2012

Long Season Corn Silage Variety Trial

Heather Darby
University of Vermont, heather.darby@uvm.edu

Conner Burke
University of Vermont

Erica Cummings
University of Vermont

Rosalie Madden
University of Vermont

Hannah Harwood
University of Vermont

See next page for additional authors

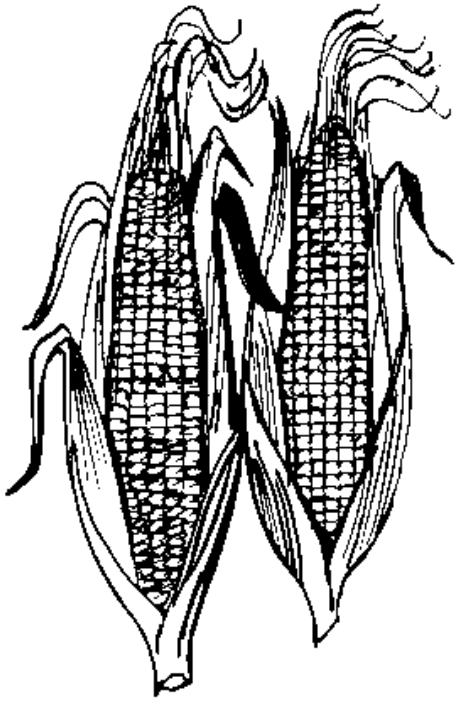
Authors
Heather Darby, Conner Burke, Erica Cummings, Rosalie Madden, Hannah Harwood, and Susan Monahan

NW CROPS & SOILS PROGRAM

UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

2012 Long Season Corn Silage Variety Trial



Dr. Heather Darby, UVM Extension Agronomist
Conner Burke, Erica Cummings, Rosalie Madden, Hannah Harwood, and Susan Monahan
UVM Extension Crops and Soils Technicians
(802) 524-6501

Visit us on the web at: http://www.uvm.edu/extension/cropsoil

The UNIVERSITY of VERMONT EXTENSION

2012 Long Season Corn Silage Variety Trial
Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

In 2012, the University of Vermont Extension Crops and Soils Team evaluated yield and quality of long season corn silage varieties at Borderview Research Farm in Alburgh, VT. Long season corn can be difficult to grow in Vermont, due to our climate's restricted Growing Degree Days (GDDs). However, on many farms long season corn can often produce higher yields and quality than many short-season varieties. The test site was at Borderview Research Farm in Alburgh, VT, which has what is considered one of the longest growing seasons in Vermont (2,717 GDDs in May - Oct 2012).

It is important to remember that the data presented in this report is from a single year. Hybrid performance data from additional tests over several years should be compared before making varietal selections.

MATERIALS AND METHODS

Several seed companies submitted varieties for evaluation (Table 1). Twenty-four corn varieties were evaluated, ranging in relative maturity from 90 – 110 days. Relative Maturity (RM) was provided by the company (Table 2).

Table 1. Participating companies and local contact information.

Dekalb/Monsanto	Mycogen	Pioneer	Seedway	Wolf River
Klaus Busch Territory Sales Manager Knox, NY 518-320-2462	Claude Fortin District Sales Manager Highgate, VT 802-363-2803	Jacob Bourdeau Bourdeau Bros. Sheldon, VT 802-933-2277	Ed Schillawski 3442 Rt. 22A Shoreham, VT 802-897-2281	Marcel Moreau Swanton, VT 802-309-4674

Table 2. Long season silage corn varieties evaluated in Alburgh, VT.

Company	Variety	RM (days)	Traits
Dekalb	DKC40-22RIB	90	SSX/RIB
Dekalb	DKC43-48	93	GenVT3P
Dekalb	DKC45-51RIB	95	SSX/RIB
Dekalb	DKC46-61RIB	96	SSX/RIB
Dekalb	DKC48-12	98	SSX
Dekalb	DKC52-61	102	GenVT2P
Mycogen	TMF2Q493	97	RR2
Mycogen	TMF2R522	98	SSX/LL/RR2
Mycogen	TMF2L530	99	RR2
Mycogen	F2F569	104	HXT/LL/RR2
Mycogen	TMF2Q717	108	SSX/LL/RR2
Mycogen	F2F626	108	SSX
Mycogen	F2F665	109	HXT/LL/RR2
Mycogen	TMF2H699	110	SSX/LL/RR2
Pioneer	P9630AM1	96	AM1/LL/RR2
Pioneer	P0210AM-R	107	AM1/RR2
Pioneer	P0216AM1	107	AM1/RR2
Seedway	SW3788RRYGCRW	97	GenVT3P-GenVT3
Seedway	SW3904L	98	Leafy
Seedway	SW4704RR	102	RR2
Seedway	SW5501L	105	Leafy
Seedway	SW6604LRR	108	Leafy/RR2
Seedway	SW6801L	110	Leafy
Wolf River	WR2702L	102	Leafy

AM1- Optimum® AcreMax® provides an insect control solution allowing growers to simplify and reduce their corn rootworm refuge by placing refuge in a bag (RIB).

GenVT2P - Genuity® VT Double PRO™ provides protection against corn earworm and other ear-feeding insects as well as fall armyworm, European corn borer, and corn earworm.

GenVT3 – YieldGard VT Triple™ uses VecTran™ technology which stacks insect- and weed-control traits in one variety. Provides glyphosate herbicide (Roundup®, Touchdown®) tolerance, as well as protection against 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.

GenVT3P- Genuity® VT Triple PRO™. Provides a dual mode of action to protect against above ground insects such as earworm, armyworm, and corn borers.

HXT – Herculex Xtra® provides season-long control of a variety of pests, including European corn borer, Western bean cutworm, corn rootworm, and black cutworm.

Leafy – Conventional Leafy.

LL – Glufosinate-ammonium herbicide (LibertyLink®) tolerant.

RIB- RIB complete (Refuge In a Bag).

RR2 – Roundup Ready corn is glyphosate herbicide (Roundup®, Touchdown®) tolerant.

SSX – SmartStax corn provides a broad spectrum of insect control, using multiple modes of action, as well as glyphosate herbicide (Roundup Ready®, Touchdown®) and glufosinate-ammonium (LibertyLink®) tolerance.

The soil type at the Alburgh location is a Benson rocky silt loam (Table 3). The seedbed was spring disked followed by spike tooth harrow. The previous crop was corn. Starter fertilizer (10-20-20) was

applied at a rate of 200 lbs per acre. Plots were 25' long and consisted of two 30-inch rows. They were planted with a John Deere 1750 planter on 18-May. The seeding rate was 34,000 seeds per acre. The plot design was a randomized complete block with two replications. Treatments were twenty-four varieties. Lumax (S-metolachlor, atrazine, and mesotrione) was sprayed at 3 pints per acre post emergence for weed control. Urea was side-dressed at a rate of 200 lbs. per acre on 23-Jun. On 17-Sep and 2- Oct, depending on RM, the corn was harvested with a John Deere 2-row chopper, and the forage wagon was weighed on a platform scale. A subsample of the harvested material was collected, dried, ground, and then sent to Cumberland Valley Analytical Services in Hagerstown, MD for quality analysis. Dry matter yields were calculated and then adjusted to 35% dry matter.

Table 3. 2012 long season corn trial specifics for Alburgh, VT.

	Borderview ResearchFarm Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Corn
Row width (in.)	30
Planting date	18-May
Harvest date	17-Sep & 2-Oct
Tillage operations	Spring disk, spike tooth harrow
Starter fertilizer	200 lbs. ac^{-1} 10-20-20
Sidedress	200 lbs. ac^{-1} urea

Silage quality was analyzed using wet chemistry at Cumberland Valley Analytical Services in Hagerstown, MD. Plot samples were sent to the lab where they were analyzed for crude protein (CP), starch, acid detergent fiber (ADF), neutral detergent fiber (NDF), and 30 hour digestible NDF (dNDF). Mixtures of true proteins, composed of amino acids, and non-protein nitrogen make up the CP content of forages. The CP content of forages is determined by measuring the amount of nitrogen 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 (dNDF). Evaluation of forages and other feedstuffs for dNDF 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 dNDF. Forages with increased dNDF will result in higher energy values and, perhaps more importantly, increased forage intakes. Forage dNDF can range from 20 – 80% NDF.

Net energy of lactation (NEL) is calculated based on concentrations of NDF and ADF. NEL can be used as a tool to determine the quality of a ration, but should not be considered the sole indicator of the quality of a feed, as NEL is affected by the quantity of a cow's dry matter intake, the speed at which her ration is

consumed, the contents of the ration, feeding practices, the level of her production, and many other factors. Most labs calculate NEL at an intake of three times maintenance. Starch can also have an effect on NEL, where the greater the starch content, the higher the NEL (measured in Mcal per pound of silage), up to a certain point. High grain corn silage can have average starch values exceeding 40%, although levels greater than 30% are not considered to affect energy content, and might in fact have a negative impact on digestion. Starch levels vary from field to field, depending on growing conditions and variety.

The silage performance indices of milk per acre and milk per ton were calculated using a model derived from the spreadsheet entitled "MILK2000", 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.

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and hybrids were treated as fixed. Hybrid mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p<0.10$).

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 hybrids 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 (LSDs) at the 0.10 level of significance are shown. Where the difference between two hybrids within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure that for 9 out of 10 times, there is a real difference between the two hybrids. Hybrids that were not significantly lower in performance than the highest hybrid in a particular column are indicated with an asterisk. In the example below, hybrid C is significantly different from hybrid A but not from hybrid B. The difference between C and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these hybrids did not differ in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these hybrids were significantly different from one another. The asterisk indicates that hybrid B was not significantly lower than the top yielding hybrid C, indicated in bold.

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

RESULTS

Weather data is recorded with a Davis Instrument Vantage PRO2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 4). Though May was warmer and wetter than normal (based on 1981-2010 data), June, July, and August all had less precipitation than normal. There were an accumulated 2,717 Growing Degree Days (GDDs), at a base temperature of 50 degrees Fahrenheit. This was 324 more than the historical 30-year average for May-September.

Table 4. 2012 weather data for Alburgh, VT.

Alburgh, VT	May	June	July	August	September	October
Average temperature (°F)	60.5	67.0	71.4	71.1	60.8	52.4
Departure from normal	4.1	1.2	0.8	2.3	0.2	4.2
Precipitation (inches)*	3.9	3.2	3.8	2.9	5.4	4.1
Departure from normal	0.5	-0.5	-0.4	-1.0	1.7	0.5
Growing Degree Days (base 50°F)	370	504	657	650	364	172
Departure from normal	102	30	17	69	46	60

Based on weather data from our onsite Davis Instruments Vantage PRO2 weather station with a WeatherLink data logger. Historical averages are for 30 years of NOAA data from Burlington, VT (1981-2010).
*Precipitation data from June- September is based on Northeast Regional Climate Center data from an observation station in Burlington, VT.

Table 5. Harvest characteristics of 24 long season corn silage varieties – Alburgh, VT, 2012.

Variety	RM	Yield 35% DM tons ac^{-1}
SW6604LRR	108	**29.0**
SW5501L	105	27.9
SW6801L	110	27.4
F2F626	108	26.9
DKC43-48	93	26.1
DKC40-22RIB	90	25.7
TMF2H699	110	24.5
P0216AM1	107	23.8
TMF2Q717	108	23.7
F2F569	104	23.4
TMF2R522	98	23.2
F2F665	109	22.5
TMF2Q493	97	22.0
SW3904L	98	21.7
DKC45-51RIB	95	21.7

SW3788RRYGCRW	97	21.7
DKC48-12	98	20.6
SW4704RR	102	19.7
DKC46-61RIB	96	19.5
DKC52-61	102	18.9
WR2702L	102	18.5
TMF2L530	99	18.3
P0210AM-R	107	17.7
P9630AM1	96	15.2
	LSD (0.10)	NS
	Trial mean	22.5

Treatments indicated in bold had the top observed performance.
NS – No statistical significance was determined between varieties.

The trial average yield was 22.5 tons per acre. The Seedway variety 'SW6604LRR' yielded the highest at 29 tons per acre, but was not statistically significant from all other varieties evaluated, (Table 5, Figure 1). The yields ranged from 15.2 to 29.0 tons per acre. With the exception of dNDF, there were no differences in quality among the varieties (Table 6). As might be expected, the BMR varieties had the highest dNDF of the long season varieties. The Mycogen variety 'F2F569' had the highest dNDF, although this was not statistically different from Mycogen varieties 'F2F665' and 'F2F626'. No significant difference was determined between long season corn silage varieties for milk per ton or milk per acre.

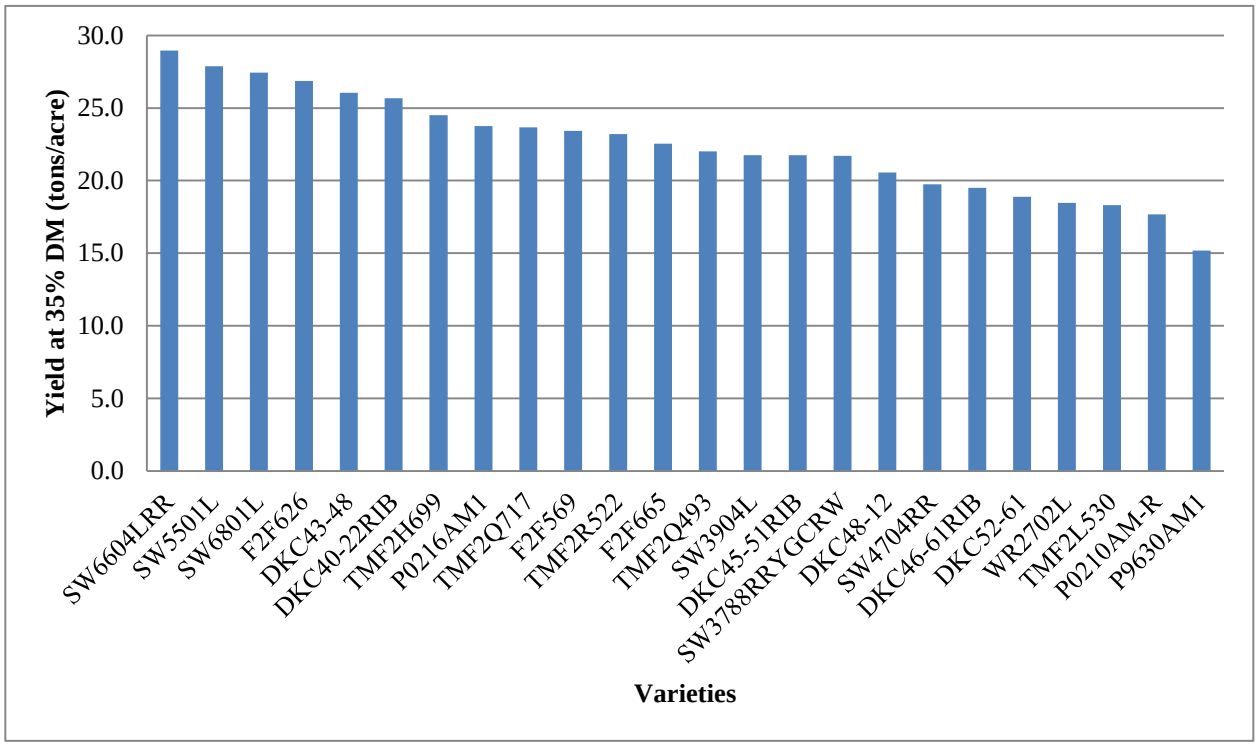


Figure 1. Long season silage corn yield in Alburgh, VT, 2012. Yield did not vary significantly by variety (p=0.10).

Table 6. Forage quality of 24 long season corn silage varieties - Alburgh, VT, 2012.

Variety	RM	Forage quality characteristics						Milk	
		CP	ADF	NDF	dNDF	Starch	NEL	Ton	acre
		% of DM	% of DM	% of DM	% of NDF	%	Mcal lb^{-1}	lb	lb
SW5501L	105	**8.8**	23.1	40.1	58.8	35.5	0.77	3071	**29870**
F2F626	108	8.5	25.7	44.7	68.3*	31.6	0.77	**3200**	29824
SW6604LRR	108	8.2	25.6	44.2	57.7	32.8	0.75	2913	29466
DKC43-48	93	7.9	**20.9**	**35.7**	56.7	**40.4**	**0.79**	3082	28086
SW6801L	110	7.6	26.1	44.4	55.0	33.4	0.75	2842	27334
DKC40-22RIB	90	7.7	26.9	45.5	55.3	29.9	0.74	2894	25986
F2F569	104	8.4	27.0	47.8	**71.7***	29.1	0.75	3101	25547
F2F665	109	8.1	27.7	47.7	68.4*	29.1	0.75	3178	25407
TMF2R522	98	8.2	22.4	38.1	56.8	38.4	0.78	3061	24819
P0216AM1	107	8.0	22.8	39.0	57.0	38.1	0.78	2943	24395
TMF2H699	110	7.7	27.3	47.6	58.3	29.7	0.74	2843	24250
TMF2Q717	108	8.0	28.1	47.5	57.1	28.1	0.73	2907	24082
TMF2Q493	97	8.8	22.5	38.7	58.1	37.3	0.78	3099	23841
SW3788RRYGCRW	97	8.1	24.3	41.2	55.8	35.9	0.76	2848	22446
DKC45-51RIB	95	8.0	27.6	46.4	56.6	28.4	0.74	2873	21882
SW3904L	98	8.1	24.2	41.1	55.1	37.9	0.76	2800	21282
DKC46-61RIB	96	7.4	25.2	42.9	56.5	33.7	0.76	2943	20024
WR2702L	102	7.8	22.3	39.2	63.5	39.3	0.78	3109	19849
DKC48-12	98	7.8	27.1	45.8	54.7	31.2	0.74	2725	19065
TMF2L530	99	7.7	26.4	44.4	58.6	32.7	0.75	2947	18806
SW4704RR	102	7.7	26.9	45.7	54.6	32.9	0.74	2712	18666
P0210AM-R	107	8.1	25.0	42.0	60.1	34.0	0.76	2988	18365
P9630AM1	96	7.6	28.7	48.6	56.7	28.3	0.72	2709	14046
DKC52-61	102	8.3	25.5	43.5	55.4	32.4	0.75	2851	12466
	LSD (0.10)	NS	NS	NS	4.4	NS	NS	NS	NS
	Trial Mean	8.0	25.4	43.4	58.6	33.3	0.75	2943	22908

Treatments indicated in bold had the top observed performance.
NS – no statistical significance was determined between varieties.

* Varieties that did not perform significantly lower than the top performing variety in a particular column are indicated with an asterisk.

Figure 2 displays the relationship between milk per ton and milk per acre for varieties trialed in Alburgh, VT. The dotted lines dividing the figure into four quadrants represent the mean milk per ton and milk per acre for the location. Hybrids that fall above or to the right of the lines performed better than the average, and hybrids below or to the left of the lines performed below average. There were many varieties at the Alburgh location that ranked above average in yield and quality. However, it is important to remember that these varieties did not perform statistically different in yield or quality. Varietal selection should be based on the goals of the farm as well as data compared from multiple sites and years.

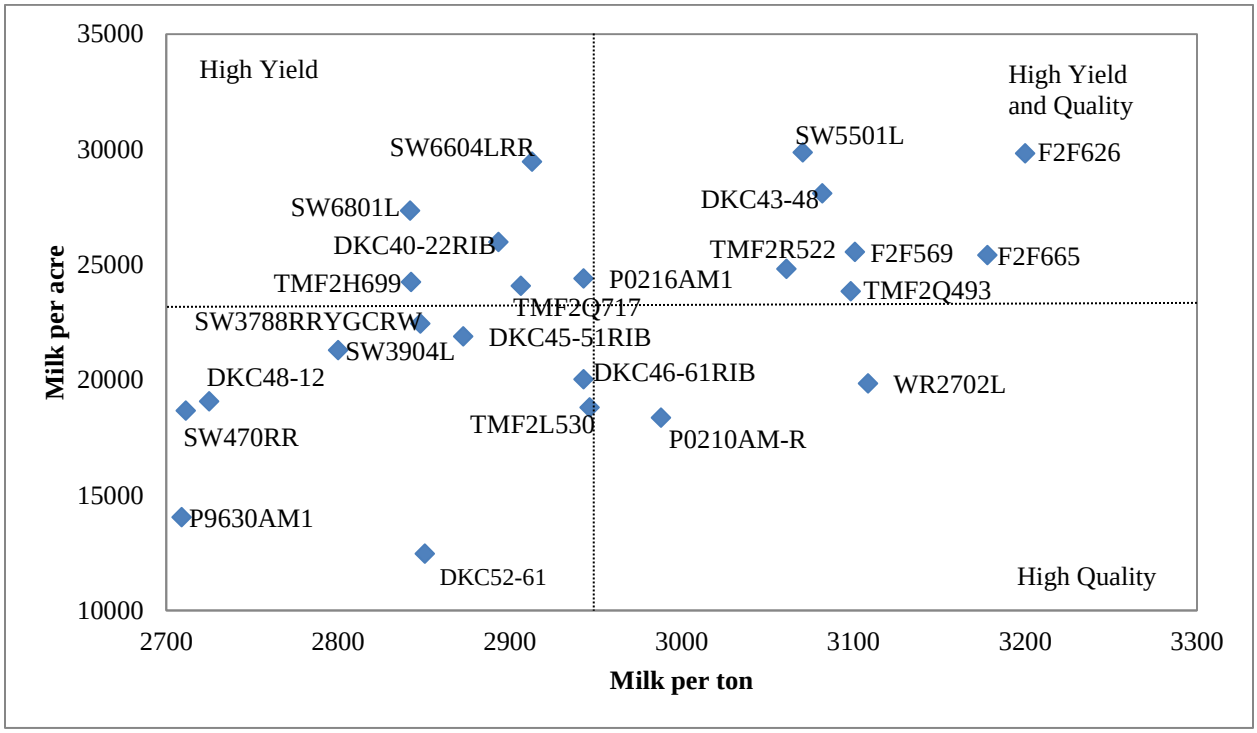


Figure 2. Relationship between milk per ton and milk per acre for long season corn silage varieties grown in Alburgh, VT. ***Dotted lines represent the mean milk per ton and milk per acre.***

DISCUSSION

All varieties reached proper maturity for harvest at Borderview Research Farm in Alburgh, VT. Given the above average GDDs for 2012 this does not come as a surprise. There was no severe lodging of corn stalks like there had been in previous years. Overall, the long season corn yielded an average of 22.5 tons per acre. The range of yields was between 15.2 and 29 tons per acre, showing the importance of proper varietal selection to maximize long season corn yields. Forage quality did not differ significantly by variety with the exception of the BMR hybrids that had higher dNDF when compared to the conventional hybrids.

ACKNOWLEDGEMENTS

UVM Extension would like to thank Roger Rainville at Borderview Research Farm in Alburgh for his generous help with the trials. We would like to acknowledge Katie Blair, Chantel Cline, and Savanna Kittell-Mitchell for their assistance with data collection and entry. We would also like to thank Klaus Busch of Dekalb/Monsanto, Claude Fortin of Mycogen, Marcel Moreau of Wolf River, Ed Schillawski of Seedway, and Dan Mongeau of Pioneer for the hybrid seed donation. The information is presented with the understanding that no product discrimination is intended and no endorsement of any product mentioned or criticism of unnamed products is implied.

UVM Extension helps individuals and communities put research-based knowledge to work.

The UNIVERSITY of VERMONT EXTENSION