2012

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NW CROPS & SOILS PROGRAM

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

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The UNIVERSITY of VERMONT EXTENSION

**2012 ORGANIC SOYBEAN VARIETY TRIAL**

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Since 2009, the University of Vermont Extension has conducted soybean variety trials to provide yield comparisons of food- and feed-grade soybeans in Vermont's climate. Varietal selection is one of the most important aspects of crop production and significantly influences yield potential. It is important to remember however, that the data presented are from replicated research trials from only one location in Vermont and represent only one season. Crop performance data from additional tests in different locations and over several years should be compared before making final varietal selections.

## MATERIALS AND METHODS

In 2012, an organic soybean variety performance trial was conducted at Borderview Research Farm in Alburgh, VT. Several seed companies submitted varieties for evaluation (Table 1). The soybean varieties were considered early maturing, with maturity groupings between 0.6 and 1.9. Both dark hilum and light or clear hilum varieties were included in the study (Figure 1). Light hilum varieties are typically grown for foodgrade uses, since the dark hilum can stain food and oil products and render yields unmarketable. Both types can be used for livestock feed, and food-grade soybeans that do not meet standards often become feed.

**Figure 1. Dark-hilum soybeans.**

**Table 1. Seed varieties and grouping followed by company.**

| Variety | Seed company | Maturity group |
|---|---|---|
| 06F8 | Blue River Hybrids | 0.6 |
| Dares | La Coop Féderee | 0.8 |
| 12A2 | Blue River Hybrids | 1.2 |
| O.1544AT | Viking | 1.4 |
| 1F44 | Blue River Hybrids | 1.4 |
| 17C2 | Blue River Hybrids | 1.7 |
| O.1706N | Viking | 1.7 |
| Boyd | Lakeview Organic | 1.8 |
| 19AR1 | Blue River Hybrids | 1.9 |
| O.1955AT | Viking | 1.9 |

The trial was planted at Borderview Research Farm in Alburgh, VT on a Benson rocky silt loam (Table 2). Treatments were ten soybean varieties which were grown organically and evaluated for yield and oil content. The experimental design was a randomized complete block with four replications. The research plots were 5' x 45'. The previous crop was corn silage and the seedbed was plowed and disked. The soybeans were planted in 30" rows on 1-Jun at a rate of 180,000 seeds per acre. Mechanical strategies were implemented to control weeds in the plots. Pre-harvest plant measurements were taken to understand the many factors affecting yield: population, height, number of pods per plant, and incidence of lodging. Plots were harvested on 25-Oct with an Almaco SPC50 plot combine. Immediately after harvest, moisture was measured with a Dickey-John M20P moisture meter; test weight was measured with a Berckes test weight scale. Samples were then dried and stored.

**Table 2. Agronomic & trial information for the 2012 soybean variety trial.**

| **Location** | Alburgh, VT<br>Borderview Research Farm |
|---|---|
| **Soil type** | Benson rocky silt loam |
| **Previous crop** | Corn silage |
| **Tillage operations** | Spring plow and disk |
| **Plot size (ft)** | 5 x 45 |
| **Seeding rate (seeds ac$^{-1}$)** | 180,000 |
| **Row Width (in)** | 30 |
| **Replicates** | 4 |
| **Planting date** | 1-Jun |
| **Weed control** | 15-Jun & 20-Jun, tineweed; 21-Jun, Brillion 4-row cultivator with S-shank; 10-Jul, hand-weeded |
| **Harvest date** | 25-Oct |
| **Pressing date** | 29-Nov |

**Figure 2. Kern Kraft KK40 press used for soybeans.**

On 29-Nov, subsamples from each plot were pressed with a Kern Kraft KK40 oil press (Figure 2). The press was fitted with "hard seed screws" and operated at a constant high temperature (175° F) and approximately 45 RPM. Oil content was calculated based on seed sample weight and final oil weight.

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. The LSD procedure was used to separate treatment means when the F-test was

significant. At the bottom of each table, a LSD value is presented for each variable (e.g. yield). Least Significant Differences (LSDs) 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.

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

## RESULTS

Using data from a Davis Instruments Vantage Pro2 weather station at Borderview Research Farm in Alburgh, VT, weather data was summarized for the 2012 growing season (Table 3). The 2012 growing season was warmer than normal, with less than average precipitation in the spring and summer, and above-average precipitation in the fall. Overall, the season accumulated 2,347 GDDs at a base temperature of 50°F. There were 222 more GDDs than the 30-year average.

**Table 3. Temperature, precipitation, and Growing Degree Days (GDD) data by month for Alburgh, VT.**

| Alburgh, VT | June | July | August | September | October |
|---|---|---|---|---|---|
| Average temperature (°F) | 67.0 | 71.4 | 71.1 | 60.8 | 52.4 |
| Departure from normal | 1.20 | 0.80 | 2.30 | 0.20 | 4.20 |
| | | | | | |
| Precipitation (inches)* | 3.2 | 3.8 | 2.9 | 5.4 | 4.1 |
| Departure from normal | -0.5 | -0.4 | -1.0 | 1.7 | 0.5 |
| | | | | | |
| Growing Degree Days (base 50°F) | 504 | 657 | 650 | 364 | 172 |
| Departure from normal | 30 | 17 | 69 | 46 | 60 |

Based on weather data from an on-site 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.

Plant populations averaged 165,690 plants per acre. The varieties differed significantly in plant populations with O.176N (Viking), O.1955AT (Viking), 12A2 (Blue River), and Boyd (Lakeview Organic Seed) having populations close to or above the desired 180,000 plants per acre (Table 4). Variety seed size differed and the planter was not calibrated for each variety and hence smaller seeds may have led to higher planted populations. Varieties 06F8 and O.1706N had the highest percentage of lodged plants (Table 4).

**Table 4. Soybean plant stand characteristics data by variety, 2012.**

| Variety | Population plants $ac^{-1}$ | Height Inches | Pods/plant # | Lodging % |
|---|---|---|---|---|
| 06F8 | 184543* | 42.3 | 27.1 | **65.0*** |
| O.1544AT | 102229 | 32.9 | 32.1 | 3.50 |
| O.1706N | **245614*** | 35.7 | 34.5 | 44.8* |
| O.1955AT | 189189* | 37.9 | 27.9 | 38.8 |
| 12A2 | 176577* | 36.3 | 39.1 | 8.80 |
| 17C2 | 119488 | 34.1 | 42.6 | 21.8 |
| 19AR1 | 217734* | 36.4 | 30.8 | 31.3 |
| 1F44 | 165956 | 42.5 | 29.1 | 7.50 |
| Boyd | 185206* | **53.9*** | 40.2 | 18.8 |
| Dares | 70365 | 42.7 | 32.4 | 5.00 |
| LSD(0.10) | 76508 | 2 | NS | 21.3 |
| Trial Mean | 165690 | 39.5 | 33.6 | 24.5 |

*Treatments that did not perform significantly lower than the top-performing treatment in a particular column are indicated with an asterisk.
NS- Treatments were not significantly different from one another.
Treatments shown in **bold** are top-performing.

Average harvest moisture was 14.3%, with no significant difference between varieties. The variety O.1706N (Viking) had the highest yield at 4092 lbs or 72.8 bushels per acre. This variety yielded statistically the same as 12A2 (Blue River Hybrids), and 19AR1 (Blue River Hybrids.) The variety Dares (La Coop Federee) had the lowest yield at 2700 lbs or 46.8 bushels per acre (Table 5). The low yield can most likely be attributed to the low plant population (Table 4; Table 5). Dares has a very large seed. The planter was not recalibrated to plant this variety and hence might have resulted in an overall lower seeding rate compared to the other soybean varieties.

There was no significant difference among varieties for test weight, which is a measure of the amount of debris and plant material in the harvest, as well as an indicator of quality. The average test weight for the trial was 56.6 lbs per bushel. Overall the trial test weight was a lower than the 60 lb per bushel industry standard for soybeans. Low test weight may have been a result of drought conditions during the grain filling stages. The variety O.1955AT and 19AR1 had the highest test weight, which was not statistically different from other varieties.

At the time of pressing, the average moisture content of the stored soybeans was 10.9%. Pressing moisture of the beans did not differ significantly by variety (Table 5). The oil content was statistically significant by variety, along with the total oil yield, the highest oil yield was in the variety 12A2 (44.4 gal per acre). Two other varieties were statistically similar to this highest yield, including 0.1706N, and 19AR1 (Table 5; Figure 1).

**Table 5. Soybean harvest and oil content data by variety, 2012.**

| Variety | Harvest moisture | Yield @ 13% moisture | | | Test weight | Pressing moisture | Oil content | Oil yield | |
|---|---|---|---|---|---|---|---|---|---|
| | % | lbs ac$^{-1}$ | bu ac$^{-1}$ | ton ac$^{-1}$ | lbs bu$^{-1}$ | % | % | lbs ac$^{-1}$ | gal ac$^{-1}$ |
| 06F8 | 14.3 | 2957 | 52.9 | 1.48 | 56.0 | 10.9 | 8.20* | 249 | 32.5 |
| 0.1544AT | 14.4 | 3153 | 55.7 | 1.58 | 56.6 | **11.0** | 6.65 | 215 | 28.2 |
| 0.1706N | 14.1 | **4092*** | **72.8*** | **2.05*** | 56.3 | 10.9 | 7.21 | 302* | 39.6* |
| 0.1955AT | 14.2 | 3162 | 55.6 | 1.58 | 56.9 | 10.9 | 7.96* | 258 | 33.8 |
| 12A2 | 14.2 | 4058* | 71.7* | 2.03* | 56.6 | **11.0** | 8.16* | **339*** | **44.4*** |
| 17C2 | 14.1 | 3378 | 60.2* | 1.69 | 56.3 | **11.0** | 7.89* | 272 | 35.6 |
| 19AR1 | 14.2 | 3506* | 61.6* | 1.75* | 56.9 | 10.8 | **8.35*** | 300* | 39.2* |
| 1F44 | 14.6 | 2793 | 49.8 | 1.40 | 56.4 | 10.8 | 7.24 | 210 | 27.6 |
| Boyd | **15.0** | 3152 | 56.1 | 1.58 | 56.3 | 10.7 | 7.84* | 255 | 33.3 |
| Dares | 14.6 | 2700 | 46.8 | 1.35 | **57.8** | 10.7 | 6.46 | 179 | 23.4 |
| LSD (0.10) | NS | 706 | 12.8 | 0.35 | NS | NS | 0.55 | 58 | 7.7 |
| Trial mean | 14.3 | 3295 | 58.3 | 1.65 | 56.6 | 10.9 | 7.59 | 257 | 33.8 |

*Treatments that did not perform significantly lower than the top-performing treatment in a particular column are indicated with an asterisk.
NS- Treatments were not significantly different from one another.
Treatments shown in **bold** are top-performing.

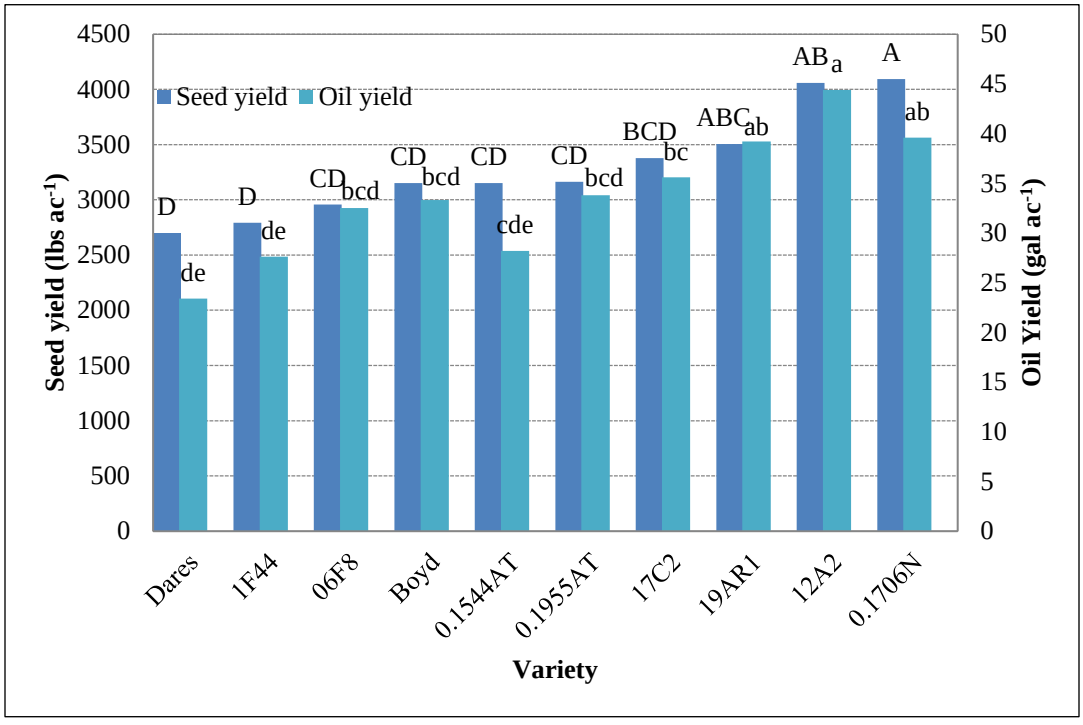


**Figure 1. Seed and oil yield by variety. The trialed soybean varieties with the same letter did not differ statistically in yield (p=0.10). Compare capital letters for seed yield and lower-case letters for oil yield.**

## DISCUSSION

The average 2012 soybean yield was 3,295 lbs or 58.3 bushels per acre. Yields in previous years have been lower than this year's due to pest damage, including weed pressure and defoliation by turkeys and deer; this was not a problem in 2012. These high yields were partly due to our aggressive weed control methods, including tineweeding twice, cultivating once, and also hand-weeding the soybeans.

Oil content was significantly different by variety. The average oil content for this variety trial was 7.59%. The highest oil content was in 19AR1 (8.35%). The oil yield did differ statistically by variety. The highest oil yield was in 12A2 (339 lbs or 44.4 gallons per acre). The trial average for oil yield was 33.8 gallons per acre. It is important to note here that a higher soybean yield is not necessarily correlated with a higher oil yield due to varying oil contents. For example, the variety 0.1706N had the highest soybean yield but was outperformed in oil yield by one other variety because of its low oil content (7.21%).

Variety selection should involve both high seed-yielding varieties and those with high oil content, if growing soybeans for oil. Varieties must 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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