NORTHWEST CROPS & SOILS PROGRAM

2013 Flax Variety Trial

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2013 FLAX VARIETY TRIAL

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Flax *(Linum usitatissimum* L.*)* is a multi-purpose crop grown for its fiber, oil (linseed oil), and meal. The importance of flax as a major crop in the United States dropped drastically in the 1980's when latex paints replaced linseed oil based paint. Recently there has been renewed interest in flax, both for human consumption and for animal feed, for its high levels of heart-healthy omega-3 fatty acids. This variety trial was established to determine what flax varieties can grow and thrive in Vermont's climatic conditions.

MATERIALS AND METHODS

Twelve flax varieties were planted at Borderview Research Farm in Alburgh, VT on 23-Apr 2013. General plot management is listed in Table 1. The experimental design was a randomized complete block replicated 4 times. Plot size was 5' x 20'. The previous crop was corn silage, and prior to that, the site had been in sod. The field was disked and spike tooth harrowed prior to planting. Plots were seeded with a Kincaid Cone Seeder at a seeding rate of 50 lbs acre^{-1}.

Population and vigor were measured on 22-May. Populations were determined by taking two 1/3 meter counts per plot. On 9-Jul plant heights were measured, and the severity of lodging was recorded as a percent of plot lodged. Flax plots were harvested with an Almaco SP50 small plot combine on 6-Sep 2013. The harvest area was 5' x 20'. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). The varieties of flax grown are listed in Table 2. Results were analyzed with an analysis of variance in SAS (Cary, NC). The Least Significant Difference (LSD) procedure was used to separate cultivar means when the F-test was significant ($p< 0.10$).

Table 1. General plot management.

Trial Information	Borderview Research Farm Alburgh, VT
Soil Type	Benson rocky silt loam
Previous crop	Corn
Planting date	23-Apr
Harvest date	6-Sep
Seeding rate	50 lbs acre^{-1}
Tillage methods	Mold board plow, disk, and spike tooth harrow

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 treatments 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. Treatments that were not significantly lower in performance than the highest value 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**

Table 2. Flax varieties, origin, year released and seed color.

Variety	Origin	Year released	Seed color
Carter	North Dakota	2004	Yellow
ND 2055	North Dakota	*	Brown
ND 2059	North Dakota	*	Brown
Neche	North Dakota	1988	Brown
Nekoma	North Dakota	2002	Brown
Omega	North Dakota	1989	Yellow
Pembina	North Dakota	1998	Brown
Prairie Blue	Canada	2003	Brown
Prairie Thunder	Canada	2006	Brown
Rahab 94	South Dakota	1994	Brown
Webster	South Dakota	1998	Brown
York	North Dakota	2002	Brown

*Experimental line, has not been publically released.

RESULTS AND DISCUSSION

Seasonal precipitation and temperature recorded at a weather station in Alburgh, VT are shown in Table 3. From April to September, there was an accumulation of 4511 Growing Degree Days (GDDs) in Alburgh which is 18 GDDs less than the 30-year average. Flax needs 1603 GDD to reach maturity.

Table 3. Seasonal weather data[1] collected in Alburgh, VT, 2013.

Alburgh, VT	April	May	June	July	August
Average temperature (°F)	43.6	59.1	64.0	71.7	67.7
Departure from normal	-1.2	2.7	-1.8	1.1	-1.1
Precipitation (inches)	2.12	4.79	9.23	1.89	2.41
Departure from normal	-0.7	1.34	5.54	-2.26	-1.5
Growing Degree Days (base 32°F)	349	848	967	1235	1112
Departure from normal	-35.6	91.4	-47	36.8	-27.2

[1]Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.
Historical averages are for 30 years of NOAA data (1981-2010) from Burlington, VT.
ł June 2013 precipitation data based on National Weather Service data from cooperative stations in South Hero, VT (http://www.nrcc.cornell.edu/page_summaries.html)

Flax yields and plot characteristics are listed in Table 4. Plant populations measured on 22-May resulted in significant differences between flax varieties with Neche having the highest population of 546 plants m^{-2}. However, those differences did not relate to yield differences when the plots were harvested on 6-Sep. Flax yields ranged from 255 to 634 lbs. $acre^{-1}$ (Figure 2), which is much lower than typical yields from regions where flax is normally grown. Yields from variety trials in North Dakota range from 1200-2100 lbs $acre^{-1}$. While yields from our Vermont flax trial probably did not match North Dakota yields, our harvest yields are likely much lower than actual yields due to the challenges faced in harvesting. Yields from our Vermont flax trial were lower than North Dakota yields. Yield was mostly compromised due to harvest difficulties with the plot combine. Direct combining the light-weight flax seed proved more challenging than expected. The air on the combine needed to be shut-off so seed would not be lost out the back of the combine.

Unfortunately, this resulted in all of the chaff and seed getting plugged in the base of the combine. Once plugged it was very difficult to remove the seed without losing some of the plot onto the ground. This issue would have likely been alleviated if the crop was swathed and dried prior to harvest. Unfortunately, the weather at the time of harvest was not favorable for swathing so direct combining was used for harvest. Next season if direct combine is necessary, hand harvest will be performed on a subsection of the plot to determine yields prior to harvest loss. A picture taken on 1-Aug (Figure 1) shows the weed-free flax variety trial.

Table 4. Plot characteristics and yield of 12 flax varieties.

Flax Variety	Population plants/m^2	Height in.	Lodging %	Yield lbs./acre
Carter	396	31.0	5	634
Prairie Thunder	358	29.8	0	557
Webster	511*	31.8	6	502
2055	520*	**34.9***	15	397
2059	480*	34.1*	23	390
Neche	**546***	32.4	4	378
Nekoma	480*	30.5	8	335
Prairie Blue	508*	32.3	6	330
Rahab 94	252	29.9	0	293
Omega	118	30.2	0	286
York	475*	29.4	1	270
Pembina	386	32.1	0	255
Trial Mean	419	31.5	6	386
LSD ($p<0.1$)	102.77	2.1982	NS	NS

*Varieties with an asterisk are not significantly different than the top performer in **bold**.
NS – No significant difference amongst varieties.

Figure 1. Flax plots on 1-Aug, Alburgh, VT.

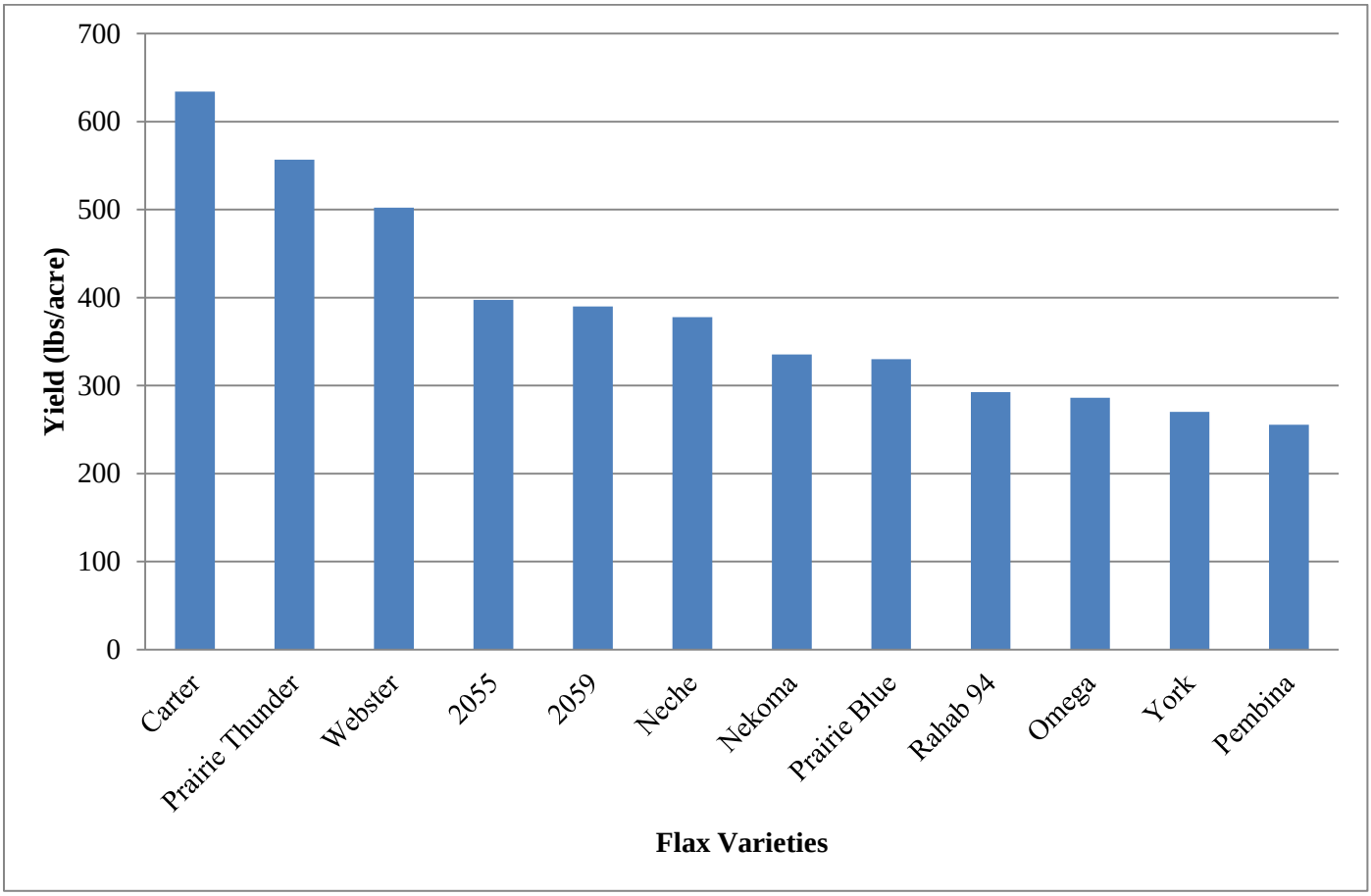

Figure 2. Average yield of flax varieties grown in Alburgh, VT, 2013.

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