Northern New York Agricultural Development Program
2024 Project Final Report

The Effect of Corn Seed Cost on the Yield and Quality of Corn Silage in Northern New York

PROJECT LEADER:
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BACKGROUND:
Margins are tight in the dairy industry. In recent years, farms have been plagued with exceptionally high grain, fuel, and fertilizer costs. While savings are hard to come by for these necessary commodities, farms may be able to find savings in other input costs, such as corn seed. Commercial corn seed comes at a variety of price points with many companies offering discounts, sometimes significant, with early purchase. In addition, companies have recently entered the seed market with budget-priced corn hybrids. As preparation for this project in 2024, a market overview showed conventional corn seed could be purchased for as little as $85/bag or for more than $400/bag for fully-traited corn seed.

A portion of the cost of seed can be attributed to the crop protection traits in the seed products. Fully-traited corn seed has been selectively developed with traits that help the crop resist pest and disease pressure and tolerate herbicide applications in the field.

This project was designed to compare the silage yield and quality from typical conventional corn seed hybrids, costing more than $200 per unit of 80,000 kernels, with lower-priced corn hybrids; and aimed to compare the field results of traited vs. untraited versions of the same hybrid (isolines) to determine potential yield impact or benefit with the use of a stacked insect protection package on corn-on-corn acreage in NNY. Pest pressure can be higher when corn is planted after corn.

METHODS:
As noted earlier, this trial was designed to evaluate hybrid performance as distinguished by seed cost. In the spring of 2024, a replicated plot study was established at two Miner Institute field sites. The plots consisted of four 30” rows that were approximately 40 ft. long. Both sites had corn silage as the previous crop with one site no-till planted (silty clay loam), the other conventionally tilled (silt loam).

Eight hybrids were selected with similar relative maturity (RM) and not previously grown at Miner Institute to not bias the study with knowledge from previous on-farm hybrid evaluations. These hybrids are identified with their respective cost in Table 1 as T-1 through T-8.

As a separate evaluation in order to test the value of above/below-ground crop pest protection trait packages in the 2024 growing season, we purchased traited versions (isolines) of two of the higher-priced corn hybrids in the trial. These traited hybrids are in Table 1 as T-9 and T-10, respectively. In the analysis, they were compared with their untraited isolines: T-8 and T-5 respectively. For information on different traits in corn seed: see the Handy Bt Trait Table for U.S. Corn Production listing the types of Bt present in all commercialized corn in the U.S. (https://www.texasinsects.org/bt-corn-trait-table.html).

This formed a total of 10 hybrids that were replicated five times at each site for a total of 100 plots. The plots were planted at 32,000 plants per acre and were fertilized at typical rates for silage corn in the region. All but one hybrid were treated with insecticide/fungicide by the seed company (Table 1 "Treated"). Since most of the corn hybrids in this study were not glyphosate-tolerant, we field-applied a conventional herbicide program to control weeds.

When the plots reached or exceeded the proper maturity for silage, two rows from each plot were chopped and weighed, with a subsample of forage being taken for quality analysis. Forage samples were sent to the Dairy One Forage Lab (Ithaca, NY) for the forage NIR (near infrared spectroscopy) Pro Package evaluation to determine nutritional composition. These metrics, along with silage yield measurements, were subjected to an analysis of variance (ANOVA) as well as orthogonal contrasts. Statistical significance was declared at $\alpha = 0.05$.

RESULTS: The results of this study can be viewed in total in Table 2 of the Appendix.

Yield and Moisture

Significant differences in yield were observed with the higher-priced corn hybrids (group B) outyielding the lower-priced hybrids (group A) by almost two tons/acre. The isolines containing the Duracade Viptera® or Vorceed® crop protection packages did not differ significantly in yield from their conventional counterparts. They did, however, differ in moisture, with both traited isolines being slightly wetter than the conventional versions of the same hybrid. While the hybrids were selected to be similar in maturity, the group A (Table 2, Appendix) hybrids did average 0.7 percentage points dryer.

Table 1. Corn hybrids in the 2024 project The Effect of Corn Seed Cost on the Yield and Quality of Corn Silage in Northern New York, Chazy, NY.

	Cost[1]	RM	Traits[2]	Treated
T1	$140	94	None	Yes
T2	$105	94	None	Yes
T3	$85	104	None	Yes
T4	$140	103	None	Yes
T5	$218	93	None	Yes
T6	$325	96	RR	Yes
T7	$305	104	None	No
T8	$315	99	None	Yes
T9	$440	99	RR, LL, Vorceed®	Yes
T10	$350	93	Duracade Viptera®	Yes

[1] *Cost per unit for products T2 and T3 does not include freight charges.*

[2] *RR: Roundup Ready®; LL: Liberty Link®, seed resistant to the herbicide glufosinate ammonium; Vorceed® crop protection traits: Cry1A.105, Cry2Ab2, Cry1F, Cry3Bb1, Cry34/35Ab1, DvSnf7; Duracade Viptera® crop protection traits: Cry1Ab, Cry1F, Vip3A, eCry3.1Ab m, Cry3A.*

Protein and Lipids

Protein and lipids are generally not a big consideration when selecting corn hybrids for silage; however, some differences were found in this single-year trial. Specifically, the lower-priced hybrids had slightly higher crude protein and a slightly higher lysine content relative to the higher priced hybrids. The lower-priced hybrids also had higher crude fat content, although corn silage fat content only represents a very small fraction of the biomass.

Carbohydrates and Energy

Corn silage is primarily grown for its energy content. Thus, energy and carbohydrate fractions are important to consider when selecting a corn hybrid. The lower-priced corn did not differ significantly in starch, fiber, net energy of lactation, or any of the digestibility metrics. The The higher-priced hybrids were slightly higher in lignin, soluble sugars (ethanol soluble carbohydrates), and non-fiber carbohydrates.

Above/below Ground Protection Traits

With the exception of simple sugars and fiber digestibility at 240 hours, there were no significant differences in quality between conventional and traited corn isolines. Simple sugars were 0.8 percentage points lower in Duracade Viptera®-traited corn and 240 hr. fiber digestibility was 2.7 percentage points lower with the inclusion of the Vorceed® trait package.

While both of the sites in this project had been in corn for two years or more, the unprotected corn isolines did not suffer significant yield or quality loss due to pests; however, pest pressure was low during this trial. It is important to evaluate these results in the context of limited pest pressure and understand that results may have varied more significantly if higher pest pressure was present. This underscores the importance of matching the best available trait package to each field.

Economics

The higher-priced corn seed cost approximately $173/unit more than the lower-priced corn purchased for this project. This represents a cost difference of approximately $69/acre at a population of 32,000 seeds per acre. When accounting for the additional tonnage produced by the higher-priced corn, this cost would break even with a standing corn value of $36.3/ton. Any amount by which the value of corn tonnage exceeds this value represents a profit for the farm according to the results of this study – not including indirect benefits, such as the potential for increased soil phosphorus (P) removal and potentially higher manure application rates.

If a farm values their standing corn crop at less than $36.3/ton, an argument could be made for planting lower-priced corn seed based on these data. In this case, the cost savings may outweigh the lower yield potential of the lower-priced genetics. It should be noted, however, that many dairy farms have a minimum inventory of corn needed to feed their herd. Thus, more acreage of lower-cost corn would be required. Some farms may have enough acreage for this, but others may be forced to add acreage or adjust their crop rotation in order to avoid purchasing feed.

The Bt-trait packages purchased for this trial cost an average of $129/unit. This represents a loss of approximately $53/acre for cases in which conditions are such that the traits do not offer any yield benefit, such as those observed in this study. It should be noted; however, that one of these packages also included glyphosate tolerance – a factor that may benefit the farm by reducing herbicide costs and improving weed control (particularly for emerged grasses).

Weather Factors

The average daily temperature for the trial location at Miner Institute in Chazy in northeastern NNY can be viewed in Figure 1 (Appendix). The hottest temperature of the year was 89.9°F and six days had a minimum temperature that was greater than 70°F. Above-average growing degree days accumulated to allow for optimal corn maturation and drydown in 2024.

Daily precipitation during the 2024 growing season at the trial location ranged from 0 to 2.5 inches with numerous limited rain events totaling to approximately 20 inches from mid-May to the end of September. The season started and ended with relatively dry weather, however, rainfall was significantly above average in July and early August (Figure 2, Appendix). Based on this, it is unlikely the trial plots experienced drought stress during the critical periods of tasseling and kernel set.

CONCLUSIONS:

The results of this limited one-season evaluation suggest that careful consideration must be given to the many factors, including yield and cost, that must be considered in selecting corn hybrids from year-to-year. For example, while the lower-cost hybrid group had slightly lower yield potential based on this trial, the lower cost per unit ($173 on average) must be considered and weighed against the potential for lower yield. Likewise, the additional cost of Bt-trait packages may make economic sense in high-pest situations, but it may also represent an economic loss in low pest situations, like those observed in this study.

Recommendations:

Hybrid selection is an important consideration that must be made on a year-to-year basis for each farm's unique growing conditions and microclimate. Here are some general recommendations:

- Seed cost varies greatly between conventional hybrids depending on the seed brand. Farmers should select the corn hybrids and hybrid genetics that are best suited for their farm based on previous on-farm testing, the soils/yield potential of the site, and the goals of the operation.
- Value-oriented corn brands are likely best suited for short season, double crop, or other cropping scenarios that are high risk or have reduced yield potential already.
- Selecting a diverse set of hybrids and planting dates for forage programs can help reduce weather-related risk.
- Farmers seeking to reduce forage expenses should consider planting at least some conventional corn on acres where pest protection traits are not expected to be needed.
- Monitoring pest and disease pressure locally and assessing yield loss is essential for determining if protection traits are justified.
- Bt trait packages should be viewed as tools for IPM programs and not as a form of insurance against pest invasion. Adding unnecessary Bt endotoxins to the hybrids that you grow increases the chances of pest resistance developing and may reduce yields in the long run.

OUTREACH:

These results will be summarized and shared in the Miner Institute Farm Report and at summer grower meetings.

NEXT STEPS:

Surveys and pest monitoring should be conducted in conjunction with on-farm trials to continue to evaluate the utility of Bt-traited corn. Low-cost corn brands/hybrids are not commonly grown in Northern New York, and on-farm testing throughout the region would improve our ability to judge their agronomic, economic and nutritional value.

ACKNOWLEDGEMENTS:

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FOR MORE INFORMATION:

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APPENDIX: Tables and Figures

Table 2. Data for corn hybrids in The Effect of Corn Seed Cost on the Yield and Quality of Corn Silage in NNY trial in Chazy, NY, 2024 – continues on next page

Table 2 (continues on next page with key). Data for Corn Hybrids in **The Effect of Corn Seed Cost on the Yield and Quality of Corn Silage in NNY Trial, Chazy, NY, 2024.**

	Groups[1]		Group A: Hybrids				Group B: Hybrids				Bt Traited[2]			*P* – Values[3]			
	A	B	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Std. Error	F-Test	Cost	DV	VC
Yield,-ton/acre (35% dm)	22.7	24.6	22.8	20.0	24.4	23.4	20.7	26.2	26.4	24.9	25.4	20.1	0.7	0.00	0.00	0.53	0.62
Moisture, %	63.1	63.8	63.5	58.2	64.6	66.1	62.9	64.4	65.1	62.7	64.2	64.5	0.5	0.00	0.02	0.01	0.01
Protein (CP), %	7.8	7.6	7.9	8.2	7.6	7.7	8.1	7.6	7.6	7.1	7.2	8.3	0.1	0.00	0.02	0.16	0.51
Soluble CP, %	31.7	32.7	31.6	30.6	32.3	32.3	32.1	33.0	33.6	31.9	32.2	32.0	0.7	0.17			
Degradable CP, %	61.8	61.6	61.2	63.5	62.1	60.3	62.0	60.9	62.1	61.2	60.5	62.2	0.8	0.20			
Acid Insoluble CP, %	0.68	0.69	0.65	0.70	0.73	0.64	0.70	0.72	0.65	0.67	0.65	0.69	0.02	0.03	0.75	0.75	0.52
Neutral Insoluble CP, %	1.43	1.44	1.45	1.41	1.43	1.41	1.50	1.62	1.30	1.34	1.32	1.45	0.03	0.00	0.54	0.31	0.69
Lysine, %	0.20	0.19	0.20	0.21	0.19	0.19	0.20	0.19	0.19	0.18	0.18	0.21	0.00	0.00	0.01	0.27	0.37
Methionine, %	0.12	0.12	0.12	0.13	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.13	0.00	0.00	0.07	0.19	1.00
Acid Detergent Fiber (ADF), %	22.4	22.2	22.5	22.7	23.1	21.6	21.5	24.9	20.4	21.8	21.0	21.5	0.6	0.00	0.49	0.98	0.29
Neutral Detergent Fiber (NDF), %	38.2	38.1	38.2	38.7	39.1	36.9	38.3	41.6	34.9	37.8	36.1	37.7	0.9	0.00	0.88	0.61	0.15
Lignin, %	3.0	3.2	2.9	3.1	3.1	2.9	3.3	3.5	2.9	3.0	2.9	3.1	0.1	0.00	0.00	0.19	0.19
Starch, %	35.1	34.8	35.0	35.2	34.2	36.1	34.5	30.9	38.4	35.6	36.8	35.0	0.9	0.00	0.66	0.68	0.35
Water Sol. Carb, %	7.5	8.0	7.4	6.3	7.4	8.7	7.8	8.8	7.1	8.1	8.4	7.3	0.4	0.00	0.06	0.41	0.61
Simple Sugars, %	4.2	4.8	4.0	3.6	4.2	5.1	5.0	5.1	4.4	4.7	4.9	4.2	0.3	0.00	0.00	0.02	0.50
Non-fiber Carbohydrates	47.0	47.5	46.9	46.4	46.5	48.1	47.0	43.8	50.6	48.7	50.1	47.1	0.8	0.00	0.01	0.97	0.22
Total Dietary N	72.8	72.3	73.0	72.1	72.6	73.4	71.9	70.5	73.9	73.0	73.5	72.5	0.5	0.00	0.15	0.33	0.42

Table 2. Data for corn hybrids in The Effect of Corn Seed Cost on the Yield and Quality of Corn Silage in NNY trial in Chazy, NY, 2024 – continued from previous page

Net Energy of Lactation	0.77	0.76	0.77	0.76	0.76	0.78	0.76	0.73	0.79	0.77	0.78	0.76	0.01	0.00	0.31	0.54	0.36
Crude Fat, %	3.1	2.9	3.1	2.9	3.2	3.3	2.7	2.9	3.1	2.9	2.9	2.9	0.1	0.00	0.00	0.06	0.07
Ash, %	3.9	3.8	4.0	3.9	3.7	4.0	3.9	4.1	3.8	3.6	3.8	4.0	0.1	0.00	0.29	0.28	0.06
Calcium, %	0.18	0.19	0.18	0.18	0.18	0.19	0.20	0.18	0.18	0.18	0.18	0.19	0.01	0.15			
Phosphorus, %	0.21	0.21	0.21	0.22	0.20	0.21	0.21	0.21	0.21	0.20	0.20	0.22	0.00	0.00	0.36	0.74	0.40
Magnesium, %	0.13	0.13	0.13	0.15	0.13	0.13	0.14	0.15	0.12	0.12	0.12	0.15	0.00	0.00	0.30	0.14	0.85
Potassium, %	0.94	0.91	0.99	0.88	0.91	0.99	0.93	0.97	0.92	0.82	0.91	0.99	0.04	0.00	0.16	0.14	0.06
Sulfur, %	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.10	0.00	0.00	0.00	0.19	0.12
Chloride, %	0.21	0.18	0.20	0.22	0.21	0.21	0.22	0.20	0.17	0.15	0.17	0.24	0.01	0.00	0.00	0.25	0.35
NDFDom 30hr % of NDF	58.5	58.4	59.8	56.1	58.8	59.3	59.2	55.4	59.6	59.5	58.2	59.3	0.9	0.00	0.89	0.91	0.22
NDFDom 120hr % of NDF	69.1	68.1	69.3	67.7	70.7	68.8	67.5	65.3	70.6	69.0	66.7	67.8	0.9	0.00	0.09	0.83	0.06
NDFDom 240hr % of NDF	71.2	70.7	71.9	70.6	72.0	70.4	70.6	67.7	73.2	71.6	69.0	70.9	0.9	0.00	0.40	0.77	0.04
Starch D (7 h)	50.6	51.0	50.8	47.2	49.9	54.5	47.4	49.6	54.9	51.9	52.9	47.0	1.2	0.00	0.66	0.80	0.53
% uNDF 30hr	15.9	15.9	15.4	17.0	16.1	15.1	15.7	18.6	14.1	15.3	15.1	15.3	0.5	0.00	0.90	0.57	0.76
% uNDF 120hr	11.8	12.2	11.7	12.5	11.4	11.5	12.5	14.4	10.3	11.7	12.0	12.2	0.4	0.00	0.14	0.58	0.56
% uNDF 240hr	11.0	11.2	10.7	11.3	10.9	11.0	11.3	13.4	9.4	10.7	11.2	11.0	0.4	0.00	0.42	0.55	0.39

[1] Group averages of the four corn hybrids (least squares means) in each category. Group A and B hybrids were of similar maturity but differed in seed cost, with Group B coming in at a higher price point than Group A.

[2] Isolines of two of the corn hybrids (identical genetics) that included the Vorceed® and Duracade Viptera® above/below ground trait packages.

[3] *P* – values are used to determine if the differences being tested are statistically significant ($\alpha = 0.05$). F – test *P* - values are used to determine overall treatment differences and were generated with a linear mixed effects model in SAS JMP software. Differences between two groups by cost, DV = T10 Duracade Viptera® vs. conventional T5 (isoline); and T9 Vorceed® vs. conventional T8 were tested with orthogonal contrast statements.

Figures:

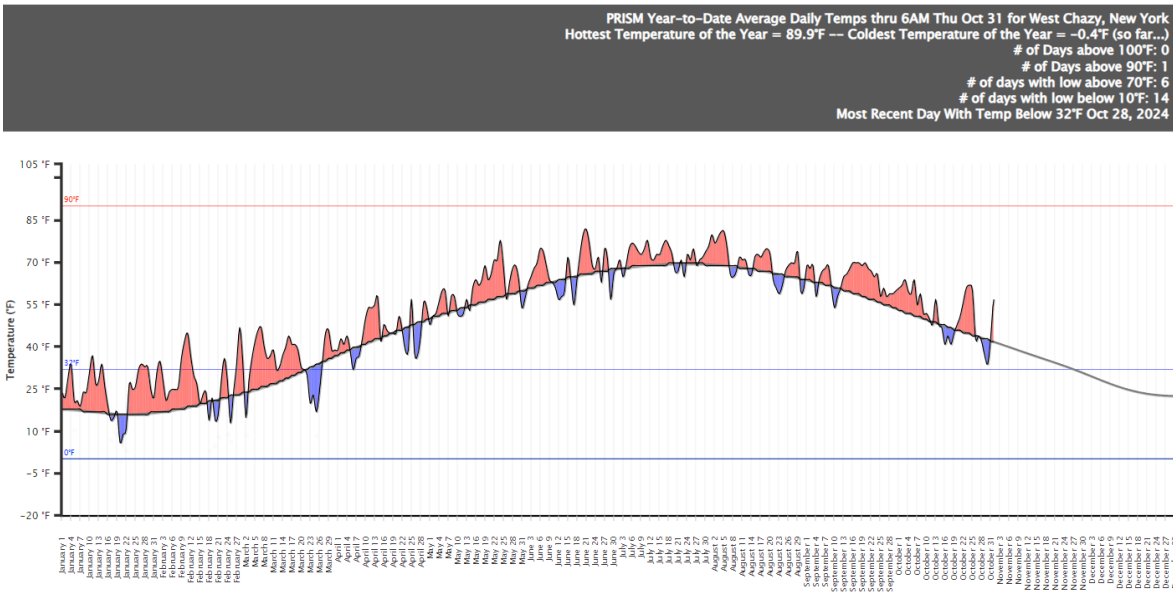

Figure 1. Average daily temperature for Miner Institute during the 2024 growing season at Chazy, New York. Above average growing degree days were accumulated, allowing for optimal corn maturation and drydown during the 2024 trial season.

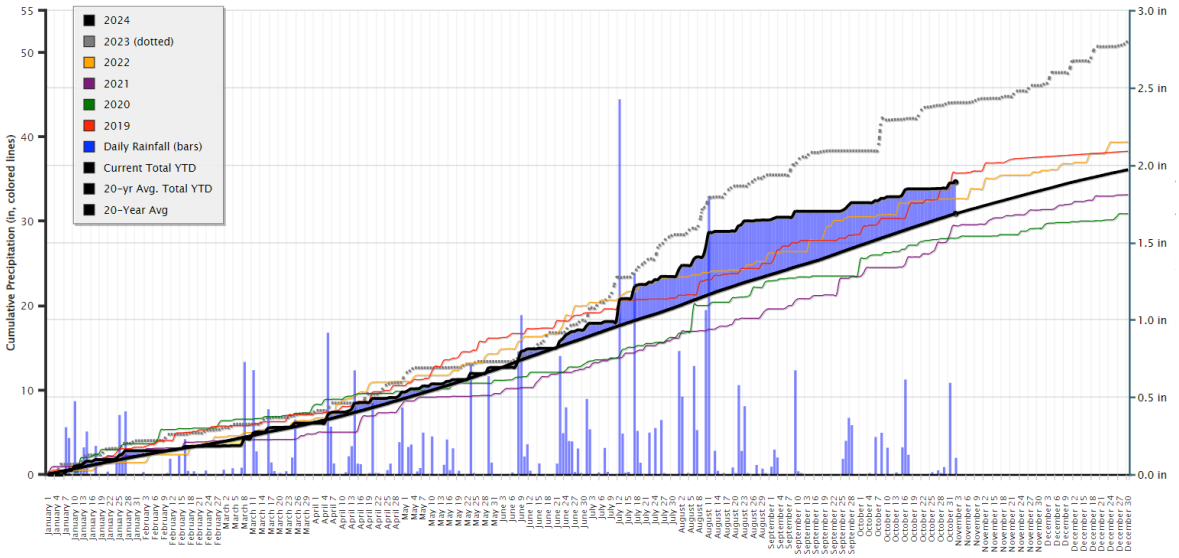

Figure 2. Daily precipitation during the 2024 growing season at Chazy, NY. While the season started and ended with relatively dry weather, July and early August rainfall was significantly above average. It is unlikely that the plots experienced drought stress during the critical periods of tasseling and kernel set.

Left: Figure 3. Planting corn plots at one of the Miner Institute fields. Photo: Allen Wilder.

Right: Figure 4. Harvesting corn plots at one of the Miner Institute fields used for the 2024 NNYADP project The Effect of Corn Seed Cost on the Yield and Quality of Corn Silage in Northern New York. Photo: Allen Wilder.