

2011 VERMONT SUNFLOWER VARIETY TRIAL

Sunflower Variety Trial

The University of Vermont Extension has conducted sunflower variety evaluation over the past four years to determine best-adapted varieties for this region. Because new varieties are developed yearly and others are discontinued, it is important to provide farmers with the latest information regarding agronomic characteristics of emerging varieties, as compared to well-known varieties. In the 2011 growing season, a replicated trial evaluating seventeen sunflower varieties, varying in relative maturities and traits was conducted in Alburgh, VT. It is important to note that the data presented is from only one location; additional tests in different locations and over several seasons should be considered.

MATERIALS AND METHODS

This year's sunflower variety trial at Borderview Farm in Alburgh, VT was planted in 5'x20' plots in a randomized block with three replicates. The soil was a Benson rocky silt loam. Treatments were varieties (Table 1). The previous crop at this location was corn, and the seedbed was prepared by spring disking and spike-tooth harrowing. Starter fertilizer was applied at a rate of 250 lbs per acre of 10-20-20. Treflan (Trifluralin) was sprayed pre-plant at 2.5 pints per acre and incorporated. The plots were planted on May 25 at a rate of 32,000 seeds per acre with a John Deere 1750 corn planter that had been equipped with sunflower fingers and planted in 30" rows. The plots were hand-weeded on June 16 and cultivated with a Brillion four-row cultivator on June 27. Agronomic and trial information for this research trial can be found in Table 2. To protect against bird damage, the sunflower trial was covered with netting.

Table 1. Seventeen sunflower varieties evaluated in the 2011 variety trial.

Variety	Seed Company	Traits	Days to Maturity	Seed Size
306	Croplan	DMR, NS	87	3
369	Croplan	DMR, NS	97	4
378	Croplan	DMR, NS	97	2
555	Croplan	CL, DMR, NS	94	4
2930	Syngenta	NS, DMR	92	3
3080	Croplan	DMR, NS	90	3
3433	Syngenta	NS, DMR	95	3
3480	Syngenta	NS, CL, DMR	95	3
3875	Syngenta	NS	103	3
3980	Syngenta	NS, CL	97	2
4651	Syngenta	NS, DMR	97	2
7120	Syngenta	HO, DMR	95	3
D101 Plus	Seeds 2000	-	Early	3
Defender Plus	Seeds 2000	NS, DMR	Early	3
Sierra	Blue River Hybrids	-	Full	3
Teton	Seeds 2000	-	Med-Early	4
Torino	Seeds 2000	NS, CL	Med-Full	3

Trait: DMR, Downy Mildew Resistant; NS, NuSun (55-75% oleic acid); CL, Clearfield® (Beyond herbicide tolerance); HO, high oleic (>80% oleic acid)

Table 2. Cultural practices for the 2011 sunflower variety trial.

Location	Borderview Farm – Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Corn
Tillage operations	Spring disk, harrow, spike-toothed harrow
Weed control	Trifluralin, pre-plant, 2.5 pints acre ⁻¹
Plot size (ft.)	5 x 20
Replicates	3
Seeding rate	32,000 plants/acre
Row width (in.)	30
Planting date	5/25/2011
Starter fertilizer	260 lbs acre ⁻¹ 10-20-20
Weed control	Hand-weeded 6/16/2011, row cultivated 6/27/2011
Harvest date	9/26/2011
Pressing date	10/04/2011

Seventeen sunflower varieties were evaluated for stand characteristics, seed yield, insect damage, and oil content. Plant stand characteristics such as population, height, head width, disease and lodging were measured just prior to harvest. Disease incidence was measured by scouting ten consecutive plants in each plot and documenting white mold at specific locations on the plant, including head, stalk, and base. White mold (*Sclerotinia sclerotiorum*), which can overwinter in the ground and spread quickly, especially in wet seasons, has proven to be a problem in the Northeast in the past. White mold in the form of head rot is shown in Figure 1.



Figure 1. *Sclerotinia* head rot.

Plots were harvested on September 26 with an Almaco SP50 plot combine with a 5' head and specialized sunflower pans made to efficiently collect sunflower heads. At harvest, test weight and seed moisture were determined for each plot, with a Berckes Test Weight Scale and a Dickey-John M20P moisture meter. After seeds were cleaned with a Clipper fanning mill to remove debris and plant material, seed samples from each plot were evaluated for insect damage. Banded sunflower moth larvae (Figure 2) damage the seed and create distinguishable exit holes in harvested seed samples.

Oil from each seed sample was extruded on October 4 with a Kern Kraft Oil Press KK40, and the oil quantity was measured. Oil content (percent) and oil yield (in lbs per acre and gallons per acre) was calculated.

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 treatments is real or whether it might have occurred due to other variations in the field. All data was analyzed using a mixed model analysis where replicates were considered random effects. At the bottom of each table a LSD value is presented for each variable (e.g.

yield). Least Significant Differences (LSD's) at the 10% level (0.10) 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 values. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In the example at right, treatment A is significantly different from treatment C but not from treatment B. The difference between A and B is equal to 400, which is less than the LSD value of 500. This means that these treatments did not differ in yield. The difference between A and C is equal to 650, which is greater than the LSD value of 500. This means that the yields of these treatments were significantly different from one another.



Figure 2. Banded sunflower moth larvae.

Variety	Yield
A	1600*
B	1200*
C	950
LSD (0.10)	500

RESULTS

Using data from a weather station in close proximity to Borderview Farm in Alburgh, VT, weather data is summarized in Table 3. The 2011 growing season was wetter than normal, with very heavy precipitation in the spring and fall. However, the months of June and July were close to average in rainfall, and temperatures were near normal. There were an accumulated 3,886 Growing Degree Days (GDDs) at a base temperature of 44°F—543 more GDDs than the 30-year average.

Table 3. Summarized weather data for 2011 – Alburgh, VT.

South Hero, VT (Alburgh)	May	June	July	August	September	October
Average temperature (°F) ±	58.7	67.1	74.4	70.4	63.8	51.5
Departure from normal	2.1	1.3	3.3	1.6	5.8	4.5
Precipitation (inches) *	8.67	3.52	3.68	10.23	5.56	2.68
Departure from normal	5.35	0.09	-0.29	6.38	2.10	0.10
Growing Degree Days (base 44° F)	454	716	942	749	591	434
Departure from normal	63.6	62.1	103.9	-26.3	98.6	241.8

± Average temperature for August-October is taken from Burlington, VT.

* Precipitation for May-July is taken from Burlington, VT.

Based on National Weather Service data from cooperative observation stations in South Hero. Historical averages are for 30 years (1971-2000).

Characteristics of each variety were evaluated prior to harvest (Table 4). The average population in 2011 was 18304 plants per acre, indicating an establishment rate of 57%. The highest population was 24103 plants per acre in the variety 369 (Croplan), though six other varieties were not significantly lower in population. Torino (Seeds 2000) was the tallest sunflower, with an average height of 58.6 inches (Figure 3). The varieties 369 (Croplan), 3980 (Syngenta), and 4651 (Syngenta) were not significantly shorter than Torino. Head width was not significantly different among varieties.

Lodging and disease susceptibility were compared by variety. Seven varieties had no lodging (Table 4). Interestingly, the variety with the most lodging also had the lowest seed and oil yields (Table 5). While rates of head rot and base rot were not statistically different among varieties, the varieties Sierra (Blue River Hybrids) and 3480 (Syngenta) were the least susceptible to stalk rot in this year's trial, each with a mean of 3.3% (Figure 4). Interestingly there does not seem to be any relationship between lodging and height and stalk rot.

Table 4. Agronomic characteristics of seventeen sunflower varieties.

Variety	Source	Population plants acre ⁻¹	Height in	Head width in	Lodging %	White mold incidence		
						Head rot %	Stalk rot %	Base rot %
306	Croplan	17860	48.9	5.7	0.00	33.3	13.3	6.7
369	Croplan	24103*	55.0*	5.9	0.00	23.3	10.0*	0.0
378	Croplan	18440	51.4	6.3	23.3	26.7	20.0	0.0
555	Croplan	22651*	51.4	5.6	10.0	20.0	10.0*	3.3
2930	Syngenta	20909*	51.7	5.9	0.00	26.7	23.3	3.3
3080	Croplan	19166*	48.7	5.2	3.30	23.3	13.3	0.0
3433	Syngenta	19021*	49.0	5.4	13.3	36.7	10.0*	0.0
3480	Syngenta	17714	48.1	5.7	0.00	33.3	3.3*	0.0
3875	Syngenta	13504	52.1	6.1	50.0	60.0	6.7*	0.0
3980	Syngenta	16988	56.2*	5.5	3.30	53.3	16.7	0.0
4651	Syngenta	14084	56.5*	6.4	10.0	20.0	26.7	3.3
7120	Syngenta	16408	48.0	5.9	0.00	36.7	6.7*	0.0
D101 Plus	Seeds 2000	18295	48.1	6.6	0.00	43.3	13.3	3.3
Defender Plus	Seeds 2000	15246	49.7	6.5	20.0	50.0	13.3	3.3
Sierra	Blue River	13649	52.9	5.4	53.3	63.3	3.3*	0.0
Teton	Seeds 2000	19602*	49.5	5.5	6.70	30.0	20.0	10.0
Torino	Seeds 2000	23522*	58.6*	5.1	0.00	36.7	13.3	0.0
LSD (0.10)		5176	4.1	NS	21.0	NS	8.8	NS
Trial Mean		18304	51.5	5.8	11.4	36.3	13.1	2.0

Treatments indicated in bold had the top observed performance.

Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.

NS – No significant difference was determined between treatments.

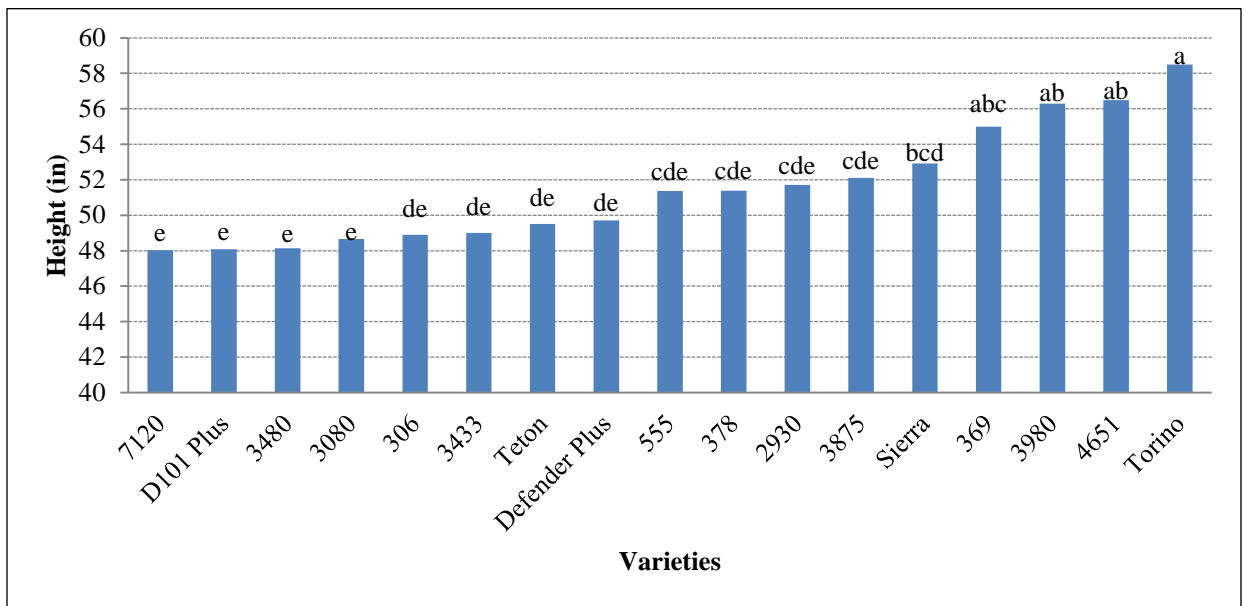


Figure 3. Height comparison of sunflower varieties, measured on the day of harvest. Varieties with the same letter did not differ statistically in yield ($p=0.10$).

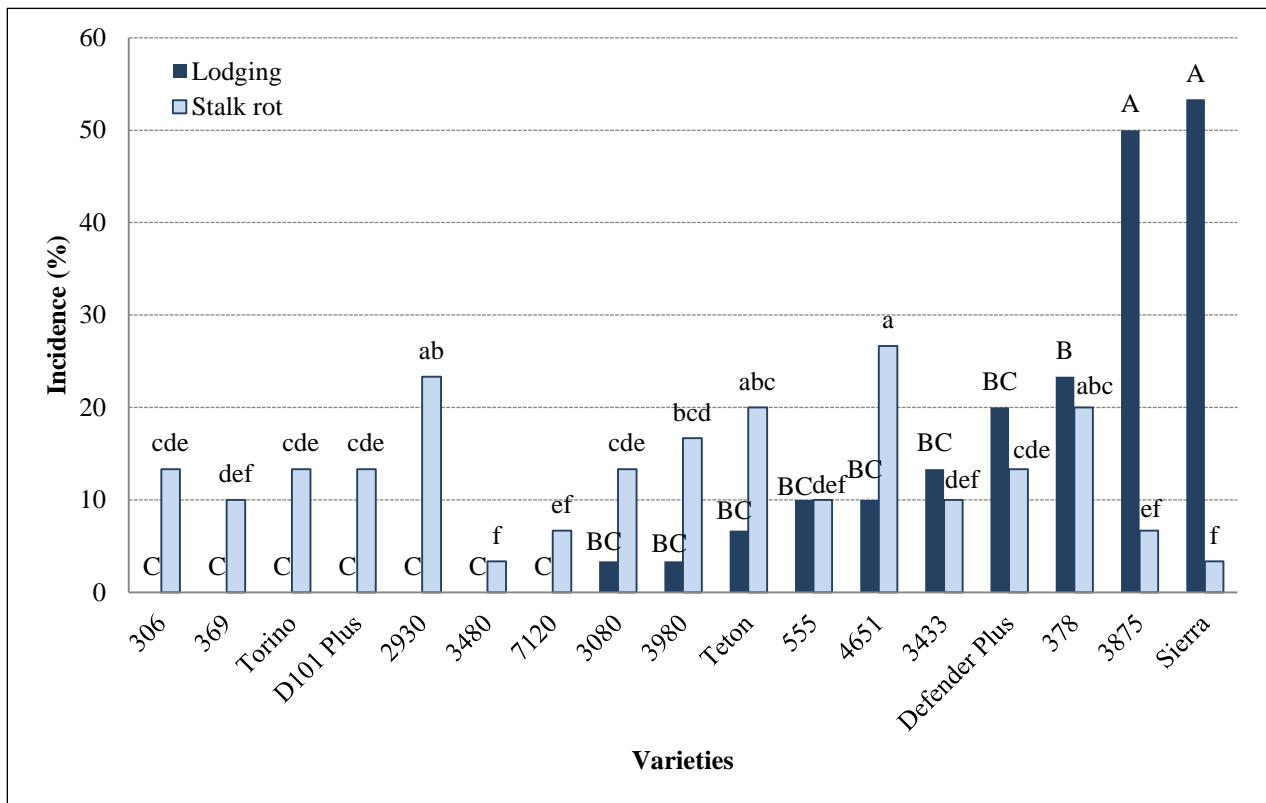


Figure 4. The effect of variety on lodging and stalk rot due to white mold. Varieties with the same letter did not differ statistically ($p=0.10$, compare capital letters for lodging and lower-case letters for stalk rot incidence).

Table 5. Harvest data for seventeen sunflower varieties.

Variety	Source	Moisture	Seed	Test	Insect	Moisture	Oil	Oil yield	
		at harvest	yield	weight	damage	at	content	lbs	gal
		%	lbs	lbs	to seed	pressing	%	acre ⁻¹	acre ⁻¹
			acre ⁻¹	bu ⁻¹	%				
306	Croplan	14.6	1169*	25.7	7.3	7.6	30.8	367*	48.2*
369	Croplan	11.8	967	25.0	9.7	7.5	26.6	272	35.6
378	Croplan	12.5	1447*	27.0*	10.0	6.9	32.0	455*	59.5*
555	Croplan	10.3	1500*	26.3*	6.3	7.8	31.3	467*	61.2*
2930	Syngenta	14.0	1110	26.3*	7.3	9.5	24.8	242	31.7
3080	Croplan	11.7	629	26.0	4.3	8.0	26.9	171	22.3
3433	Syngenta	14.5	1262*	28.0*	7.7	7.6	27.4	347*	45.4*
3480	Syngenta	16.3	821	25.3	5.3	7.9	31.6	284	37.2
3875	Syngenta	14.4	1141*	25.7	3.7	6.4	31.6	358*	46.9*
3980	Syngenta	12.3	924	23.0	6.7	5.3	29.8	274	35.9
4651	Syngenta	15.6	1326*	26.0	6.3	6.7	24.5	297	38.9
7120	Syngenta	14.8	1186*	25.3	9.3	7.7	30.6	382*	50.1*
D101 Plus	Seeds 2000	11.4	1271*	26.7*	6.3	7.7	28.4	368*	48.2*
Defender Plus	Seeds 2000	14.6	1419*	26.3*	3.3	7.1	28.0	399*	52.3*
Sierra	Blue River	14.1	308	24.7	7.7	7.6	29.2	85	11.2
Teton	Seeds 2000	15.2	1129*	25.7	7.3	7.3	31.6	370*	48.4*
Torino	Seeds 2000	13.0	1694*	27.0*	8.7	5.6	31.8	541*	70.9*
LSD (0.10)		NS	569	1.7	NS	NS	NS	200	26.2
Trial Mean		13.6	1135	25.9	6.9	7.3	29.2	334	43.8

Treatments indicated in bold had the top observed performance.

* Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.

NS – No significance was determined between treatments.

Average moisture level at harvest was 13.6%. Average test weight, which is a measure of the seed fill (or density) and amount of plant debris and other trash material in the yield, was 25.9 lbs per bushel. Seed yields were low compared to past harvests, but were significantly affected by varietal differences. The average seed yield was 1135 lbs per acre. Torino yielded the highest, with 1694 lbs per acre. Varieties that did not have a significantly lower seed yield than Torino were 555 (Croplan), 378 (Croplan), Defender Plus (Seeds 2000), 4651 (Syngenta), D101 Plus (Seeds 2000), 3433 (Syngenta), 7120 (Syngenta), 306 (Croplan), 3875 (Syngenta), and Teton (Seeds 2000). Insect damage to seeds was evaluated after cleaning each sample; no significant difference was found between varieties. While there was no significant difference in oil content by variety, there was a significant difference in oil yields (Table 5). Torino had a calculated oil yield of 70.9 gallons per acre. Varieties that did not have a significantly lower oil yield than Torino were 555, 378, Defender Plus, 7120, Teton, D101, 306, 3875, and 3433.

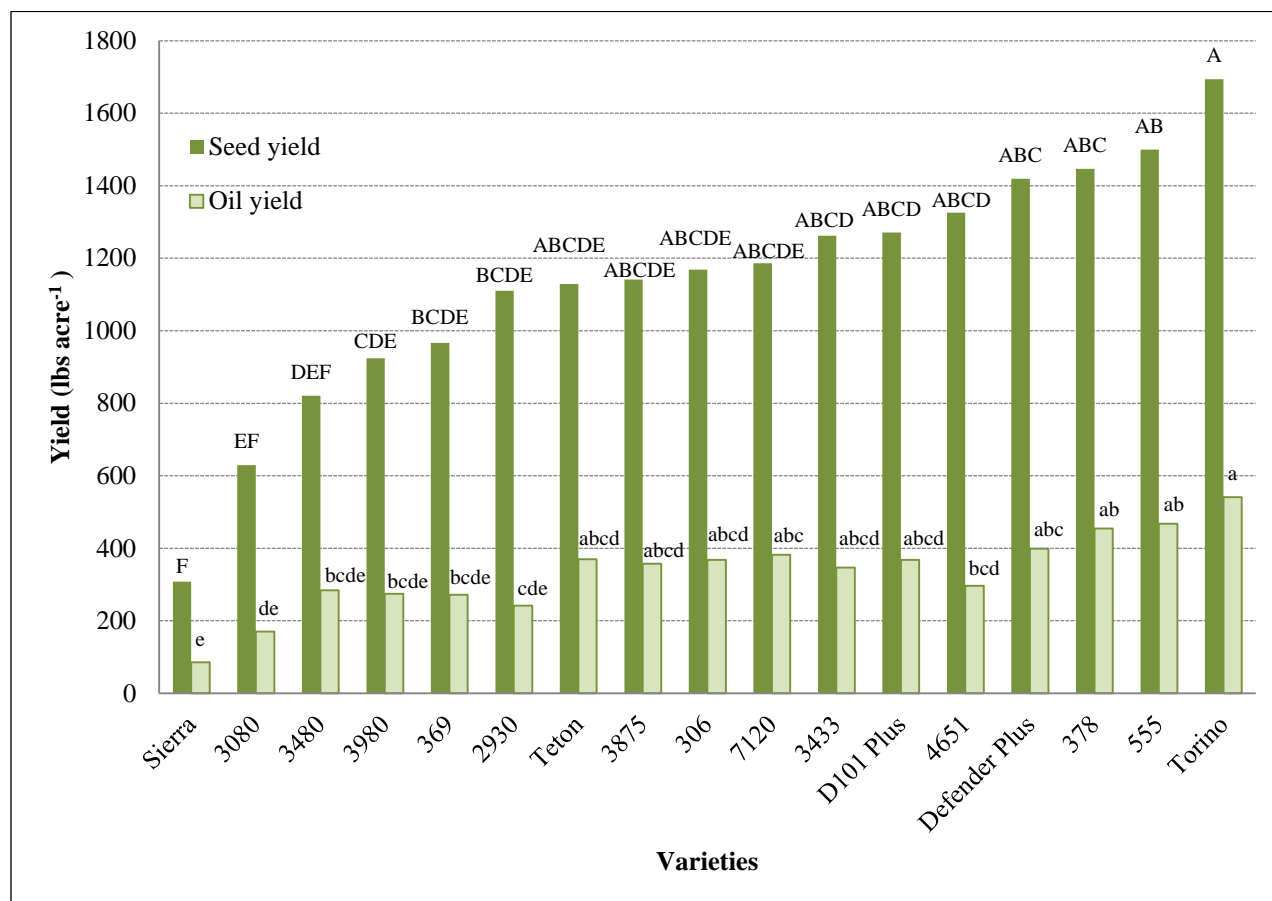


Figure 5. Seed and oil yields for seventeen sunflower varieties. Varieties with the same letter did not differ statistically ($p=0.10$, compare capital letters for seed yield and lower-case letters for oil yield).

DISCUSSION

The average sunflower establishment rate was 57%, perhaps due to early season conditions. A wet and cool spring may have contributed to poor seed germination and stand establishment. In addition, the trial was planted into wet soils and resulted in compaction. The compacted soils may have also reduced emergence of seedlings. The average population was 18,304 plants per acre, was approximately 14,000 plants lower than the seeded population of 32,000 seeds per acre. Low establishment rates can partially account for the lower yields.

The drastically increased precipitation this year may account for the high rate of both lodging and white mold in the sunflowers. White mold thrives in wet conditions and is easily transferred through plant contact. Because stalk rot and lodging rates were not necessarily linked, it is possible that lodging occurred because of wet soil conditions or the high winds that occurred in late August during Tropical Storm Irene.

Overall trial yields were approximately 500 pounds per acre below the state average. Lower yields were mostly likely due to poor stands and severe lodging in some cases. Oil content was also below average in 2011. Low oil content could be a result of insect damage or other environmental factors. It is important to note here that a higher seed yield is not necessarily correlated with a higher oil yield due to varying oil

contents. Variety selection should involve both high yielding and high oil content varieties. It is important to select varieties with high levels of resistance to diseases. Varieties should be selected based on the goals of the grower, and it should be recognized that these results are only from one location and one season. Growers should consider varietal performances from multiple seasons and locations before making decisions about which varieties will work for them.

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