The Effect of Environment on Corn Silage NDFD

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Understanding yield and quality changes during the life cycle of corn is critical for timing harvest of a field. Corn forage yield increases steadily through its life cycle and peaks about 1-2 weeks before black layer formation (R6). Corn exhibits a "double peak" for corn silage quality during its life cycle. The first peak is related to energy derived from stover fiber (NDFD) and water-soluble carbohydrates, while the second peak is derived from NDFD and starch content of grain.

Genotype x environment (GxE) interactions are often observed for corn grain yield and to some extant forage yield. Little is known about GxE effects on forage quality. It is likely GxE effects are greater on the starch energy pool than the NDFD energy pool. The objective of this research was to begin to understand the effect of weather on corn silage quality, especially NDFD.

Silage yield quality data was derived from the UW Corn Evaluation Program (1995-2020). A total of 45,597 silage yield and quality observations were used in the analysis. For the Arlington site reported here, a total of 5,495 plots were used.

Weather data (26 years) was derived from the Midwest Regional Climate Center. The corn silage growing season was divided into intervals. The overall season was April 1 to September 15. The vegetative period was April 1 to July 14, and the reproductive period was from July 15 to September 15. The growing season was further divided into planting (April 1 to May 31), leaf development (June 1 to July 14), pollination (July 15 to August 4), and grain-fill (August 5 to September 15). Cool/warm and dry/wet year for each interval were identified using ± one standard deviation from the 26-yr average. All other years were characterized as average.

Table 1. Corn silage yield and quality response to GDU and precipitation accumulation from April 1 to September 15 during 1995 to 2020 at Arlington, WI.

Season (Significant years)	Forage yield tons/ac	NDF %	NDFD %	Starch %	Milk/Ton lbs	Milk/Ac lbs
GDUs						
Cool (14,13,09,08,04,97)	10.0	48	58	29	3100	31200
Average	10.0	46	59	30	3130	31300
Warm (18,12,05)	9.9	40	58	35	3190	31800
LSD [0.10]	NS	2	NS	1	50	NS
Precipitation						
Dry (12,11,05)	8.9	44	58	35	3100	27800
Average	10.3	45	60	30	3140	32400
Wet (10,08,06,00)	9.3	48	55	30	3080	28700
LSD [0.10]	0.5	2	2	1	50	1800

Growing degree unit (GDU) accumulation during cool and warm seasons did not affect forage yield, NDFD, or milk/ac (Table 1). Warm seasons decreased NDF but increased starch content and milk/ton. Precipitation during both dry and wet seasons decreased forage yield, milk/ton, and milk/ac from an average season. Seasons with greater precipitation increased corn silage NDF but decreased NDFD and starch content.

Table 2. Corn silage NDFD (%) response to GDU and precipitation accumulation during various development stages. Data are derived from the UW Corn Evaluation Program (1995-2020).

	Season Apr. 1 - Sep .15	Vegetative Stages Apr. 1 - July 14	Reproductive Stages July 15 - Sep. 15	Planting Apr. 1 – May 31	Leaf Development June 1 - July 14	Pollination July 15 - Aug. 4	Grain Filling Aug. 5 – Sep. 15
GDUs							
Cool	58	58	59	57	60	60	58
Average	59	59	59	60	59	59	59
Warm	58	60	60	58	60	59	61
LSD [0.10]	NS	2	NS	1	NS	NS	2
Precipitation							
Dry	58	60	60	55	60	58	58
Average	60	59	60	59	59	59	60
Wet	55	57	56	60	59	58	56
LSD [0.10]	2	NS	1	1	NS	NS	2

Over the entire season, GDU accumulation did not affect NDFD (Table 2). Corn silage NDFD increased with warmer GDU accumulation over the vegetative stages April 1 to July 14. GDU accumulation affected NDFD more during planting than leaf development. Greater GDU accumulation during grain-filling increased silage NDFD. Over the entire season, dry and wet weather lowered NDFD compared to an average year. Wetter weather during reproductive stages, especially during grain filling decreased NDFD. Results show the NDFD energy pool can be significantly lowered during years with cool, wet weather during grain filling.