Identification of High Bush Blueberry Cultivars Suitable for Juice Production in Nova Scotia

Project Number: NS0357

Final Report 2013

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Prospect Agri-Services

In cooperation with John Lewis, Horticulturalist, Perrennia

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ABSTRACT

Nine cultivars of highbush blueberry were planted by the cooperating grower in 2011 to enable researchers to run a two year trial over the 2012 and 2013 growing seasons. Cover crops were established in 2012 for evaluation in 2013. In each season, a small crop of blueberries were harvested with yield and quality data collected. “Bluecrop” and “Draper” produced the highest plot yield in both seasons. All cultivars in the plot have not yet become established thus yield to date are low. Berries were pressed for juice in both seasons. Results were variable in 2012 which was thought to be related to the stressful, dry growing conditions. Results were improved in 2013 with increased juice yield of 10% on average across cultivars. The plants in the plot are not well established after only 2 growing seasons, however the cultivar “Bluecrop” performed the best overall in terms of fruit yield, juice yield, acceptable plant shape, high plant stand and low percentage of frost heaved plants.

OBJECTIVE

To evaluate cultivars of highbush blueberries, particularly those which have not been grown in Nova Scotia in the past; to determine cultivars that would meet the quality requirements of the juice market and produce a suitable plant and berry for mechanically harvesting.

MATERIALS AND METHODS

Two-year-old plants were transplanted by Dykeview Farms in the fall of 2011 as an in-kind contribution to this trial to enable harvesting within the narrow window of this two year trial. Cover crops were established within the cultivar trial in 2012 by the grower for evaluation in 2013. A very small amount of fruit was harvested in 2012. Cover crop evaluation and harvest, observational plant growth and habit data and harvest data was collected in 2013.

RESULTS AND DISCUSSION

2012
The plants in this trial were established within a commercial blueberry planting at Dykeview Farms. The plants in the plot were allowed to fruit in the summer after planting which is not the standard practice on this farm in order to have some yield from both seasons of this trial. However, not all plants were established well enough to produce much, if any fruit. Some plots were harvested between August 8 and 29, 2012 with yield and quality data collected. “Bluecrop” produced the highest yield. “Draper” and “Bluejay” produced moderate yields. Quality was average or better. Fruit samples from the plots were pressed for juice to determine recovery and attributes suitable for juice quality. As such small samples were available to press, this data may
not be representative of the cultivar at maturity. 2012 was a warm summer with drier conditions than most recent years and although irrigation was provided, plant stress was evident.

2013
The cover crops filled in well in 2013. Samples were harvested to determine plant growth and tonnage as a representation of maintenance requirements such as mowing and whippersnipping. Three samples were collected from various replicates of the cover crop and averaged for kilogram of wet weight per metre square. Sub-samples were dried to determine dry matter content of the cover crops. The clover mixes produced the largest volume of plant material and would require increased maintenance. The grass mixes had a higher dry matter content as expected and were for the most part lower growing and required less maintenance. It remains to be seen if the use of nitrogen fixing plants as cover crops will have any effect on the blueberry plants over time.

Blueberry plant stand, plants heaved by frost, presence of new shoot growth and plant height were measured prior to harvest. An observational rating for fruit load per plant and the suitability of the plant for mechanically harvesting was also collected at this time. Plant stand was high for most cultivars with the exception of “Superior” which was the lowest at 79.5% resulting from poor plant establishment and stressful growing conditions in 2012. This cultivar suffered the most frost heaving and is one of the shortest groups of plants in the trial. It did however, have a suitable plant shape for mechanical harvest. Fruit harvest began July 30 for earlier cultivars and continued to September 26 for the latest cultivars. As in 2012, fruit samples from the plots were pressed for juice to determine recovery and attributes suitable for juice quality. Results were improved over 2012 with more juice recovered from the berries and the Brix/TA ratio becoming closer to expected results for some cultivars.

CONCLUSIONS
Nine cultivars of highbush blueberries planted in 2011 by the cooperating grower were evaluated in the 2012 and 2013 seasons. Six cover crop mixes were established in 2012 and evaluated in 2013. Harvest data was collected on most cultivars in 2012 and all nine cultivars in 2013 with yield and quality evaluated. “Bluecrop”, “Draper” and “Arlen” produced the most yield in 2013. “Bluecrop” and “Draper” were also the top producing cultivars in 2012. Samples of berries from the trial were pressed for juice in 2012 and 2013. Results from 2012 were extremely variable and thought to be effected by plant stress caused by drought conditions. The results from 2013 were improved, although most cultivars have not yet achieved the expected results. The yield of juice from the fruit improved by 10% on average from 2012 to 2013. Plant growth was evaluated for the first time in 2013 for suitability for mechanical harvest. At this time, “Chanticlear” and “Superior” appeared to be the most suited to mechanical harvest with vase shaped plants. A number of other cultivars appeared to have acceptable plant growth to this point and performed better in terms of yield and quality. The natural plant habit of “Draper”, “Elizabeth” and “Arlen” did not seem suitable with significant plant width at the base of the plant. This may be improved with pruning and training. “Bluecrop” had the most consistent performance with the highest yield of fresh fruit and juice yield, an acceptable plant habit, a high plant stand and a low percentage of frost heaved plants. As plants become more mature and pruning techniques improve the shape of them, the results may vary somewhat. Blueberries are long lasting perennial plants thus evaluation over
multiple years is essential. It is important that this trial will continue in 2014 and 2015 with funding from the Nova Scotia Department of Agriculture, Innovation Capacity of Farmers.

ACKNOWLEDGEMENTS: Thanks are extended to the following trial cooperators: Bobby Kidston, Dykeview Farms, John Lewis, Perennia and Prospect Agri-Services staff. Thanks to Jack Van Roestel, Perennia for consultation for cover crop data collection and Kristen Hildebrand Cue, Nova Agri for conducting juice analysis.
## Table 1. Blueberry cultivar trial - yield and plant characteristics, 2013

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield kg/ha</th>
<th>Yield lb/acre</th>
<th>Weight of largest berry (g)</th>
<th>Diameter of largest berry (mm)</th>
<th>Weight of smallest berry (g)</th>
<th>Diameter of smallest berry (mm)</th>
<th>Brix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluecrop</td>
<td>941</td>
<td>837</td>
<td>2.9</td>
<td>19.0</td>
<td>1.3</td>
<td>12.9</td>
<td>14.4</td>
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<tr>
<td>Draper</td>
<td>916</td>
<td>815</td>
<td>3.5</td>
<td>20.4</td>
<td>1.5</td>
<td>14.0</td>
<td>13.9</td>
</tr>
<tr>
<td>Arlen</td>
<td>745</td>
<td>663</td>
<td>2.8</td>
<td>18.3</td>
<td>1.3</td>
<td>13.2</td>
<td>13.2</td>
</tr>
<tr>
<td>Elizabeth</td>
<td>636</td>
<td>566</td>
<td>3.0</td>
<td>18.4</td>
<td>2.2</td>
<td>11.5</td>
<td>13.2</td>
</tr>
<tr>
<td>Jersey</td>
<td>340</td>
<td>303</td>
<td>1.8</td>
<td>15.0</td>
<td>1.3</td>
<td>11.5</td>
<td>14.0</td>
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<tr>
<td>Superior</td>
<td>153</td>
<td>136</td>
<td>2.0</td>
<td>16.3</td>
<td>1.0</td>
<td>11.1</td>
<td>11.5</td>
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<tr>
<td>Chanticlear</td>
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<td>102</td>
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<td>1.0</td>
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<td>12.0</td>
</tr>
<tr>
<td>Ozark Blue</td>
<td>66</td>
<td>58</td>
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<td>18.0</td>
<td>2.2</td>
<td>14.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Bluejay</td>
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<td>7</td>
<td>2.0</td>
<td>16.0</td>
<td>1.0</td>
<td>13.0</td>
<td>14.0</td>
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<tr>
<td><strong>Grand Mean</strong></td>
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<td><strong>387</strong></td>
<td><strong>2.73</strong></td>
<td><strong>17.68</strong></td>
<td><strong>1.42</strong></td>
<td><strong>12.52</strong></td>
<td><strong>13.35</strong></td>
</tr>
</tbody>
</table>

## Table 2. Blueberry cultivar trial - Results from Juice Press, 2013

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>pH</th>
<th>Brix</th>
<th>TA</th>
<th>Brix/TA ratio +</th>
<th>% Yield (corrected for loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluecrop</td>
<td>2.9</td>
<td>13.7</td>
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<tr>
<td>Draper</td>
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<td>1.38</td>
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<td>81.0</td>
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<td>Arlen</td>
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<td>13.7</td>
<td>1.6</td>
<td>8.6</td>
<td>80.4</td>
</tr>
<tr>
<td>Elizabeth</td>
<td>2.8</td>
<td>14.1</td>
<td>2.0</td>
<td>7.1</td>
<td>78.6</td>
</tr>
<tr>
<td>Jersey</td>
<td>3.2</td>
<td>14.3</td>
<td>0.8</td>
<td>17.9</td>
<td>75.8</td>
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<tr>
<td>Superior</td>
<td>2.9</td>
<td>12.9</td>
<td>1.51</td>
<td>8.5</td>
<td>N/A</td>
</tr>
<tr>
<td>Chanticlear</td>
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<td>13.0</td>
<td>0.5</td>
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<td>78.2</td>
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<td>Ozark Blue</td>
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<td>9.5</td>
<td>N/A</td>
</tr>
<tr>
<td>Bluejay</td>
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<td>15.2</td>
<td>1.21</td>
<td>12.6</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Grand Mean</strong></td>
<td><strong>2.96</strong></td>
<td><strong>13.82</strong></td>
<td><strong>1.29</strong></td>
<td><strong>12.36</strong></td>
<td><strong>79.00</strong></td>
</tr>
</tbody>
</table>

N/A: Not enough berries for analysis

5
Table 3. Blueberry cultivar trial - quality, 2013

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fruit appearance</th>
<th>Calyx quality</th>
<th>Firmness</th>
<th>Bruising</th>
<th>Durability of bloom</th>
<th>Colour</th>
<th>Flavour</th>
<th>Texture</th>
<th>Size of stem scar</th>
<th>Overall quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluecrop</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
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<td>4</td>
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</tr>
<tr>
<td>Draper</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Arlen</td>
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<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
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<td>Elizabeth</td>
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<td>4</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Superior</td>
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<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Chanticlear</td>
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<tr>
<td>Bluejay</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<tr>
<td><strong>Grand Mean</strong></td>
<td><strong>3.4</strong></td>
<td><strong>3.1</strong></td>
<td><strong>3.4</strong></td>
<td><strong>4.1</strong></td>
<td><strong>3.5</strong></td>
<td><strong>4.0</strong></td>
<td><strong>3.4</strong></td>
<td><strong>3.2</strong></td>
<td><strong>2.8</strong></td>
<td><strong>3.5</strong></td>
</tr>
</tbody>
</table>

*Ratings of 1 - 5 with 5 “most desirable and 3 “average

Table 4. Blueberry cultivar trial - Cover crop harvest samples, 2013

<table>
<thead>
<tr>
<th>Cover crop</th>
<th>Mix</th>
<th>Yield kg/m² (at harvest)</th>
<th>% Dry Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Scotian Gold Common Clover Mix</td>
<td>5.7</td>
<td>27.8</td>
</tr>
<tr>
<td>C2</td>
<td>Huia Clover Mix</td>
<td>5.6</td>
<td>18.7</td>
</tr>
<tr>
<td>C3</td>
<td>Scotian Gold 50% Clover Mix</td>
<td>5.6</td>
<td>23.2</td>
</tr>
<tr>
<td>G1</td>
<td>Quality Seed Mix</td>
<td>1.0</td>
<td>41.7</td>
</tr>
<tr>
<td>G2</td>
<td>Scotian Gold Grass Mix</td>
<td>1.4</td>
<td>31.8</td>
</tr>
<tr>
<td>G3</td>
<td>Canada Green Mix</td>
<td>1.7</td>
<td>31.6</td>
</tr>
<tr>
<td><strong>Grand Mean</strong></td>
<td><strong>3.50</strong></td>
<td><strong>29.13</strong></td>
<td></td>
</tr>
</tbody>
</table>

Scotian Gold is a local forage seed supplier.
<table>
<thead>
<tr>
<th>Code</th>
<th>Cover Crop Mix</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Scotian Gold Common Clover Mix</td>
<td>20 % Common White Clover 8 % Royal Kentucky Blue 20 % Fiesta 4 Perennial Rye 16 % Windward Clewing Fescue 16 % Crossbow Creeping Red 20 % Transist Intermediate Rye</td>
</tr>
<tr>
<td>C2</td>
<td>Huia Clover Mix</td>
<td>20 % Huia White Clover 8 % Royal Kentucky Blue 20 % Fiesta 4 Perennial Rye 16 % Windward Clewings Fescue 16 % Crossbow Creeping Red 20 % Transist Intermediate Rye</td>
</tr>
<tr>
<td>C3</td>
<td>Scotian Gold 50% Clover Mix</td>
<td>50 % Common White Clover 5 % Royal Kentucky Blue 10 % Windward Clewing Fescue 10 % Crossbow Creeping Red 25 % Transist Intermediate Rye</td>
</tr>
<tr>
<td>G1</td>
<td>Quality Seed Mix</td>
<td>20 % Primary Perennial Ryegrass 20 % Rhino Hard Fescue 20 % Jamestown IV Clewing Fescue 10 % Sitka Tall Fescue 30 % Corsair Kentucky Bluegrass</td>
</tr>
<tr>
<td>G2</td>
<td>Scotian Gold Grass Mix</td>
<td>10 % Royal Kentucky Blue 25 % Fiesta 4 Perennial Rye 20 % Windward Clewings Fescue 20 % Crossbow Creeping Red 25 % Transist Intermediate Rye</td>
</tr>
<tr>
<td>G3</td>
<td>Canada Green Mix</td>
<td>40 % Creeping Red Fescue 20 % Kentucky Bluegrass 20 % Perennial Ryegrass</td>
</tr>
</tbody>
</table>
Table 6. Blueberry cultivar trial - Field measurements and observational data, 2013

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>% Stand</th>
<th>% Plants Frost Heaved</th>
<th>Plant Height (cm)</th>
<th># New shoots/plant</th>
<th>Fruit Load(^z)</th>
<th>Plant shape(^z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jersey</td>
<td>100</td>
<td>12.5</td>
<td>77.0</td>
<td>0</td>
<td>1.3</td>
<td>3</td>
</tr>
<tr>
<td>Bluecrop</td>
<td>95.8</td>
<td>4.3</td>
<td>95.0</td>
<td>0.3</td>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>Bluejay</td>
<td>95.8</td>
<td>30.4</td>
<td>72.8</td>
<td>1.4</td>
<td>0.1</td>
<td>3</td>
</tr>
<tr>
<td>Ozark Blue</td>
<td>83.0</td>
<td>35.0</td>
<td>76.8</td>
<td>0.3</td>
<td>0.5</td>
<td>3</td>
</tr>
<tr>
<td>Draper</td>
<td>100</td>
<td>12.5</td>
<td>89.8</td>
<td>0.4</td>
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<td>1</td>
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<tr>
<td>Chanticlear</td>
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<td>13.6</td>
<td>73.6</td>
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<td>0.6</td>
<td>4</td>
</tr>
<tr>
<td>Elizabeth</td>
<td>100</td>
<td>4.2</td>
<td>87.6</td>
<td>0.7</td>
<td>1.4</td>
<td>2</td>
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<tr>
<td>Superior</td>
<td>79.5</td>
<td>31.6</td>
<td>54.6</td>
<td>0.5</td>
<td>1.2</td>
<td>4</td>
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<tr>
<td>Arlen</td>
<td>100</td>
<td>29.2</td>
<td>94.9</td>
<td>0.6</td>
<td>1.3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Grand Mean**   **94.0**  **19.25**  **80.23**  **0.52**  **0.92**  **2.8**

\(^z\)Ratings of 1 - 5 with 5 “most desirable and 3 “average
Table 7. Blueberry cultivar trial - yield and plant characteristics, 2012

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield kg/ha</th>
<th>Yield lb/acre</th>
<th>Weight of largest berry (g)</th>
<th>Diameter of largest berry (mm)</th>
<th>Weight of smallest berry (g)</th>
<th>Diameter of smallest berry (mm)</th>
<th>Brix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluecrop</td>
<td>58</td>
<td>51</td>
<td>2</td>
<td>15</td>
<td>1</td>
<td>12</td>
<td>13.1</td>
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<tr>
<td>Draper</td>
<td>37</td>
<td>33</td>
<td>2</td>
<td>17</td>
<td>1</td>
<td>14</td>
<td>13.8</td>
</tr>
<tr>
<td>Bluejay</td>
<td>26</td>
<td>24</td>
<td>1</td>
<td>14</td>
<td>1</td>
<td>10</td>
<td>13.0</td>
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<tr>
<td>Superior</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>11</td>
<td>1</td>
<td>9</td>
<td>13.5</td>
</tr>
<tr>
<td>Ozark Blue</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>14</td>
<td>N/A</td>
<td>N/A</td>
<td>13.3</td>
</tr>
<tr>
<td>Arlen</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>13</td>
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<td>12.0</td>
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<td>Chanticlear</td>
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<td>2</td>
<td>1</td>
<td>12</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td><strong>Grand Mean</strong></td>
<td><strong>19.6</strong></td>
<td><strong>17.4</strong></td>
<td><strong>1.4</strong></td>
<td><strong>13.7</strong></td>
<td><strong>1.0</strong></td>
<td><strong>11.6</strong></td>
<td><strong>13.52</strong></td>
</tr>
</tbody>
</table>

N/A * Not enough berries for analysis

Table 8. Blueberry cultivar trial - Results from Juice Press, 2012

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>pH</th>
<th>Brix</th>
<th>TA</th>
<th>Brix/TA ratio</th>
<th>% Yield (corrected for loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluecrop</td>
<td>3</td>
<td>15</td>
<td>1</td>
<td>11</td>
<td>66</td>
</tr>
<tr>
<td>Draper</td>
<td>3</td>
<td>16</td>
<td>1</td>
<td>14</td>
<td>76</td>
</tr>
<tr>
<td>Bluejay</td>
<td>3</td>
<td>16</td>
<td>1</td>
<td>20</td>
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</tr>
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<td>N/A</td>
<td>N/A</td>
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<td>N/A</td>
</tr>
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<td>12</td>
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<td>7</td>
<td>71</td>
</tr>
<tr>
<td>Arlen</td>
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<td>14</td>
<td>2</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>Chanticlear</td>
<td>3</td>
<td>13</td>
<td>1</td>
<td>9</td>
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<td><strong>3.0</strong></td>
<td><strong>14.3</strong></td>
<td><strong>1.3</strong></td>
<td><strong>11.3</strong></td>
<td><strong>69.2</strong></td>
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</tbody>
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N/A * Not enough berries for analysis

+Expected Brix/TA ratio was 17-25
Table 9. Blueberry cultivar trial - quality, 2012

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fruit appearance</th>
<th>Calyx quality</th>
<th>Firmness</th>
<th>Bruising</th>
<th>Durability of bloom</th>
<th>Colour</th>
<th>Flavour</th>
<th>Texture</th>
<th>Size of stem scar</th>
<th>Overall quality</th>
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</tbody>
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*Ratings of 1 - 5 with 5 “most desirable and 3 “average*