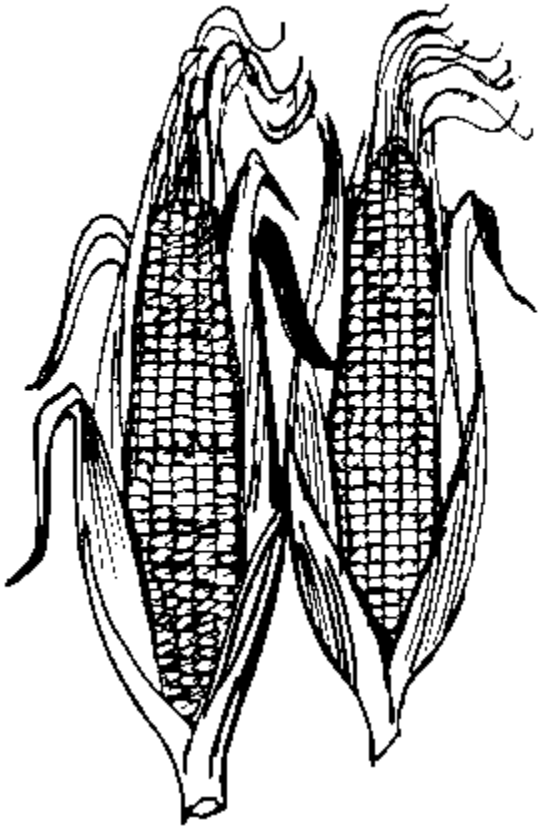
UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

2009
Long Season
Corn Silage Trial



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2009 VERMONT LONG SEASON CORN SILAGE TRIALS

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In 2009, the University of Vermont Extension conducted an experiment to evaluate yield and quality of long season corn hybrids with and without specialty traits (genetic modifications). It is important to remember 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, the corn hybrid specialty traits trial was conducted at Crosswinds Dairy in Alburgh, VT. Several seed companies submitted varieties for evaluation. Companies and contact names are listed in Table 1. Twelve corn varieties ranging in maturities from 90-110 days were grown at this site. The Relative Maturities (RM) was provided by the companies. The specific varieties, their traits, and relative maturities are listed in Table 2.

Table 1. Participating Companies and Local Contact Information

Mycogen	Pioneer
Claude Fortin District Sales Manager Highgate, VT 802-363-2803	Jacob Bourdeau Bourdeau Bros. Sheldon, VT 802-933-2277

Table 2. Hybrids with speciality traits evaluated in Alburgh, VT

Company	Variety	RM	Description & Traits
Mycogen	TMF2W587	105	RR, LL, HXXTRA
Mycogen	TMF2W583	105	RR
Mycogen	F2F566	105	BMR, Conventional
Mycogen	F2F569	104	BMR, RR, LL, HXXTRA
Mycogen	F2F568	100	BMR, RR
Mycogen	F2F489	105	BMR, RR, LL, HX1
Pioneer	35F44	110	RR, LL, HXXTRA
Pioneer	35F37	105	RR
Pioneer	38P43	101	RR, LL, HXXTRA
Pioneer	38P40	95	RR

BMR – Brown Mid-Rib Corn is of higher digestibility because it contains less lignin than other non BMR corn hybrids. BMR corn is not considered a GMO.
HXXTRA – The HerculexXTRA® insect protection trait controls European corn borer, corn rootworm, western bean cutworm, black cutworm and fall armyworm
LL – LIBERTY LINK CORN® is tolerant to broadcast applications of Liberty herbicide, glufosinate ammonium.
RR – ROUND-UP READY CORN® is resistant to the herbicide glyphosate, a post-emergent, foliar applied, non-selective herbicide.
YGVT3 – YieldGard VT Triple® insect protection trait controls Western Corn Rootworms, Northern Corn Rootworms, European Corn Borers, Black Cutworms, Stalk Borers, Wireworms, White Grubs, Seed Corn Maggots, Early Flea Beetles, and Corn Earworms

WEATHER DATA

Seasonal precipitation and temperature recorded at weather stations in close proximity to the trial site is shown in Table 3. This season brought cooler than normal temperatures and higher than normal rainfall patterns across the region. In general corn silage yields were average to below average for most farms including our trial locations. Below average Growing Degree Days (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 1876 which was about 355 GDD less than normal for this area.

Table 3. Temperature, precipitation, and growing degree days summary-2009

Alburgh	April	May	June	July	August	September	October
Average Temperature	44.9	53.9	62.8	65.9	67.7	57.7	44.1
Departure from Normal	+1.4	-2.7	-3.0	-5.2	-1.3	-2.7	-4.7
Precipitation	2.89	6.32	5.19	8.07	3.59	4.01	5.18
Departure from Normal	+0.38	+3.39	+1.98	+4.66	-0.26	+0.55	+0.79
Growing Degree Days (50˚)	111.5	209.0	398.0	494.5	557	286	40.5
Departure from Normal	+71.0	-51.4	-76.0	-158.1	-32.0	-26.0	-61.8

CULTURAL PRACTICES

The field had been planted to corn for at least the last 6 years. The seedbed was prepared with conventional tillage methods. The plots were planted with a John Deere 4-row corn planter on May 26, 2009 at 32,000 seeds to the acre. The soil type was Covington silty clay loam on an A slope (0-3%). Fertilizers and herbicides were applied based on the farms standard practices. The plot design was a randomized complete block with two replications and the plot size measured an average of 10'x100'. The plots were harvested on October 21, 2009 with a John Deere 2 row chopper, and the forage wagon was weighed on a platform scale. A subsample was collected for moisture determination and quality analysis. Pertinent trial information is summarized in Table 4.

Table 4. Long season corn variety trial information - 2009

Trial Information	Vermont Technical College
Soil type	Silty clay loam
Previous Crop	Corn
Row Width (in.)	30
Planting date	26-May
Harvest date	21-Oct
Harvest population (plants/acre)	26,000
Tillage operations	Spring chisel& spring disk
Manure (gal/acre)	Spring & fall applied - 7500 gal/acre

SILAGE QUALITY

Silage quality was analyzed using wet chemistry techniques at Cumberland Valley Analytical Services in Hagerstown, Maryland. Plot samples were dried, ground and analyzed for crude protein (CP), neutral detergent fiber (NDF), and 30h digestible NDF (dNDF). 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, non-protein 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 exist,
3) Genetic, dietary, and environmental differences affecting feed utilization are not considered.

PRESENTATION OF DATA

Results for the corn variety trial are listed in Table 5. Dry matter yields were calculated and then 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 of two replications. Figure 1 displays the relationship between milk per ton and milk per acre. The dotted lines dividing the figure into four quadrants represent the mean milk per ton and acre for the location. Therefore hybrids that fall above the lines performed better than the average and hybrids below the lines performed below average. The yields of the varieties are also depicted in figure 2. In Table 6, the average of the triple stacked hybrids were compared to its conventional or RR counterpart. In Table 7, individual triple stacked hybrids were compared to their conventional or RR counterpart. A LSD value is presented for each variable (i.e. yield) comparing if specialty traits hybrids differed from conventional hybrids. Least Significant differences (LSD's) at the 10% level of probability are shown. If there is no significant difference (NS) this means that these hybrids did not differ from one another.

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 hybrid 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

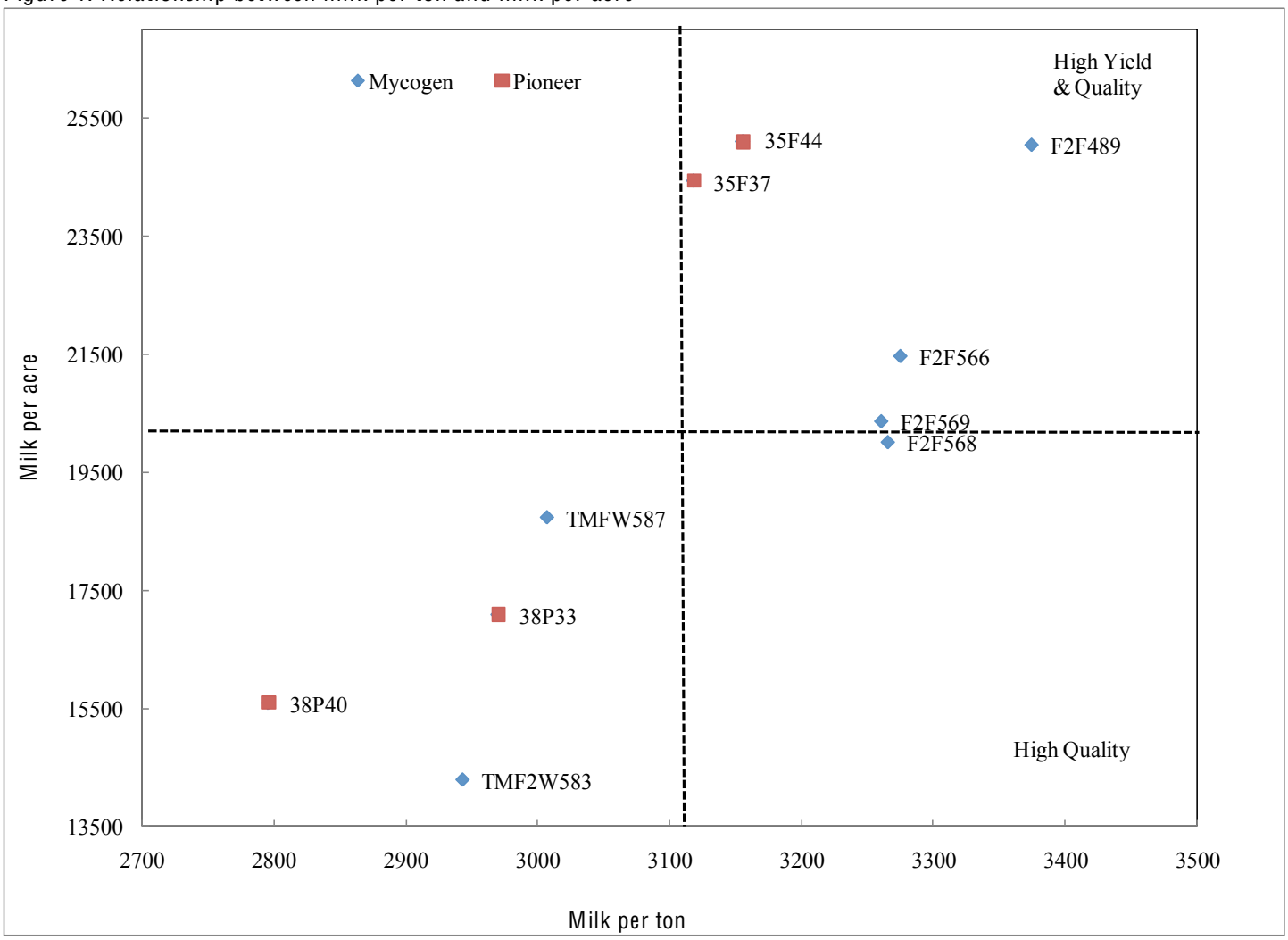
RESULTS

Table 5. Silage yield and quality evaluation of long season corn varieties- Alburgh, VT

Company	Hybrid	DM at harvest	Yield 35 % DM	Forage Quality Characteristics					Milk per	
				CP	ADF	NDF	dNDF	Nel	ton	acre
		%	T/A	%	%	%	%	%		
Mycogen	F2F566	38.0	18.7	8.80	24.0	41.0	72.7*	0.76	3276	21467
Mycogen	F2F569	38.5	17.8	9.10	24.4	41.7	72.0*	0.76	3261	20362
Mycogen	F2F568	39.0	17.5	9.20	25.3	43.0	71.6*	0.76	3266	20008
Mycogen	TMF2W587	40.0	17.8	9.50*	24.2	39.8	59.2	0.76	3008	18736
Mycogen	TMF2W583	40.0	13.9	8.80	25.1	41.8	59.1	0.75	2944	14292
Mycogen	F2F489	44.0	21.2	9.30	21.7	37.2	73.1*	0.78*	3375*	25046*
Pioneer	35F44	45.5	22.7*	8.20	21.7	35.0	60.5	0.79*	3156	25103*
Pioneer	35F37	46.0	22.4*	8.40	22.2	35.8	59.9	0.78*	3119	24437
Pioneer	38P43	47.0*	16.4	8.90	23.4	38.5	55.0	0.76	2970	17087
Pioneer	38P40	47.0*	15.9	8.80	27.7	44.7	59.1	0.72	2796	15591
Trial mean		42.5	18.4	8.90	24	39.8	64.1	0.76	3117	20213
LSD (0.10)**		2.9	3.6	0.40	NS	NS	3.9	0.03	113	4249

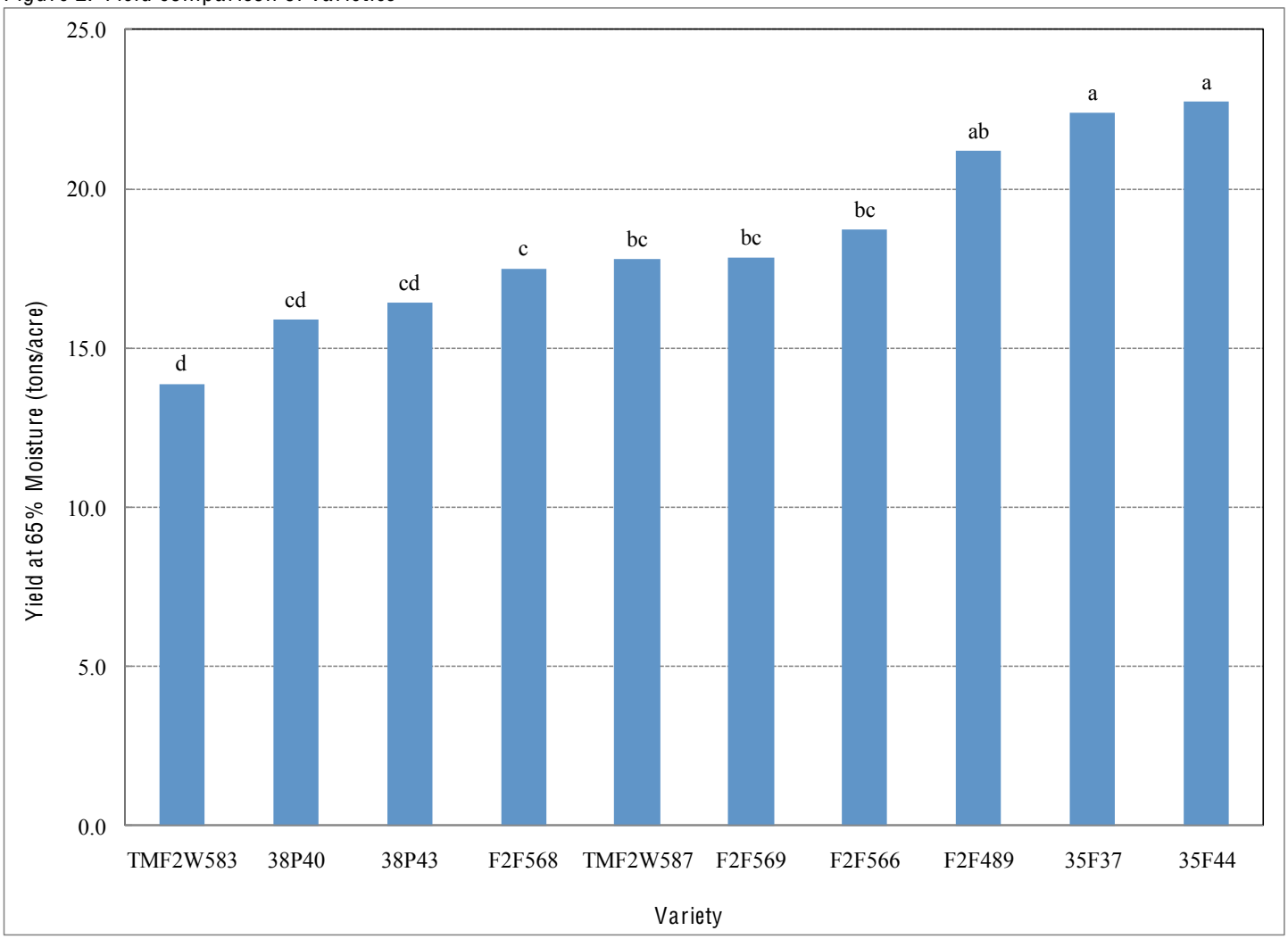
* Corn that did not perform significantly lower than the top performing hybrid in a particular column is indicated with an asterisk.
** See text for further explanation.
NS - None of the varieties were significantly different from one another.

Figure 1. Relationship between milk per ton and milk per acre



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

Figure 2. Yield comparison of varieties



Hybrids with the same letter did not differ statistically in yield.

Table 6. Statistical comparison of yield and quality for hybrids with specialty traits vs no traits.

Hybrid type	DM at harvest %	Yield 35% DM T/A	Forage Quality Characteristics CP %	ADF %	NDF %	dNDF %	Nel %	Milk per ton	Milk per acre
RR or no trait Hybrids	42.0	17.8	8.80	24.0	40.0	64.2	0.76	3115	19458
Triple Stacked Hybrids	43.0	19.1	9.00	23.9	39.7	64.0	0.76	3119	20968
LSD (0.10)**	NS	NS	NS	NS	NS	NS	NS	NS	NS

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

Table 7. Statistical comparison of traditional modified hybrids and single, triple or quad stacked modified hybrids

Company	Hybrid	Relative maturity	Specialty traits	DM at harvest	Yield 35 % DM	Forage Quality Characteristics					Milk per	
						CP	ADF	NDF	dNDF	Nel	ton	acre
				%	T/A	%	%	%	%	%		
Pioneer	35F37	105	RR	46.0	22.4	8.4	22.2	35.8	59.9	0.78	3119	24437
Pioneer	35F44	110	RR, LL, HXXTRA	45.5	22.7	8.2	21.7	35.0	60.5	0.79	3156	25103
LSD (0.10)				NS	NS	NS	NS	NS	NS	NS	NS	NS
Pioneer	38P40	95	RR	47.0	15.9	8.80	27.7	44.7	55.0	0.72	2796	15591
Pioneer	38P43	101	RR, LL, HXXTRA	47.0	16.4	8.85	23.4	38.5	57.3	0.76	2970	17087
LSD (0.10)				NS	NS	NS	NS	NS	NS	*	*	NS
Mycogen	TMF2W583	105	RR	40.0	13.9	8.75	25.1	41.8	59.1	0.75	2944	14292
Mycogen	TMF2W587	105	RR, LL, HXXTRA	40.0	17.8	9.50	24.2	39.8	59.2	0.76	3008	18736
LSD (0.10)				NS	*	*	NS	NS	NS	NS	NS	*
Mycogen	F2F568	100	BMR, RR	39.0	17.5	9.20	25.3	43.0	71.6	0.76	3266	20008
Mycogen	F2F569	104	BMR, RR, LL, HXXTRA	38.5	17.8	9.10	24.4	41.7	72.0	0.76	3261	20362
Mycogen	F2F566	105	BMR, Conventional	38.0	18.7	8.75	24.0	41.0	72.7	0.76	3276	21467
LSD (0.10)				NS	NS	*	NS	NS	NS	NS	NS	NS

*Hybrids are significantly different at the 0.10 level.

DISCUSSION

The overall yield for the long season corn trial was 18 tons per acre. The top performing hybrids yielded over 22 tons of forage per acre. The highest quality hybrids were the BMR varieties. The top hybrids for the trial were Mycogen F2F489 and Pioneer 35F44 with milk per acre values of over 25,000. There were no significant differences in yield and quality of the RR Ready and conventional hybrids when compared to triple or quad stacked hybrids. When individual hybrids were compared there were very few statistical differences between hybrids. Interestingly the conventional BMR hybrid (F2F568) did not differ from its transgenic counterparts. With farm budgets tightening up it is interesting to see that the sophisticated modified hybrids that cost between 19% and 24% higher than traditionally modified hybrids may not be worth the additional investment in regards to yield and quality.

UVM Extension would like to thank The Reynolds Family and Roger Rainville and staff at Borderview Farm for their help implementing the trial. We would also like to thank Claude Fortin of Mycogen and Dave Kostyo of Pioneer for the hybrid seed donation.

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