



## Northern NY Agricultural Development Program 2016-2017 Project Report

### Commercial Corn Hybrid Evaluation for Silage and Grain in Northern NY

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#### **Collaborators:**

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- Mike Van Amburgh, Animal Science, Cornell University
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#### **Cooperating Producers:**

- St. Lawrence County: Jon Greenwood, Greenwood Dairy, Madrid, NY
- Clinton County: William H. Miner Agricultural Research Institute, Chazy, NY

#### **Background:**

Corn is the primary row crop grown in northern New York (NNY), harvested from about 145,000 acres when averaged over the past four years. It provides essential feed for the dairy industry. About 64% of NNY's corn acres are harvested as silage and 36% as grain. The dairy industry and ethanol production facilities both contribute to strong demand for corn silage and grain in NNY. As the seed industry continues to introduce new corn hybrids to the market, evaluation of these hybrids in growing conditions representative of northern NY is critical to assisting growers in selecting hybrids best suited to their growing environment and needs.

The importance of corn silage as a high yielding, high quality feed for dairy cattle continues to increase as dairy farmers look to optimize feed value from available acreage. A focus on silage-specific corns by the seed industry has also increased the offering to producers and increased the need for independent evaluation of these traits to determine their merit in feeding programs.

Corn grain is a valuable NNY commodity in its own right, but also a major contributor to any hybrid's silage yield potential. Seed companies typically test hybrids in grain trials as a first step in determining what is worth marketing in the region and what might merit further evaluation for silage yield and quality. Thus grain yield evaluations of commercial hybrids continue to provide information of importance in NNY.

### **Methods:**

Commercial corn hybrids for silage were planted at Cornell's Willsboro Research Farm in Essex County (80 to 95 day hybrids) and at the Greenwood Farm in St. Lawrence County (96 to 110 day hybrids). Grain hybrid trials (79 to 89 day hybrids) were planted at both the Greenwood Farm in St. Lawrence County and at the W.H. Miner Agricultural Research Institute in Clinton County. Hybrid entries were solicited from seed companies doing business in New York and the Northeast.

Hybrids were machine planted in three replications at each site using a randomized complete block design. Individual plots consisted of two (grain) or four (silage) rows, 17.5' long at 30" spacing. Plantings were done on 18 May in Madrid (silage and grain) and Chazy (grain only) and 20 May in Willsboro (silage only).

Silage hybrids were planted at 34,000 plants/acre. Grain hybrids were over-planted and thinned to 30,000 plants/acre. Hybrids were evaluated in June for emergence. Electric fencing was erected as needed to minimize wildlife damage to the plots. Cross-planted corn was seeded in alleyways at Chazy for the same reason.

Eyespot was present on the silage trial in Madrid, so disease ratings were gathered on the hybrids in this trial using a 1-5 rating scale based on the percentage of leaf area covered in lesions.

For both silage trials, the center two rows of four-row silage plots were harvested with a two-row plot harvester equipped with a weighing system, and timed to come as close to 65% whole plant moisture as possible. The Willsboro trial was harvested on 26 September (average 68.7% moisture) and the Madrid trial on 28 September (average 64.8% moisture).

Forage samples from each plot were sent to Cumberland Valley Analytical Laboratory for NIR analysis to determine DM, CP, ADFCP, NDFCP, soluble CP, ADF, NDF, NDFom, lignin, starch, sugar, ash, NDF digestibilities (12, 30, 120h along with uNDF120 and uNDF240), and 7-h starch digestibility. Results were used in a CNCPS 6.5 analysis in which the analytical values were applied to a typical New York higher corn silage-based diet (forage ~ 60% of diet DM; corn silage at ~ 70% of forage DM). Diet was

designed by Dr. Tom Overton, with further review by Dr. Mike Van Amburgh, Cornell University. CNCPS 6.5 predictions will be used to evaluate differences in intake potential and subsequent energy and protein allowable milk yield based on the nutrient and digestibility characteristics of each hybrid.

For corn grain trials, early vigor was evaluated at knee-high stage, with 5 = excellent vigor and 1 = very poor vigor.

Stay-green and plant health were rated in September (1 = green plants, 5 = leaves dead).

No significant pest pressure was observed at either site for grain hybrids.

Plots at Madrid were harvested with a combine equipped with weigh buckets and moisture meter (28 November). Harvest was done by hand at Chazy (7-8 November).

Immediately before harvest, the number of stalks broken (or lodged) below the ear was counted and expressed as a portion of the total number of plants in the plot (% stalk lodging).

Plants leaning over from the base at more than a 45 degree angle were counted as root-lodged, and expressed as a proportion of the total number of plants (% root lodging).

Yield data from both sites included grain weight per plot and grain moisture at harvest. Yields were calculated at 15.5% grain moisture and used to calculate yield:moisture ratio for each hybrid. Yield:moisture ratio measures hybrid efficiency in producing high yield under short-season conditions. Hybrids that show high yields and earlier maturity (lower grain moistures) have higher Y/M ratios.

We use three statistics to evaluate the quality of grain yield data from these experiments:

- The coefficient of variation (CV) is a measure of the amount of uncontrolled variability due to differences in the soil, microclimate, fertility, etc. Grain yield CVs below 12 are excellent and those around 15 are acceptable.
- Grain moisture CVs below 5 are excellent.
- The least significant difference (LSD) is computed at the 5% level of probability. If a difference between two hybrids is larger than the LSD listed for the trial, then the odds are at least 95 to 5 (or 19 to 1) that there is true varietal difference between the hybrids, or, as the statisticians say, the difference between the two hybrids is "significant."

**As a cautionary note, growers should choose hybrids based on multi-year and multi-location data whenever possible, since any hybrid can have a “banner year” or “banner environment” but not necessarily hold up over different locations and growing seasons.**

## **Results:**

Crop development at both Madrid and Willsboro was good. The grain trial planted at Chazy suffered from excessive moisture during the first half of the growing season. This led to extreme variability in the field, with the corn that was over the drain tiles developing well and the corn in between remaining smaller, yellow, and generally behind in terms of its development. Consequently, the data obtained from Chazy were too variable to be informative and are not reported here.

Results for 85-95 day silage hybrids at Willsboro are shown in Table 1. There was some variability in plant population at this site that should be considered when comparing hybrids in this data set. Results for 96-110 day silage hybrids at Madrid are shown in Table 2. Silage yields at this site were excellent. Results for eyespot evaluation of hybrids at Madrid are presented in Table 3.

Corn hybrid grain trial results from Madrid are presented in Table 4. Data quality was good and hybrid grain yields from this site were very good.

**NOTE: Tables should not be reproduced if any portion is omitted or if data order is changed.**

## **Conclusions/Outcomes/Impacts:**

Willsboro:

Plant population in the Willsboro silage trial showed significant variation, ranging from a low of about 26,000/acre to highs around 32,000/acre. This variation may have affected both yield and quality parameters for some hybrids.

Silage yields at Willsboro averaged 19.6 tons/acre for the 80-95 day hybrids tested (Table 1). Yield differences were significant, with individual hybrids ranging as high as 23.4 tons/acre.

Variation in dry matter percent was also significant (range 27.8% to 37.4%, with 18 of the 23 hybrids clustered between 30% and 34%). Variation was significant for most quality parameters as well, with the exception of starch digestibility and most NDF-related parameters.

Madrid:

Madrid silage data for 96 to 110 day hybrids (Table 2) showed significant variation in plant population as well, but over a narrower range that was near the target plant density for this trial (range 30,000/acre to 37,500/acre; target density 34,000/acre).

This trial had outstanding yield (average of 31.9 tons/acre with individual hybrids as high as 36.2 tons/acre; differences significant). Overall mean dry matter was 35.2% -- right on target for harvest timing. As could be expected, the hybrids at the earlier end of this maturity range had a bit higher dry matter and those at the later end a bit lower. Variation was significant for all quality parameters.

### Fiber Digestibility

While several forage quality parameters are important, fiber digestibility continues to be a key focus of assessing corn silage. Undigested neutral detergent fiber at 240 hrs (uNDF240), as well as the rate of digestion assessed using the measurement of NDF digestibility at multiple time points, is key to understanding the value of corn silage in a total ration for lactating cows. The amount a cow can consume (her dry matter intake) is strongly correlated to milk-producing potential and a lower uNDF240 value is an indicator that the cow will be able to consume more of the forage.

In addition to analyzing fiber digestibility values, these trials allow the further study of apparent interactions between the growing environment and fiber digestibility of the corn plant.

On-going evaluation of hybrids with the Cornell Net Carbohydrate and Protein Synthesis (CNCPS) model, where each hybrid in the testing program is entered into a standardized lactating cow feed ration, allows for the evaluation of the effect of fiber digestibility and other key forage quality parameters on expected animal performance with a diet containing that hybrid.

### Yield, Yield-Moisture Ratio

For the early maturity (79 -89 day) grain hybrids at Madrid (Table 4), yields were excellent and ranged as high as 232 bu/acre. Grain moisture at harvest showed nearly a 10% spread from the driest to the wettest hybrids, indicating that the hybrids tested encompassed a fair range of maturities.

The yield:moisture ratio provides an indication of hybrid efficiency in producing high yield under short-season conditions. **This ratio is one of the best guides to choosing a hybrid with excellent yield potential and appropriate maturity.** The absolute value of the yield:moisture ratio is not as important as the relative values of the hybrids tested. Based on this ratio, Chemgro 5385V42 and 5245RDP, King's Agriseeds MCT 3891, and Seedway SW23493000GT were all more than one standard deviation above the mean, indicating that they fell in the top 16% of the values for this trial. All of these hybrids were at the very early end of the maturity range. For growers with a longer available growing season, some of the later hybrids with high yields may also be good choices.

As a reminder, **growers should choose hybrids based on multi-year and multi-location data whenever possible**, since any hybrid can have a “banner environment” but not necessarily hold up as strongly over a range of different locations and growing seasons.

The data in this report will be incorporated into hybrid performance tables in the upcoming Cornell Guide for Integrated Field Crop Management, which provides that multi-year data summary. The hybrids listed in this report are noted as examples only, based on data from only one site and year. Growers will need to choose hybrids based on performance across multiple sites and/or years, and based on the mix of traits that best fits their individual operations and needs.

### **Outreach:**

Results from 2017 Northern New York Agricultural Development Program (NNYADP)-funded silage evaluations, and results from other sites in New York and Vermont, will soon be available via the New York and Vermont Corn Silage Hybrid Trials 2017 report and on the web at:

<https://prodairy.cals.cornell.edu/production-management/resources>.

NNYADP grain trial results will be available soon in the 2017 Hybrid Corn Grain Performance Trials report (Plant Breeding Mimeo 2018-1) and on the web at:

<http://plbrgen.cals.cornell.edu/research-extension/crop-variety-trials/corn-variety-testing>.

These results will be incorporated into the multi-year tables of recommended hybrids in the 2019 Cornell Guide for Integrated Field Crop Management published by Cornell University in fall 2018.

Results of 2016 NNYADP testing of corn grain hybrids were incorporated into the multi-year tables of recommended hybrids in the 2018 Cornell Guide for Integrated Field Crop Management (Cornell University, 2017). These results are available for farmer and seed company use in selecting hybrids best adapted to the challenging soils and climates of Northern NY. These publications are distributed through extension offices and at various extension and outreach meetings.

Silage results have been shared at numerous crop meetings, both in NNY and beyond. PRO\_DAIRY Extension Associate Joe Lawrence has presented this data at the following venues:

- 2018 Miner Institute Crop Congress
- 2018 North country Crop Congress (Lowville)
- 2017 Field Crop Dealer Meeting
- 2017 Certified Crop Advisor training
- 2018 Western New York Corn Congresses - Batavia and Waterloo
- 2018 Oneida County Crop Congress
- 2018 South Central New York Winter Crop Meeting.

### **Next Steps:**

Provided that funding is available, we plan to continue testing hybrids in NNY to ensure that farmers and seed companies have a solid basis for their choices of corn silage and grain hybrids for this important region of the state.

### **Acknowledgments:**

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Chazy, and we gratefully acknowledge the support of the W.H. Miner Agricultural Research Institute in providing field space for our corn grain trial.

**Reports and/or articles in which results of this project have been published:**

Eyespot disease ratings gathered on silage hybrids at Madrid have just been accepted for publication – a great example of how these trials can provide relevant and useful data beyond what was initially envisioned.

Lawrence, J.R., J.A. Cummings. 2018. Evaluation of corn silage hybrids for resistance to eyespot in New York, 2017. Plant Disease Management Reports. (In press).

Corn grain trial results are published in the following documents:

Smith, M.E. 2018. 2017 New York Hybrid Corn Grain Performance Trials. Cornell University, Cornell Cooperative Extension, Plant Breeding and Genetics 2018-1. (In press.)

Smith, M.E. and J. Singer. 2017. Corn grain hybrid selection. pp. 53-55. In: Thomas-Murphy, J. (ed.) 2018 Cornell Guide for Integrated Field Crop Management. Pesticide Management Education Program, Cornell Univ., Ithaca NY. 160 pp.

The 2017 New York and Vermont Corn Silage Hybrid Trial data tables are posted at:

[https://prodairy.cals.cornell.edu/sites/prodairy.cals.cornell.edu/files/shared/documents/2017 CS Trial Data Tables 11.22.17.pdf](https://prodairy.cals.cornell.edu/sites/prodairy.cals.cornell.edu/files/shared/documents/2017%20CS%20Trial%20Data%20Tables%2011.22.17.pdf).

The 2017 New York Hybrid Corn Grain Performance Trials with hybrid testing results from NNY and from other sites statewide will be posted at:

<http://plbrgen.cals.cornell.edu/research-extension/crop-variety-trials/corn-variety-testing>.

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