UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

2009
Vermont Organic Corn Silage Performance Trial Results

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The UNIVERSITY of VERMONT EXTENSION

2009 VERMONT ORGANIC CORN SILAGE PERFORMANCE TRIALS

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In 2009, the University of Vermont Extension conducted an organic corn silage evaluation program, in cooperation with Vermont Technical College (VTC). The purpose of the program is to provide unbiased performance comparisons of commercially available organic corn varieties. It is important to remember, however, that the data presented are from a single test at only one location. Hybrid-performance data from additional tests in different locations and often over several years should be compared before you make conclusions.

TESTING PROCEDURE

In 2009, an organic corn silage performance trial was conducted at VTC in Randolph, VT. The field used for the variety trial was not certified organic at the time of the trial. However, the field and production practices met all certified organic standards as required by the USDA. The field is in the process of being certified for 2010. Several seed companies and farmers submitted varieties for evaluation. Companies and contact names are listed in Table 1. The organic corn grown at the Randolph site was considered early maturing corn (75-95 RM), based on the hybrid Relative Maturities provided by the companies. The specific varieties and relative maturities are listed in Table 2.

Table 1. Participating Companies and Local Contact Information

Albert Lea Seed	Lakeview Organic Grain	American Organic
1414 West Main Street PO Box 127, Albert Lea, MN 56007 800-352-5247	Klass & Mary-Howell Martens Box 361 Penn Yan, NY 14527 315- 531-1038	PO Box 385 Warren, IL 61087 866-471-9465
Frank Kutka	**Butterworks Farm**	**Blue River Organics**
615 3rd St E Dickinson, ND 58601 701-225-7853	Jack Lazor 421 Trumpass Rd Westfield, VT 05874 802-744-6855	Boucher Fertilizer 2343 Gore Road Highgate Ctr., VT 802-868-3939

Table 2. Organic corn varieties evaluated in Randolph, VT.

Company	Variety	RM	Description
Blue River	33L90	92	Hybrid
Blue River	33N73	92	Hybrid
Blue River	08K18	80	Hybrid
American Organic Seed & Grain	C714	94-96	Hybrid
Butterworks Farm	Early Riser	75-80	Open-pollinated
Albert Lea Seed Co	SF5-6710	98	Open-pollinated
Albert Lea Seed Co	099-90N	90	Open-pollinated
Albert Lea Seed Co	E95	95	Open-pollinated
Lakeview Organic	Wapsie Valley	85	Open-pollinated
Frank Kutka	Maki's Pride	85-92	Open-pollinated
Frank Kutka	North Dakota Syn.	85-88	Open-pollinated
Frank Kutka	CuzMex	90-95	Open-pollinated

Seasonal precipitation and temperature was recorded at a weather station close in proximity to Randolph (Table 3). This season brought cooler than normal temperatures and higher than normal rainfall patterns across the region. In general, silage yields were average to below average for most farms including our trial locations. Below average GDD resulted in corn maturing at a slower rate and hence a later than normal harvest date. The total accumulated GDD for corn growth was 1899 which was about 200 GDD less than normal for this area.

Table 3. Temperature, precipitation, and growing degree days summary – Randolph, VT.

Randolph							
	April	May	June	July	August	September	October
Average Temperature	42.4	51.2	58.8	62.9	64.7	54.6	41.5
Departure from Normal	+2.4	-1.2	-2.4	-2.9	-1	-0.7	-2.5
Precipitation	2.1	5.8	4.5	7.9	5.6	1.8	5.2
Departure from Normal	-0.81	+2.31	+1.0	+4.09	+1.59	-1.74	+1.83
Growing Degree Days (50˚)	97.5	191.5	309.5	408.5	468.5	243.5	34.5
Departure from Normal	+55.5	-70.5	-73.0	-81.3	+39.1	-38.5	-70.9

*Based on National Weather Service data from cooperative observer stations in close proximity to field trials. Historical averages are for 30 years of data (1971-2000)..

CULTURAL PRACTICES

The seedbed at each location was prepared by conventional tillage methods. The previous crop was an alfalfa/grass mix hayfield. Fertilizer and herbicides were applied based on the farms standard practices. Plots were planted with a four row corn planter. Plots were planted the length of the field and averaged 350 feet in length. The plots were hand harvested with machetes. Two 17.5' row sections were harvested and weighed with a small platform scales. A 10 plant subsample was chopped with Troy-Built chipper shredder. After mixing, a subsample of chopped corn was taken and analyzed for forage quality by the Cumberland Valley Forage Laboratory in Maryland. Pertinent trial information is summarized in Table 4.

Table 4. Organic corn variety trial information - 2009

Trial Information	Vermont Technical College
Soil type	Silt loam
Previous Crop	Hay
Row Width (in.)	30
Planting date	21-May
Harvest date	13-Oct.
Harvest population (plants/acre)	24,000
Tillage operations	Spring Plow Spring Disk
Manure (gal/acre)	Spring applied - 8000 gal/acre
Tineweeding	1x
Row cultivation	2x

SILAGE QUALITY

Silage quality was analyzed using wet chemistry techniques at the Cumberland Valley Forage Laboratory in Pennsylvania. Plot samples were dried, ground and analyzed for crude protein (CP), neutral detergent fiber (NDF), 30h digestible NDF (dNDF), and starch. Mixtures of true proteins, composed of amino acids, and nonprotein nitrogen make up the CP content of forages. The CP content of forages is determined by measuring the amount of N and multiplying by 6.25. The bulky characteristics of forage come from fiber. Forage feeding values are negatively associated with fiber since the less digestible portions of plants are contained in the fiber fraction. The detergent fiber analysis system separates forages into two parts: cell contents, which include sugars, starches, proteins, nonprotein nitrogen, fats and other highly digestible compounds; and the less digestible components found in the fiber fraction. The total fiber content of forage is contained in the neutral detergent fiber (NDF). Chemically, this fraction includes cellulose, hemicellulose, and lignin. Because of these chemical components and their association with the bulkiness of feeds, NDF is closely related to feed intake and rumen fill in cows. Recently, forage testing laboratories have begun to evaluate forages for NDF digestibility. Evaluation of forages and other feedstuffs for NDF digestibility is being conducted to aid prediction of feed energy content and animal performance. Research has demonstrated that lactating dairy cows will eat more dry matter and produce more milk when fed forages with optimum NDF digestibility. Forages with increased NDF digestibility will result in higher energy values, and perhaps more importantly, increased forage intakes. Forage NDF digestibility can range from 20 – 80%.

The silage performance indices of milk per acre and milk per ton were calculated using a model derived from the spreadsheet entitled, "MILK2007" developed by researchers at the University of Wisconsin. Milk per ton measures the pounds of milk that could be produced from a ton of silage. This value is generated by approximating a balanced ration meeting animal energy, protein, and fiber needs based on silage quality. The value is based on a standard cow weight and level of milk production. Milk per acre is calculated by multiplying the milk per ton value by silage dry matter yield. Therefore milk per ton is an overall indicator of forage quality and milk per acre an indicator of forage yield and quality. Milk per ton and milk per acre calculations provide relative rankings of forage samples, but should not be considered as predictive of actual milk responses in specific situations for the following reasons:

1) Equations and calculations are simplified to reduce inputs for ease of use.
2) Farm to farm differences exists.
3) Genetic, dietary, and environmental differences affecting feed utilization are not considered.

PRESENTATION OF DATA

Results are listed in Table 5, 6, and 7. Dry matter yields were calculated and than adjusted to 35% dry matter for the report. Varieties are ranked by dry matter at harvest in table 5. The numbers presented in the tables are an average of two replications. A graph (Figure 1) has been included to report yields. Hybrids with the same letter were not statistically different in yield. Figure 2 displays the relationship between milk per ton and milk per acre. The dotted line dividing the figure into four quadrats represents the mean milk per ton and acre for the location. Therefore hybrids that fall above the lines performed higher than the average and hybrids below the lines performed below average.

LEAST SIGNIFICANT DIFFERENCE (LSD)

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine, whether a difference among varieties is real or whether it might have occurred due to other variations in the field. At the bottom of each table a LSD value is presented for each variable (i.e. yield). Least Significant differences (LSD's) at the 10% level of probability are shown. Where the difference between two varieties within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure in 9 out of 10 chances that there is a real difference between the two varieties. Varieties that were not significantly lower in performance than the highest hybrid in a particular column are indicated with an asterisk. In the example below A is significantly different from C but not from B. The difference between A and B is equal to 1.5 which is less than the LSD value of 2.0. This means that these varieties did not differ in yield. The difference between A and C is equal to 3.0 which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that B was not significantly lower than the top yielding variety.

Variety	Yield
A	6.0
B	7.5*
C	9.0*
LSD	2.0

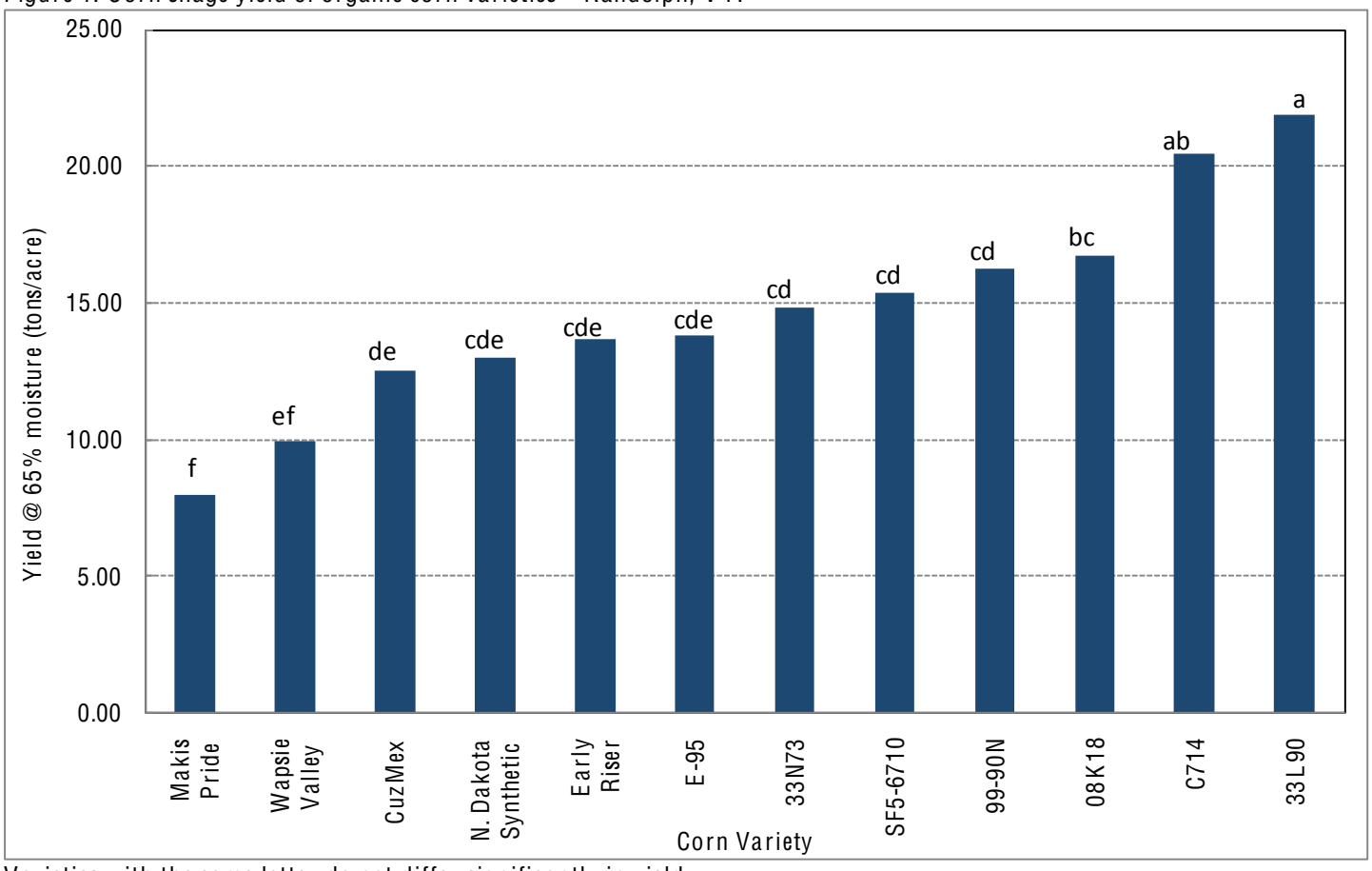
RESULTS

Table 5. Silage yield evaluation of organic corn varieties – Randolph, VT.

Company	Variety	Type	Relative maturity	DM at harvest %	Yield 35 % DM T/A	Stover %	Ear %
Albert Lea Seed	E-95	OP	94-97	26.0	13.8	50.1	49.9
North Dakota State Univ.	CuzMex	OP	90-95	28.0	12.5	55.4	44.6
Blue River Organics	33N73	Hybrid	92	29.9	14.8	52.6	47.4
North Dakota State Univ.	Makis Pride	OP	85-92	30.0	7.96	52.8	47.2
Viking Organic	SF5-6710	Hybrid	98	30.1	15.3	45.8	54.2
Viking Organic	99-90N	Hybrid	90	30.9	16.3	49.0	51.0
Blue River Organics	33L90	Hybrid	92	31.3	21.9*	58.4	41.6
American Organics	C714	Hybrid	94-96	32.0*	20.5*	51.0	49.0
Lakeview Organic Grain	Wapsie Valley	OP	85	33.3*	9.92	45.2	54.8
North Dakota State Univ.	N. Dakota Synthetic	OP	85-88	33.5*	13.0	50.7	49.3
Butterworks Farm	Early Riser	OP	75-80	34.5*	13.7	49.0	51.0
Blue River Organics	08K18	Hybrid	80	35.0*	16.7	47.2	52.8
Trial Mean				31.2	14.7	50.6	49.4
LSD (0.10)**				2.7	4.2	NS	NS

* Corn that did not perform significantly lower than the top performing variety in a particular column is indicated with an asterisk.
** See text for further explanation.
NS - None of the varieties were significantly different from one another.

Figure 1. Corn silage yield of organic corn varieties – Randolph, VT.



Varieties with the same letter do not differ significantly in yield.

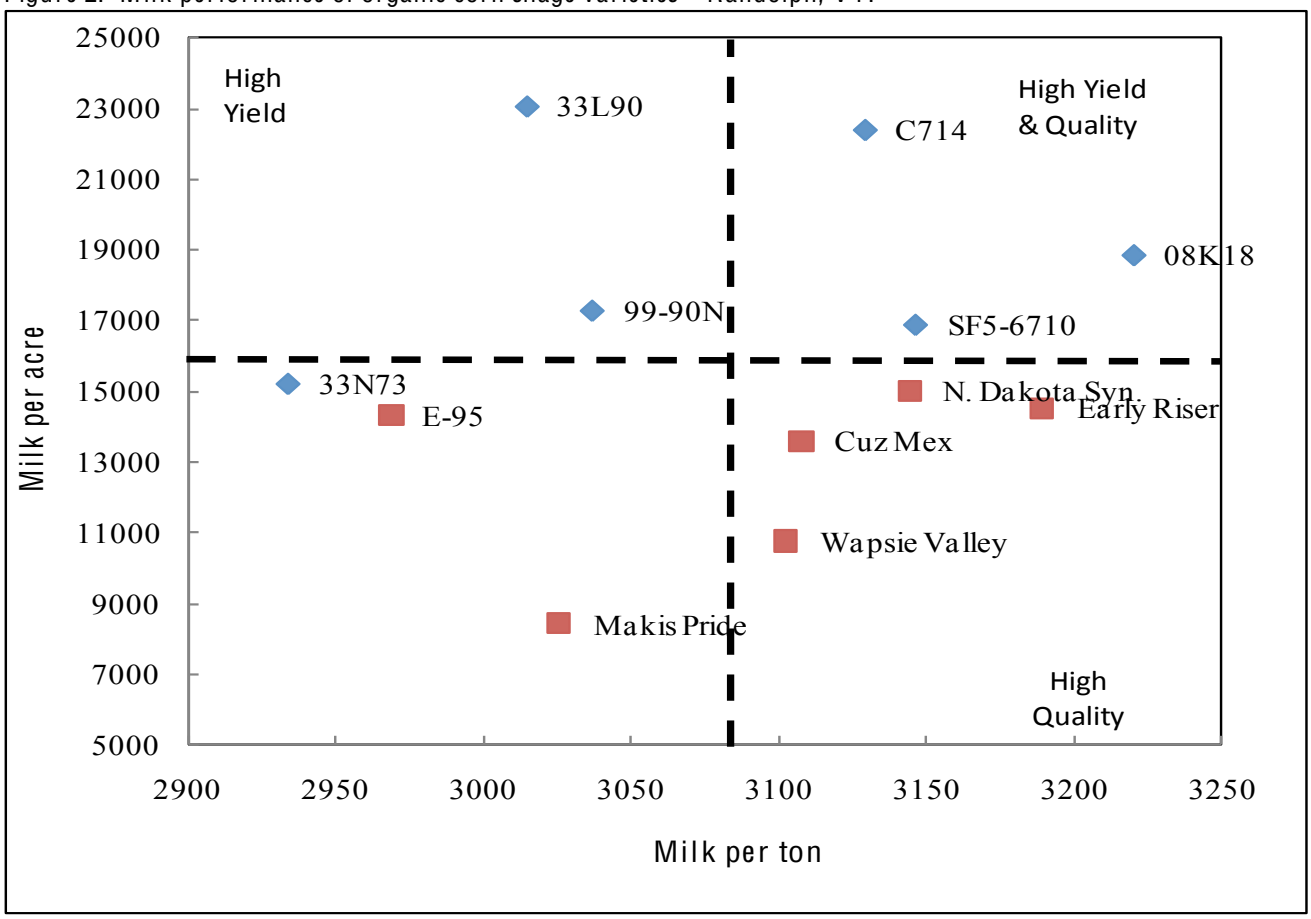
RESULTS

Table 6. Silage quality evaluation of organic corn varieties – Randolph, VT.

Company	Variety	Type	Relative maturity	Forage Quality Characteristics					Milk per	
				CP	ADF	NDF	dNDF	Nel	ton	acre
				%	%	%	%	%		
Albert Lea Seed	E-95	OP	94-97	8.60*	26.3	43.3	60.4	0.76	2969	14317
North Dakota State Univ.	CuzMex	OP	90-95	9.05*	25.6	43.0	63.0	0.76	3108*	13611
Blue River Organics	33N73	Hybrid	92	8.00	26.3	44.4	58.2	0.75	2934	15227
North Dakota State Univ.	Makis Pride	OP	85-92	8.70*	25.7	42.7	59.6	0.76	3026	8429
Viking Organic	SF5-6710	Hybrid	98	8.05	23.3*	40.5*	67.1*	0.78*	3146*	16896
Viking Organic	99-90N	Hybrid	90	8.15	24.6	41.4	60.6	0.77*	3037	17295
Blue River Organics	33L90	Hybrid	92	9.30*	25.8	43.7	58.7	0.76	3015	23067*
American Organics	C714	Hybrid	94-96	8.25	21.3*	36.4*	61.8	0.79*	3129*	22404*
Lakeview Organic Grain	Wapsie Valley	OP	85	8.70*	22.2*	39.1*	62.5	0.78*	3102	10774
North Dakota State Univ.	N. Dakota Synthetic	OP	85-88	8.80*	22.0*	37.0*	62.6	0.79*	3189*	14537
Butterworks Farm	Early Riser	OP	75-80	9.35*	23.4*	39.8*	61.5	0.77*	3145*	15029
Blue River Organics	08K18	Hybrid	80	8.45*	22.1*	37.2*	64.1*	0.80*	3220*	18864*
Trial Mean				8.60	24.0	40.7	61.7	0.77	3085	15871
LSD (0.10)**				1.0	3.1	4.8	3.5	0.03	149	4817

* Corn that did not perform significantly lower than the top performing variety in a particular column is indicated with an asterisk.
** See text for further explanation.
NS - None of the varieties were significantly different from one another.

Figure 2. Milk performance of organic corn silage varieties – Randolph, VT.



Dotted lines indicate overall milk per ton and milk per acre means of the corn varieties.

RESULTS

Table 7. Trial means comparing hybrids with open pollinated organic corn varieties – Randolph, VT

Corn type	DM at harvest	Dry matter	Stover	Ear	Forage Quality Characteristics					Milk per	
					CP	ADF	NDF	dNDF	Nel	ton	Acre
	%	T/A	%	%	%	%	%	%	%		
Hybrid	31.5	6.20	50.7	49.3	8.37	23.9	40.6	61.7	0.77	3080	19096
OP	30.9	4.10	50.5	49.5	8.87	24.2	40.8	61.5	0.77	3090	12669
LSD (0.10)*	NS	0.77	NS	NS	0.44	NS	NS	NS	NS	NS	2411

* See text for further explanation.
NS - None of the varieties were significantly different from one another.

DISCUSSION

This was the first year for the UVM Extension organic corn variety trial. Overall the trial was a success; however, the weather conditions throughout the season presented various challenges. The soil temperature was suboptimal at the time of planting. The cool temperatures following planting resulted in poor germination. The OP corn had lower germination rates (22,000 plants/acre) than most of the hybrid corn (24,000 plants/acre). This ultimately this may have contributed to an overall lower yield of OP varieties as compared to the hybrid corn. The Blue River Organic hybrids had an organic seed treatment and also the highest harvest population (27,000 plants/acre).

The excessive rainfall that plagued the summer months also made mechanical weed control very difficult. Moderate weed populations were evident in the plots but seemed to have little impact on corn silage yields and quality. Interestingly, there was no sign of nutrient stress on the corn plants. This was somewhat surprising given the amount of rainfall and cool temperatures this season. The high crude protein (CP) levels were also an indicator of adequate nitrogen for the plants. Overall, the CP levels in this organic trial were 1 to 2 % points higher compared to other UVM corn variety trials.

The GDD accumulated in Randolph were 200 days less than the 20 year average. This cool season kept many of the hybrids from reaching the proper moisture for silage harvest. Corn stored with moistures over 70% can lead to poor fermentation, herd health issues, and overall nutrient losses from silage leachate.

The organic hybrids had more than 2 tons higher dry matter yields than the OP varieties. With the exception of CP, the OP varieties did not differ from hybrids in overall forage quality. As mentioned earlier the lower yield could be attributed to the lower harvest populations. The CP levels were 0.5% higher in the OP varieties. Each farm would have to evaluate the value of OP corn for their individual farm. Many farms prefer the ability to save their own seed from year to year. For those that prefer to purchase seed the cost of OP is often half the price of hybrid corn seed. Overall, the seed decision will be based on the overall goals of the farm operation.

UVM Extension would like to thank Sosten Longu and the students at Vermont Technical College for their help planting, weeding, cultivating, and harvesting the organic corn variety trial. We would also like to thank Brent Beidler for his help organizing, planting and cultivating the organic corn variety trial. Finally, we would like to recognize Organic Valley FAFO program for their generous support for this project.