AS 657 ASL R2605

2011

2010 Iowa Corn Silage Yield Trial and Rye Cover Crop Demonstration

Jennifer A. Bentley
Iowa State University

Brian J. Lang
Iowa State University

2010 Iowa Corn Silage Yield Trial and Rye Cover Crop Demonstration

A.S. Leaflet R2605

Jennifer Bentley, Iowa State University Extension dairy field specialist; Brian Lang, Iowa State University Extension agronomist

Introduction

Corn silage is harvested from about 1.8% of Iowa corn acres. Most corn silage is harvested in the northeast and northwest portions of the state where the majority of dairy herds are located. In these regions, corn silage is a major portion of the row-crop acres. Because no independent yield trials are being conducted on corn hybrids for silage in Iowa, a coalition consisting of Iowa State University Extension, Northeast Iowa Community College, the Northeast Iowa Dairy Foundation, and several seed corn representatives initiated a corn silage hybrid trial at the Northeast Iowa Dairy Foundation farm in 2008. This is the third year of the corn silage trial.

Materials and Methods

The trial was conducted at the same location all three years (2008-2010) on a Fayette silt loam soil, 163C2, 5 to 9% slope and moderately eroded. Experimental design was a randomized complete block design with three replications. The previous (2009) crop was corn harvested for corn silage. The trial was planted on May 5, 2010 and harvested on September 1, 2010.

The trial received 10,000 gallons per acre of dairy manure in the fall of 2009 from the large manure storage pit at the Dairy Foundation's farm. The manure analysis was 19-10-19 pounds N - P_20_5 - K_20 per 1,000 gallons. An additional 100 pounds per acre nitrogen was side dressed in the spring 2010. Herbicide was applied early post emergence consisting of 2 quarts Harness Extra plus 3 ounces of Hornet per acre. Aztec was applied at 7.3 pounds per acre for corn rootworm management.

Winter rye was seeded in the fall of 2009 after the trial area and surrounding field was harvested, chisel plowed and field cultivated. A rate of one bushel per acre was used. Emergence of the rye was poor. With the thin stand and limited growth in spring 2010, it was determined unfeasible and uneconomical to harvest the rye for forage. Instead it was incorporated with spring tillage in preparation for planting the 2010 corn silage trial.

Twelve hybrids were planted in 4-row plots 30 feet long. Each was replicated three times. Plant populations were recorded on May 27 at the V-1 stage. The harvested area consisted of 10 foot of row from the middle two rows of each plot. A 10 foot 4-by-4 was laid beside each row to obtain a uniform cutting height of 4 inches. Harvested plants were weighed on a platform scale. Six stalks from each plot were randomly selected to be chopped in a wood chipper. Two subsamples were taken from the chopped silage after aggressively stirring the contents. Each subsample was placed in a vacuumed sealed plastic bag and labeled. Both subsamples were transported that day to the Dairy Foundation where they were stored in a cool, dry place. The subsamples were allowed to ferment for approximately 5 weeks. Then one set of subsamples was sent to Cumberland Valley Analytical Services for analysis. The other set was kept at the Dairy Foundation as a backup set. All samples were coded so that laboratories were blind to hybrid variety and company.

Cumberland Valley Analytical Services conducted dry matter and NIR analysis of each sample. Tests included crude protein, acid detergent fiber, neutral detergent fiber (NDF), in-vitro NDF digestibility (IVNDFD) at 12 and 30 hours, IVNDFD rate, starch, starch digestibility 7-hour, total fatty acids, crude fat, and lignin. The laboratory also calculated net energy lactation, net energy gain, net energy maintenance, and milk per ton. Milk per ton uses "Milk2006", an adaptation of Milk2000 reported by R. Shaver, University of Wisconsin. Milk2006 approximates animal performance based on a standard cow weight and milk production level (1350 lb. body weight and 90 lb/day at 3.8% fat). The values used to calculate Milk2006 were based on laboratory values for hybrid moisture, crude protein, NDF, IVNDFD, starch, ash, NDFICP and ether extract (fat). Field calculations were used for dry matter yield. No kernel processing was assumed.

Results

The 2010 corn silage trial yield and forage quality results of the twelve hybrids are provided in Table 1. The shaded area of Table 1 provides results that best estimate relative hybrid performance (yield and Milk2006 per ton and per acre calculations).

Further Analysis of the Data

Increasingly, dairy nutritionists feel there are more factors than those used in Milk2006 that are involved in ranking hybrids for farm profits across farms and over time. To determine a more accurate hybrid ranking, Mike Allen at Michigan State University developed a partial budget program called "Corn Picker for Silage" that considers all economically important traits that vary by hybrid for corn silage production. The output is an estimate of the profitability of one hybrid compared to another. Hybrid inputs include dry matter yield, concentrations of NDF, CP, IVNDFD and seed costs.

The calculations are as follows:

1. Total corn silage needs from the hybrids compared for the entire farm.
2. Cost of corn silage produced from each hybrid including seed, production, harvest, storage, land.
3. Adjustment for difference in cost of supplemental corn grain and soybean meal because of differences in concentrations of NDF or starch and CP.
4. Value of differences in milk yield and feed intake because of difference in IVNDFD.
5. Number of acres of land required for each hybrid.
6. The total cost of corn silage plus/minus adjustments for Challenger compared to cost of corn silage Defender.

Corn Picker considers the corn silage required for the entire herd and considers the intake based on the NDF digestibility of the hybrid and forage NDF concentration of the diet. It considers all costs of producing corn silage including fixed costs of storage and machinery. It adjusts for differences in supplementation with either corn or SBOM and difference in IVNDFD affect on milk yield. Difference in supplements needed and milk yield costs are adjusted for as well as the amount of land (cost/ac) needed to produce the needed corn silage. Partial budgets, such as Corn Picker, account for economically important information related to corn hybrid selection that varies from farm and over time. You can download the Corn Picker Excel spreadsheet at: www.msu.edu/~mdr/cornpicker.html.

Acknowledgements

Appreciation is extended to the Northeast Iowa Dairy Foundation, Northeast Iowa Community College, the seed corn dealers and volunteers who assisted in the establishment and harvest of these trials.

Participating Companies:

- **American Organic** www.american-organic.com
- **Croplan Genetics** www.croplangenetics.com
- **Monsanto Seed Group, DeKalb Genetics** www.asgrowanddekalb.com
- **Mycogen Seeds** www.mycogen.com
- **NuTech Seed, LLC** www.nutechseed.com
- **Pioneer Hi-Bred International** www.pioneer.com

Explanation of Quality Traits:

* Means within a column followed by the same lowercase letter are not significantly different by the LSD (0.05) multiple range test.

1. RM = relative maturity of hybrid in days of growth to maturity. However, there is not a specific standard for this measure. For an explanation of RM go to: http://www.agry.purdue.edu/ext/corn/news/timeless/HybridMaturity.html
2. Traits. VT3 = YieldGard VT Triple® has two insect protection traits, YieldGard VT Rootworm for corn rootworm larvae and YieldGard Corn Borer for European corn borer. RR2 = Roundup Ready 2 and enables crop tolerance to glyphosate herbicide. HXX = Herculex XTRA, has two insect protection traits, HX1 for European corn borer and HXRW for corn rootworm larvae. LL = Liberty Link and enables crop tolerance to Liberty herbicide. VT = YieldGard VT Rootworm and offers insect protection for corn rootworm larvae. RR = Roundup Ready and enables crop tolerance to glyphosate herbicide.
3. IVNDFD = in-vitro neutral detergent fiber digestibility. The portion of the neutral detergent fiber digested by animals at a specified level of feed intake. High IVNDFD is desirable.
4. IVNDFD Kd rate = fractional digestion rate, potentially digestible NDF fraction at any time.
5. Starch digestibility, 7-hour. Listed on the forage analysis as Low, Average or High. We assigned theoretical numerical values of Low=1, Average=3, and High=5, in order to calculate a mean response for the multiple samples collected and analyzed for each hybrid.

Table 1. Corn Silage Hybrid Traits.

Company	Hybrid	RM[1]	Traits[2]	Population plants/acre	Dry matter yield ton/acre	Harvest Moisture %	CP %	Lignin %	Total fatty acids %	Crude Fat %
American Organic	D915	105	none	28,800^{ab}	9.34^{abc}	68.5^{a}	7.8^{ab}	2.71^{a}	2.4^{bc}	3.0^{b}
American Organic	E810	110	none	28,200^{a}	8.39^{a}	71.7^{de}	8.3^{cd}	3.26^{de}	2.4^{bc}	3.2^{d}
Croplan	S4900	100	VT RR	31,700^{c}	9.48^{bcd}	68.4^{a}	8.0^{bc}	3.15^{cde}	2.5^{cd}	3.2^{d}
Croplan	S6100	107	VT RR	31,333^{bc}	9.07^{ab}	71.0^{bcd}	8.3^{cd}	3.37^{e}	2.3^{ab}	3.0^{b}
DeKalb	DKC61-69	111	VT3 RR2	28,033^{a}	10.11^{cde}	70.8^{bcd}	7.9^{ab}	3.11^{bc}	2.5^{cd}	3.1^{c}
DeKalb	DKC59-64	109	VT3 RR2	28,033^{a}	9.89^{bcde}	71.8^{de}	7.8^{ab}	3.22^{de}	2.3^{ab}	3.0^{b}
Mycogen	TMF2W727	113	HXX LL RR2	31,900^{c}	10.60^{e}	74.6^{f}	7.9^{ab}	3.24^{de}	2.2^{a}	2.9^{a}
Mycogen	F2F665	109	HXX LL RR2	29,400^{abc}	9.08^{ab}	72.7^{e}	8.6^{d}	2.89^{ab}	2.3^{ab}	3.1^{c}
NuTech	3T-713	113	VT3 RR2	29,767^{abc}	10.33^{de}	70.0^{abc}	7.8^{ab}	3.16^{cde}	2.6^{d}	3.2^{d}
NuTech	5X-007	107	HXX LL RR2	28,833^{a}	9.72^{bcde}	69.9^{ab}	7.6^{a}	3.03^{bcd}	2.4^{bc}	3.0^{b}
Pioneer	P1011XR-X127	108	HXX LL RR2	30,533^{abc}	10.27^{cde}	71.6^{cde}	8.1^{bc}	3.25^{de}	2.3^{ab}	3.0^{b}
Pioneer	P1162XR-X127	109	HXX LL RR2	28033^{a}	9.62^{bcde}	71.3^{d}	8.0^{bc}	2.96^{bc}	2.4^{bc}	3.1^{c}
Average				29,547	9.66	71	8	3.11	2.4	3.1
LSD 0.05*				2,540	0.99	1.7	0.4	0.24	0.2	0.1

			IVNDFD	IVNDFD	IVNDFD		Starch					
	ADF	NDF	12-hr.[3]	30-hr.[3]	rate[4]	Starch	Digest	Nel	Neg	Nem	Milk2006	Milk2006
Hybrid	%	%	%	%	Kd	%	7-hr.[3]	Mcal/lb	Mcal/lb	Mcal/lb	per ton	per acre
D915	24.1[a]	35.7[a]	29.7[d]	56.4[d]	3.70[d]	34.8[f]	5	0.75[e]	0.76[d]	0.48[d]	3,412[f]	31,860[cd]
E810	27.0[cd]	42.3[def]	28.7[cd]	51.1[bc]	3.13[abc]	27.5[ab]	3	0.71[bc]	0.73[ab]	0.46[bc]	3,139[bcd]	26,346[a]
S4900	26.1[bc]	39.9[bc]	27.1[abc]	52.9[cd]	3.34[cd]	32.1[de]	3.7	0.72[cd]	0.74[bc]	0.46[bc]	3,295[e]	31,214[bcd]
S6100	26.9[bcd]	40.4[cde]	26.9[abc]	50.4[bc]	3.16[bc]	29.0[bc]	4.3	0.71[bc]	0.73[ab]	0.46[bc]	3,093[bc]	28,052[ab]
DKC61-69	25.3[ab]	38.2[bc]	25.7[ab]	49.3[abc]	3.02[abc]	33.2[def]	4.3	0.73[d]	0.75[cd]	0.47[cd]	3,241[de]	32,777[cd]
DKC59-64	26.0[bc]	39.2[bc]	25.1[a]	45.7[a]	2.70[a]	32.0[de]	4.3	0.72[cd]	0.74[bc]	0.46[bc]	3,077[b]	30,417[bc]
TMF2W727	28.3[d]	42.6[ef]	27.9[cd]	48.0[ab]	2.83[ab]	26.4[a]	5	0.69[a]	0.72[a]	0.44[a]	2,914[a]	30,876[bcd]
F2F665	28.1[d]	42.8[f]	37.3[e]	63.0[e]	4.31[e]	25.2[a]	3	0.70[ab]	0.72[a]	0.44[a]	3,264[e]	29,637[bc]
3T-713	25.7[abc]	38.9[bc]	26.9[abc]	51.1[bc]	3.20[bc]	33.4[ef]	3.7	0.73[d]	0.74[bc]	0.47[cd]	3,284[e]	33,930[d]
5X-007	25.5[ab]	38.0[b]	27.0[abc]	48.2[ab]	2.89[ab]	32.9[def]	5	0.73[d]	0.74[bc]	0.47[cd]	3,195[cde]	31,088[bcd]
P1011XR-X127	26.9[bcd]	40.1[bcd]	27.4[bc]	50.3[bc]	3.12[abc]	29.0[bc]	4.3	0.71[bc]	0.73[ab]	0.46[bc]	3,077[b]	31,613[cd]
P1162XR-X127	25.4[abc]	38.8[bc]	27.7[bcd]	47.7[ab]	2.80[ab]	30.9[cd]	4.3	0.73[d]	0.74[bc]	0.47[cd]	3,130[bcd]	30,099[bc]
Average	26.3	39.7	28.1	51.2	3.18	30.5	4.2	0.72	0.74	0.46	3,177	30,659
LSD 0.05*	1.7	2.3	2.2	3.9	0.44	2.5	- - -	0.02	0.02	0.02	112	3,267