



## Forage Production and Quality for Selected Varieties of Corn Silage

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### Summary

*Corn silage is an important feedstuff for North Dakota cattle producers economically and nutritionally. However, deciding which variety to grow can be difficult without local data. The 26 corn silage varieties in this trial ranged in dry-matter yield from 6,717 to 7,885 pounds/acre.*

*The highest-producing variety was Dairyland 3808, while the variety with the highest dry-matter percentage was Mycogen 0526AM. The crude protein levels among all varieties ranged from 8.4% to 9.5%, and the highest-performing variety was Mycogen TMF91Q.*

*We found varietal differences ( $P \leq 0.05$ ) for calcium, phosphorus, magnesium and potassium but not sulfur. Total digestible nutrients (TDN) ranged from 71.6% to 73.6%, and the two varieties with the highest TDN were Dairyland 3099RA and Pioneer P9998Q.*

### Introduction

Cattle production is a very important part of the North Dakota economy. Production has been stable at about 1.8 million cattle, including calves (U.S. Department of Agriculture, National Agriculture Statistics Service [USDA NASS], 2020).

The largest expense for most cattle producers in North Dakota and across the northern Great Plains is winter feed. Producers not only need to provide

enough dry matter but also need to provide forage of adequate quality.

Many producers in North Dakota choose to produce high-quality feed for their livestock in the form of silage. In 2019, approximately 140,000 acres of silage were harvested, producing 2.73 million tons of feed (USDA NASS, 2020) at a value of \$122.9 million.

Just as a farmer selects wheat, grain corn or soybean varieties based on yield data, a good cattle producer should be selecting silage varieties based on field trial studies. The issue with this concept is that most of the published corn silage data does not come from North Dakota, creating decisions based on findings that may not fit the region. The intent of this trial was to provide producers with accurate, local silage data gathered in North Dakota.

### Study Area

This corn silage trial was conducted at the NDSU Central Grasslands Research Extension Center near Streeter, N.D. Experimental plots were grown on Wabek-Appam soils, which are classified as gravelly sandy loam soils on 6% to 9% slopes (USDA, Natural Resource Conservation Service, 2021). Monthly precipitation was 62% below the long-term average, and below average four of the five months of the trial (Table 1). Average monthly temperature ranged from 3 degrees below average to 4 degrees above average, with three out of the five months having temperatures above average (North Dakota Agricultural Weather Network [NDAWN], 2020).

**Table 1.** Monthly precipitation and average monthly temperature during the corn silage variety trial at the Central Grasslands Research Extension Center near Streeter, N.D., in 2020. (NDAWN, 2020)

Month	Precipitation	Departure from Average	Average Temperature	Departure from Average
	-----inches-----		-----F°-----	
May	1.81	-0.64	51	-3
June	1.35	-2.06	67	+4
July	2.13	-1.07	71	+2
August	2.73	+0.42	69	+1
September	0.31	-1.73	57	0
<b>Total</b>	<b>8.33</b>	<b>-5.08</b>	<b>63</b>	<b>+0.5</b>

## Methods

- The trial was planted on May 28, 2020, using a John Deere 1700 MaxEmerge Plus (eight rows, 30-inch spacing). Seeds were planted 2 inches deep at a population of 26,000/acre.
- Nutrients were supplied based on soil testing and required started fertilizer (40 pounds of phosphorus and 20 pounds of potassium per acre) and an application of 200 pounds/acre of urea.
- Plots consisted of two rows, 400 feet in length, which is equal to 0.05 acre. Twenty-six varieties were replicated four times (Table 2).
- Weed control was accomplished through herbicides because we practice no-till farming at the station. Preplant burn-down was accomplished by applying 1 quart of glyphosate with 1 ounce of Sharpen® (BASF Corp.) per acre. In-season weed control consisted of 1 quart of glyphosate with 15 ounces of Armezon® PRO (BASF Corp.) per acre.
- Plots were harvested on Sept. 7, 2020. Plots were harvested with a two-row Gehl corn chopper that shot the silage directly into a Knight mixer/feed wagon equipped with a digital scale. The silage was mixed with the reel as the plot was harvested. After chopping the whole plot into the wagon, the tractor was stopped and weight was recorded. A composite sample of each plot was taken as the wagon was unloaded and used to determine forage quality.
- Samples were sent to Dairyland Laboratories Inc. for nutritional quality testing using wet chemistry analysis.
- Data were analyzed as a completely randomized design using the general linear model in SAS 9.4 (SAS Institute, Cary, N.C.). Significant differences of least square means at the  $P \leq 0.05$  level were separated using t-tests.

## Results

Corn varieties were analyzed for harvest weight, yield, moisture, dry matter (DM), crude protein (CP), acid detergent fiber (ADF), calcium, phosphorus, magnesium, potassium, sulfur, total digestible nutrients (TDN), net energy for growth (NeG), net energy for maintenance (NeM), and net energy of lactation (Nel 3x). We found significant differences among varieties for all tested parameters except sulfur.

**Table 2.** List of varieties with company and relative maturity (RM).

Company	Variety	RM
Croplan	CP 3300 SRR	93
Croplan	CP 5000 SAS3122	110
Croplan	CP 4100 SVT2P	101
Croplan	CP 3899 VT2P	98
Pioneer	P 9608Q	96
Pioneer	P 9998Q	99
Pioneer	P 0157 AMXT	101
Pioneer	P 0031Q	103
NK	E095D3	95
NK	E105	105
NK	NK 0440	104
Integra	5500 STP	105
Integra	4810 STP	98
Integra	4550 STP	95
Integra	5191	101
Legacy	L4545	100
Legacy	L5467	104
Legacy	L4567	100
Dairyland	3808	108
Dairyland	4545Q	105
Dairyland	3211	111
Dairyland	3099RA	98
Mycogen	TMF91Q	91
Mycogen	0526AM	95
Mycogen	TMF94L37	94
Mycogen	1247AMXT	102



Table 3 presents all of the harvest and yield data. The top 11 varieties ranged in yield from 6,717 to 7,885 pounds/acre. Variety 3808 was the highest yielding and posted the highest harvest weight; however, it had the third lowest dry-matter content. Variety 3808

yielded 7,885 pounds/acre and was not different ( $P > 0.05$ ) from the next 10 highest yielding varieties. The three highest yielding varieties were 3808, P998Q and CP3899VT.

**Table 3.** Least significant means of wet weight yield, dry matter yield and moisture.

Variety	Wet Weight Yield <sup>a</sup>	100% Dry-matter Yield	Moisture Content
	-----Pounds/acre-----		----%----
3211	25,145 a	6,409 cdefgh	69.1 abc
3808	25,435 a	7,885 a	69.2 abc
5191	22,898 abc	6,539 bcdefg	67.5 abc
0526AM	16,522 f	6,306 defgh	60.0 d
1247AMXT	20,942 abcdef	6,410 cdefgh	64.4 abcd
3099RA	17,754 def	7,180 abcde	62.8 cd
4545Q	22,029 abcd	6,091 efgh	66.5 abcd
4550STP	19,420 bcdef	5,654 gh	64.7 abcd
4810STP	21,667 abcde	7,069 abcdef	64.4 abcd
5500STP	20,652 abcdef	6,506 bcdefg	65.2 abcd
CP3300SRR	20,507 abcdef	7,247 abcd	64.5 abcd
CP3899VT2P	21,522 abcde	7,516 abc	67.0 abc
CP4100SVT2P	23,696 ab	6,147 defgh	67.7 abc
CP5000SAS3122	22,826 abc	6,071 efgh	67.8 abc
E095D3	18,261 cdef	6,717 abcdefg	63.2 bcd
E105	22,102 abcd	5,340 h	70.6 a
L4545	16,957 ef	7,103 abcdef	64.7 abcd
L4567	22,029 abcd	7,318 abcd	66.7 abcd
L5467	20,072 bcdef	6,264 defgh	62.6 cd
NK0440	22,536 abcd	6,041 fgh	69.7 ab
P0031Q	19,928 bcdef	6,248 defgh	65.3 abcd
P0157AMXT	21,087 abcdef	6,575 bcdefg	65.6 abcd
P9608Q	20,942 abcdef	6,876 abcdef	64.1 abcd
P9998Q	18,551 cdef	7,610 ab	62.8 cd
TMF91Q	19,493 bcdef	6,415 cdefgh	65.0 abcd
TMF94L37	18,841 bcdef	6,873 abcdef	63.3 bcd
<b>LSD</b>	<b>226.68*</b>	<b>1167.6*</b>	<b>6.54668*</b>

<sup>a</sup> Values in the same column followed by the same letter are not significantly different by the t-test at the 95% level of confidence.



Table 4 (next page) presents a selection of feed quality parameters tested for each variety. Crude protein (CP) content ranged among varieties from 8.4% to 9.5% of dry matter, with a least significant difference (LSD) of 0.66. Variety TMF91Q had the highest CP and was greater ( $P \leq 0.05$ ) than the two lowest varieties. Varieties L4567 and 3099RA had the second and third highest CP levels, respectively, but were only greater ( $P \leq 0.05$ ) than CP4100SV, which had the lowest CP content.

Acid detergent fiber (ADF) ranged from 20.32% to 23.21%, with an LSD of 2.25 (Table 4). The top three varieties with the lowest ADF content were 3099RA, P9998Q and P0157AMXT, respectively. The ADF content of these three varieties was lower ( $P \leq 0.05$ ) than the four highest ADF varieties: 4550STP, TMF91Q, 4810STP and 5500STP.

The silage varieties were tested for composition of five minerals and we found significant varietal differences for all minerals except sulfur. Table 4 shows the mean of each variety for calcium, phosphorus, magnesium and potassium. Calcium means ranged from 0.20% (1247AMXT) to 0.29% (E105), with an LSD of 0.071. E105 was only significantly greater ( $P \leq 0.05$ ) than the five lowest performing varieties for calcium composition.

Phosphorus, magnesium and potassium all showed higher levels of variability among varieties. Varieties P0031Q and NK0440 had the highest phosphorus levels and were greater ( $P \leq 0.05$ ) than the lowest 12 varieties.

With magnesium, variety TMF91Q had the highest level and was greater ( $P \leq 0.05$ ) than the lowest 12

varieties; however, the second highest variety was only greater ( $P \leq 0.05$ ) than the three lowest varieties.

Potassium showed the greatest differences among variety, where CP3300SR was greater than 23 of the 26 varieties. Varieties TMF91Q and 4810STP, which had the second and third highest potassium levels, were greater than the 10 lowest varieties.

Varieties 3099RA and P9998Q had the highest levels of total digestible nutrients (TDN). However, these varieties were only greater ( $P \leq 0.05$ ) than the three lowest varieties. TDN values ranged from 71.59% to 73.62%, with an LSD of 1.47.

Net energy was tested for lactation, growth and maintenance. We saw varietal differences with all three measurements of energy, but we decided to report only net energy of growth (NeG). The varieties P0157AMX, 3099RA, E095D3, E105 and CP5000SA had the highest NeG levels at 48.04, 48.01, 47.64, 47.62, and 47.62 mega calories per hundredweight (Mcal/cwt), respectively.

The NeG values ranged from 45.27 to 48.04 Mcal/cwt, with an LSD of 1.14. The top two performing varieties were greater ( $P \leq 0.05$ ) than the lowest eight varieties, while the next three top varieties are only greater ( $P \leq 0.05$ ) than the lowest three.



## References

- Soil Survey Staff, Natural Resources Conservation Service, U.S. Department of Agriculture. 2021. Web Soil Survey. Available online at: <http://websoilsurvey.sc.egov.usda.gov/>. Accessed Feb. 7, 2021.
- U.S. Department of Agriculture National Agriculture Statistics Service [USDA NASS]. 2019. 2018 State Agriculture Overview – North Dakota. Retrieved from [www.nass.usda.gov/Quick\\_Stats/Ag\\_Overview/stateOverview.php?state=NORTH%20DAKOTA](http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NORTH%20DAKOTA)

*Photos by Kevin Sedivec*

