



2013 Danish Barley Variety Trial



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With the revival of the small grains industry in the Northeast and the strength of the localvore movement, craft breweries and distilleries have expressed an interest in local barley for malting. Malting barley must meet specific quality characteristics such as low protein content and high germination. Many farmers are also interested in barley as a feed source for livestock. Barley is a high energy and protein source, similar to corn and wheat. The Northwest Crops and Soils Team have been growing out spring barley varieties that were originally obtained from a colleague in Denmark. Over the last three years, the goal has been to increase the small seed lots to better quantify performance. In 2013, we finally had enough seed to measure yield and quality of these specialty varieties.

MATERIALS AND METHODS

Twelve Danish barley 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 for the varieties for which we had sufficient seed. Plot size was 5' x 20'. The previous crop was corn silage. The field was disked and spike tooth harrowed prior to planting. Plots were seeded with a Kincaid Cone Seeder at a seeding rate of 125 lbs acre⁻¹.

Populations were measured on 22-May, by taking two 1/3 meter counts per plot. On 13-Jul plant heights were measured, and the severity of lodging was recorded as a percent of the plot lodged. Plots were harvested with an Almaco SPC50 small plot combine on 22-Jul 2013. The harvest area was 5' x 20'. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN) and a subsample was collected to determine quality characteristics. Samples were ground using the Perten LM3100 Laboratory Mill. Flour was analyzed for protein content using the Perten Inframatic 8600 Flour Analyzer. Most commercial mills target 12-15% protein content. Falling number was measured (AACC Method 56-81B, AACC Intl., 2000) on the Perten FN 1500 Falling Number Machine. The falling number is related to the level of sprout damage in the grain. It is determined by the time it takes, in seconds, for a stirrer to fall through a slurry of flour and water to the bottom of a test-tube. Falling numbers greater than 350 indicate low enzymatic activity and sound quality wheat. A falling number lower than 200 indicates high enzymatic activity and poor quality grain. Deoxynivalenol (DON), a vomotoxin, was analyzed using Veratox DON 5/5 Quantitative test from the NEOGEN Corp. This test has a detection range of 0.5 to 5 ppm. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption. The varieties of Danish barley grown are older landraces that were selected in Denmark as the varieties giving the best tasting beer. Varieties are listed in Table 2. Results were analyzed with a Tukey-Kramer method of comparison in SAS (Cary, NC).

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 | 22-Jul |
| Seeding rate | 125 lbs acre ⁻¹ |
| Tillage methods | Mold board plow, disk, and spike tooth harrow |

Table 2. Danish barley varieties.

| Danish barley variety | Type |
|-----------------------|-------|
| Abed Archer | 2-row |
| Auriga | 2-row |
| Brage | 6-row |
| Deva | 2-row |
| Fero | 6-row |
| Imperial | 6-row |
| Maja | 2-row |
| Malthesia | 2-row |
| Naked | 6-row |
| Power | 2-row |
| Rostov | 6-row |
| Sekskantet | 6-row |

RESULTS AND DISCUSSION

Seasonal precipitation and temperature recorded at a weather station in Alburgh, VT are shown in Table 3. From April to July, there was an accumulation of 3399 Growing Degree Days (GDDs) in Alburgh which is 45.6 GDDs more than the 30-year average. May and June precipitation topped seven inches above normal.

Table 3. Seasonal weather data¹ collected in Alburgh, VT, 2013.

| Alburgh, VT | April | May | June | July |
|---------------------------------|-------|------|-------|-------|
| Average temperature (°F) | 43.6 | 59.1 | 64.0 | 71.7 |
| Departure from normal | -1.2 | 2.7 | -1.8 | 1.1 |
| Precipitation (inches) | 2.12 | 4.79 | 9.23† | 1.89 |
| Departure from normal | -0.7 | 1.34 | 5.54 | -2.26 |
| Growing Degree Days (base 32°F) | 349 | 848 | 967 | 1235 |
| Departure from normal | -35.6 | 91.4 | -47.0 | 36.8 |

¹Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.

† 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)

Historical averages are for 30 years of NOAA data (1981-2010) from Burlington, VT.

The variety Imperial yielded the highest, averaging 2935 lbs acre⁻¹ (Table 4). In all, ten of the varieties had statistically similar yields. Deva and Abed Archer were the lowest yielding varieties (Figure 1). Naked, Maja, and Fero had the highest test weights. The industry standard for barley test weight is 48 lbs bushel⁻¹. Crude protein levels ranged from 10.4 to 13.7% (Figure 1).

Levels of the vomotoxin, Deoxynivalenol (DON) ranged from 1.7 to 11.1 ppm (Table 4 and Figure 2). Although none of these varieties would be suitable for human consumption (since their DON levels are over 1 ppm), it is informative to see the wide range of susceptibility to *Fusarium Head Blight* (*Fusarium graminearum*). Varieties that had relatively low DON levels in the very wet, rainy 2013 season show some resistance to *Fusarium Head Blight*.

Overall, lodging of the Danish barley varieties ranged from 15 to 90% of the plot lodged (Table 4 and Figure 2). Again, the very rainy season contributed to lodging, and it is informative to note the varieties that stood up well given the difficult weather conditions.

Table 4. Harvest yields and quality characteristics of Danish Barley grown in Alburgh, VT, 2013.

| Variety | DM Yield % | TW lbs bu ⁻¹ | Moist % | CP % | FN sec | DON ppm | Population plant m ⁻² | Height cm | Lodging % |
|-------------|---------------|----------------------------|------------|--------------|-----------|-------------|-------------------------------------|--------------|--------------|
| Imperial | 2935* | 30.7 | 16.1 | 12.4* | 326 | 5.4* | 200 | 85.6* | 31.9* |
| Fero | 2430* | 42.0* | 14.8 | 12.1* | 347 | 5.3* | 229 | 97.7* | 23.8* |
| Auriga | 2082* | 41.3 | 16.4 | 10.4 | 378 | 2.1* | 233 | 72.8 | 15.0* |
| Brage | 2067* | 39.8 | 14.0 | 12.7* | 330 | 6.9 | 209 | 93.8* | 60.0 |
| Sekskantet | 2036* | 40.0 | 9.8 | 12.3* | 290 | 7.3 | 212 | 98.0* | 37.5* |
| Power | 1817* | 39.0 | 14.1 | 12.8* | 296 | 6.1 | 249 | 96.0* | 30.6* |
| Maja | 1678* | 42.1* | 13.9 | 13.6* | 361 | 2.8* | 217 | 87.4* | 64.3 |
| Rostov | 1677* | 36.5 | 15.8 | 13.0* | 312 | 11.1 | 251 | 94.0* | 50.0 |
| Malthesia | 1617* | 39.3 | 17.1 | 11.0* | 344 | 4.1* | 234 | 70.5 | 24.8* |
| Naked | 1334* | 51.5* | 15.2 | 11.3* | 238 | 3.4* | 217 | 94.4* | 89.6 |
| Deva | 1199 | 39.0 | 16.0 | 13.5* | 323 | 2.8* | 170 | 79.0 | 40.0* |
| Abed Archer | 1141 | 39.0 | 17.0 | 13.7* | 373 | 1.7* | 241 | 87.3* | 45.4* |
| Trial Mean | 1748 | 39.9 | 14.8 | 12.4 | 330 | 4.7 | 219 | 87.5 | 41.0 |
| p-value | <0.10 | <0.10 | NS | <0.10 | NS | <0.10 | NS | <0.10 | <0.10 |

*Varieties with an asterisk are not significantly different than the top performer in **bold**.

NS – No significant difference amongst varieties.

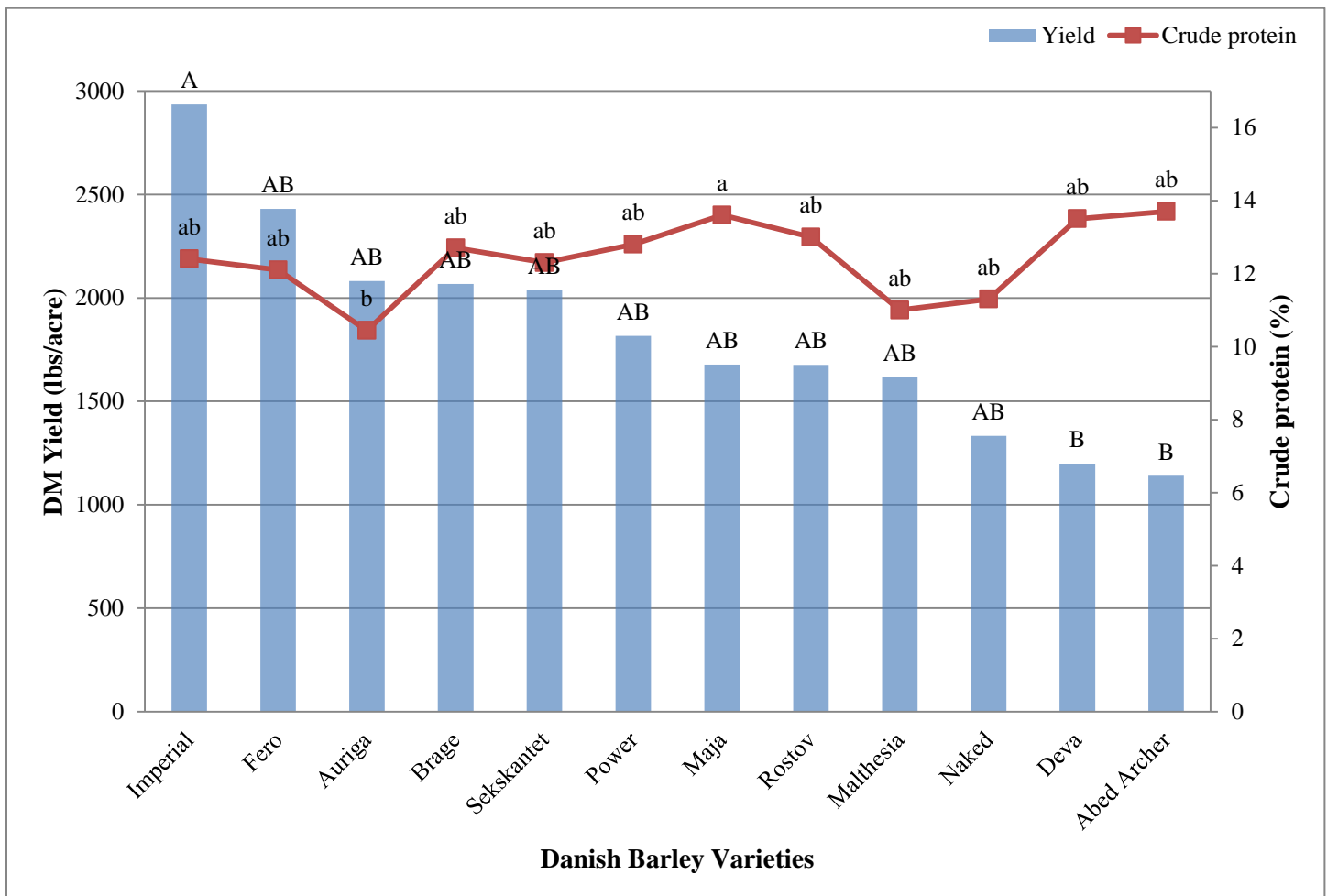


Figure 1. Average yields and crude protein of Danish barley varieties grown in Alburgh, VT, 2013.

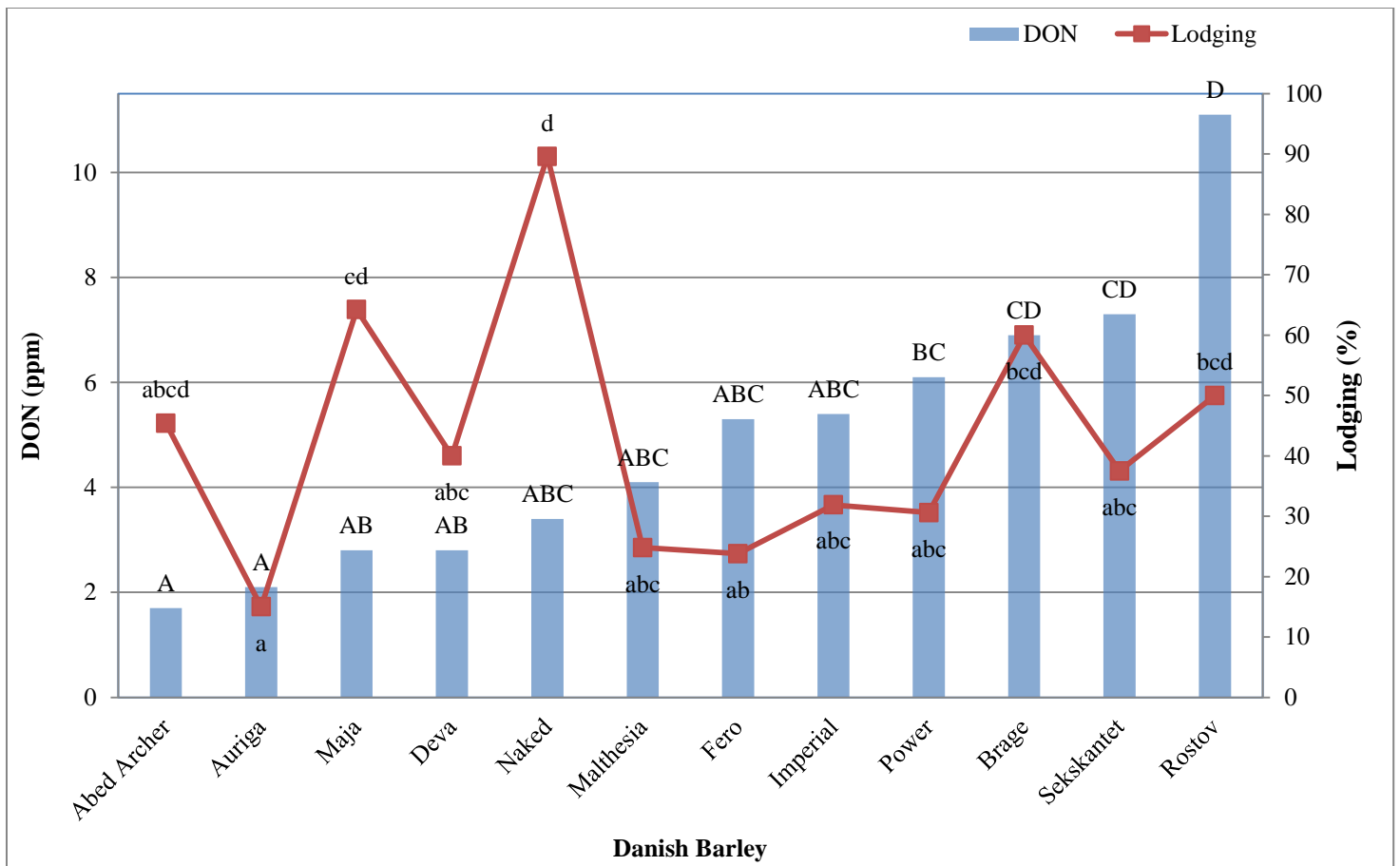


Figure 2. Average DON levels and lodging (%) of Danish barley varieties grown in Alburgh, VT, 2013.

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