin, % of DM	0.93	0.93	1.03	0.80	0.17	0.84

¹Treatments: control (CON; no fungicide), V5 (1 application), R1 (1 application), & V5+R1 (2 applications).

²Fixed Effects (TRT) on corn plants; superscripts denote statistical differences among treatments.