

Canada

**Newfoundland
Labrador**

ALTERNATIVE CROPS INITIATIVE

2014-2015 PARDP Report



Prepared by: Deanne Simms (B.Sc. Agr.)

**Alternative Crops Development Officer
Forestry & Agrifoods Agency
Agrifoods - PMD**

TABLE OF CONTENTS

Executive Summary	2
Background & Rationale for Investigation	3
Funding & Partnerships	4
Methods & Implementation	5
Results & Discussion	6
Conclusion & Future Recommendations	11
References	12
Appendix A - Photos	13
Appendix B – ANOVA Results	

Executive Summary

The objectives of the Alternative Crops Initiative are; the continued research and development into new and innovative varieties of cranberry for the commercial industry; research of alternative crops that have commercial potential in NL, in particular, lingonberry and blueberry.

This is a multi-year study that began in 2012 and will continue for a minimum of six years. The budget requisite for 2015/16 has been projected at \$54,672.00.

In the spring of 2012, two fields were identified for blueberry research; one located at Pynn's Brook and the other at Wooddale. Throughout that summer both fields were cultivated and prepared for planting. 90 plants each of three mainland varieties (Chippewa, Polaris and Northland) were first planted in Pynn's Brook. In 2013 drip irrigation was set up in this field and berry yields were collected in 2013 and 2014. Results for 2013 include; a total of 1844.26, 1562.12, 2074.31 grams of fruit were recorded for Polaris, Chippewa and Northland respectively. There was an average of 39.24, 31.24, 47.14 grams of fruit per plant for Polaris, Chippewa and Northland respectively. Northland outperformed the other two varieties.

In 2012 the Forestry & Agrifoods Agency partnered with Agriculture and Agrifood Canada (AAFC) to carry out research on new cultivars of half-high blueberry. These plants were developed by Dr. Samir Debnath at the Atlantic Cool Climate Crop Research Center (ACCCRC) in St. John's, using in vitro technology. They are hybrids of our native low bush blueberry variety and non-native half high blueberry varieties. 1080 hybrids consisting of 31 cultivars were planted at the Wooddale Tree Nursery in the summer of 2013. The existing irrigation system was extended to this field and fencing was erected to prevent wildlife damage. 150 hybrids were also planted in the same field as the mainland plants in Pynn's Brook and 216 hybrids were planted in a second field in Pynn's Brook.

In addition the hybrid blueberry plants, AAFC also provided hybrid lingonberry plants; 32 cultivars in all. These are crosses of our native lingonberry and European varieties. Since there were a limited number of these provided, over the next year the focus was on rhizome propagation, to obtain sufficient material of the 32 cultivars to perform field trials. In 2014 the site of the longstanding lingonberry trials in Pynn's Brook was renovated and will be cultivated and prepared for planting in 2015.

In 2013 the longstanding cranberry research site in Pynn's Brook was completely renovated with removal of all plant and sand material. New sand was sourced and applied to seven plots within the site. In 2014 the Forestry & Agrifoods Agency partnered with Rutgers University of New Jersey to obtain vine material of three new varieties that are showing exceptional production numbers in their studies. In April 2014 we received the vine material of Mullica Queen, Crimson Queen and Demoranville. Vines were promptly propagated in peat plus at the Wooddale Tree Nursery to expand on material. Planting of the 3 new varieties and Pilgrim as the control, was completed in Pynn's Brook in June 2014. Applications of 210 grams/plot of 15-5-15 were applied weekly following planting, for a total of 8 weeks.

Other partners in this project include Mr. Cavin Samms of Howley and Mr. Garland Smith of Grand Falls-Windsor. Many Agrifoods Staff provide professional information and advice as well.

Background & Rationale for Investigation

The wild lowbush blueberry plant *Vaccinium angustifolium* is the most abundant species growing in Newfoundland and Labrador. There are approximately 19 farms producing 222,667 pounds valued at \$151,000 (Stats Canada, 2010). The wild lingonberry shrub *Vaccinium vitis-idaea*, better known as partridgeberry in Newfoundland and redberry in Labrador also grows abundantly throughout the province and is harvested from unmanaged natural stands. Annual production varies, but a mean annual harvest of 212,746 pounds makes Newfoundland and Labrador the largest North American producer (Butt, E., et al. 1995). Most of the blueberry and lingonberry marketed are frozen and shipped out of the province to large secondary processors. The vast majority of fresh pick in the province is either used by the harvester or sold direct to consumers; there is little to no presence in local retail or grocery stores.

Both types of berries are well adapted to our weather and acidic soil and known to be exceptionally high in antioxidants. Predictably the demand for berries and other small fruit, both wild and cultivated, has grown substantially in the past two decades because of their health benefits. They are known to be rich in vitamins, foliates and other nutrients (Opal Consulting Inc., 2010). Canadians consumed about 318.5 million kilograms of berries in 2009 or about 14 kg per capita; locally the large supermarket chains in Newfoundland (e.g. Sobeys, Dominion and Coleman's) are selling an estimated 300 to 400 thousand pounds of frozen berries annually worth between \$1.5 and \$2.0 million (Statistic Canada, Food Available in Canada 2009).

Conversely to the lowbush blueberry is the highbush. This refers to cultivated blueberry plants, which were developed from the wild variety in the first half of the 20th century. British Columbia grows the majority of highbush blueberries (93%) but they can also be found in Ontario, Quebec and Nova Scotia. They are harvested earlier than lowbush berries and are larger and less perishable, which makes them highly suitable for shipping to retail markets. As a result, much of the highbush crop is sold fresh, in contrast to the lowbush crop, which is mostly destined for processing and freezing (Agriculture & Agri-Food Canada, Canadian Blueberries 2011).

Typically the farms growing cultivated blueberries in this province select a half-high variety which is a hybrid of the highbush and the lowbush. Bred for colder zones, they are hardier and shorter to survive our cold temperatures and snow cover. However farms have remained small with fewer than 100 plants. There may be many reasons for this; high initial investment, lack of suitable land, resources, harvesters, government support, etc. However, there are well established markets for these berry crops including local fresh, large primary processors and smaller secondary processors who produce jams, jellies, sauces and wines. This province has barely tapped the berry market that exists in Canada and has enormous potential to grow.

The Forestry & Agrifoods Agency has partnered with Agriculture and Agri-Food Canada (AAFC) to research and develop the local commercial blueberry and lingonberry industries. Dr. Samir Debnath, a research scientist with the Atlantic Cool Climate Crop Research Centre of Canada in St. John's has been breeding new cultivars of blueberry and lingonberry by crossing native varieties with non-native varieties. In the case of blueberry he is producing half-high plants by crossing mid and highbush with local lowbush varieties. Pertaining to lingonberry he is crossing European varieties with local native lingonberry. Conceivably these new varieties could hold the characteristics of both the non-native type and the native type. In other words it may be possible to cultivate these new varieties on a large, commercial scale while keeping the extraordinary superior traits of our local blueberry and lingonberry. 31 cultivars of blueberry and 32 cultivars of lingonberry were provided to the Agency from AAFC to conduct field trials and this project will follow the progress of these trials and report the results.

Funding & Partnerships

This is a multi-year study that will continue for a minimum of six years with the goal of collecting five years of research data. This project began in 2012 and required a budget of \$117,464.63 for the 2012/13 fiscal year. Approximately \$44,000 was spent during the 2013/14 fiscal year and \$51,613 during the 2014/15 fiscal year. The projected budget for 2015/16 is \$51,613.

In 2012 the Forestry & Agrifoods Agency partnered with Agriculture and Agrifood Canada (AAFC) to carry out research on new cultivars of half-high blueberry and lingonberry. This plant material was developed by Dr. Samir Debnath of the ACCRC (AAFC) in St. John's. He propagated unique cultivars of half-high blueberry by crossing non-native high-bush blueberry with our native wild low-bush blueberry; 31 unique cultivars and a total of 1800 plants were provided for research purposes. These will be referred to as the NL blueberry in this report. Also propagated were unique cultivars of lingonberry by crossing European varieties with our native wild lingonberry, otherwise known locally as partridgeberry; 32 unique cultivars and a total of 60 plants were provided for research purposes. These will be referred to as the NL lingonberry in this report.

In early 2014 the Agency partnered with Rutgers, The State University of New Jersey in New Brunswick, New Jersey. This research university contributed cranberry vine material of three new varieties not yet studied in this province. The varieties include Crimson Queen, Mullica Queen and Demoranville. The vine material, which arrived in April 2014, was promptly propagated in peat plugs at the Alternative Crops Research Facility in Wooddale. Approximately 500 plugs of each variety were planted in a research trial at the Pynn's Brook cranberry site in June of 2014.

Two farms also partnered with the Agency to carry out additional blueberry trials. Mr. Calvin Samms of Howley (2013) and Mr. Garland Smith of Grand Falls (2014) provided suitable land and were directly involved in the field preparation and planting. Later in 2014 leaf and soil samples were collected from all fields for analysis.

Methods & Implementation

Research Sites

In 2012 Pynn's Brook and the Wooddale Tree Nursery were identified as potential locations for blueberry and lingonberry research trials. Soil reports from samples collected identified suitable land at both locations. All sites had suitable pH, \leq 2% slope, could be or was already fenced and had well drained, sandy to sandy loam soil.

In April of 2012, 300 two year old plants of 3 half-high blueberry varieties arrived from a mainland supplier. These were re-potted at the Wooddale Tree Nursery and some cuttings were collected for propagation. 90 plants of each of the 3 varieties were planted in field#1 at Pynn's Brook in June of 2012. In 2013 and 2014 fruit yields were collected and recorded. See results.

In October 2012, 1800 plants of 31 unique blueberry cultivars were provided by Dr. Samir Debnath of AAFC. 1080 of these were planted in one acre field #3 trials at the Wooddale Tree Nursery in July of 2013. In Pynn's Brook 150 of these blueberry plants were planted in field #1 alongside the mainland varieties (June 2013) and 216 were planted in a newly developed field #2 (July 2013). As well, 124 NL blueberry plants were at C. Samms field in Howley (Sept 2013) and 233 were planted at G. Smith field in Wooddale (July 2014).

Experimental Design

To prepare the blueberry fields in Pynn's Brook rows were tilled using a stand behind, gas operated rototiller. To each row peat was added liberally and the rows re-tilled before planting. In Wooddale and Howley tractor pulled implements were used to prepare the whole field and peat was added liberally to each hole that was dug prior to planting. NL blueberry plants were planted 1 meter apart within rows and rows were 3 meters apart. Following planting approximately 6 inches of woodchips were placed on top of the rows. This helps retain moisture and reduce pests.

NL lingonberry plants from AAFC will be planted in a single row down the center of a raised bed. Each row will contain only one variety since plants spread by rhizome growth and it is necessary to keep varieties separate for data collection. Plants will be spaced ½ meter apart within rows and row centers will be spaced 1 meter apart. Sussi and Sanna will be used as the controls. Following planting 10 centimeters of mulch will be applied on the beds of plants.

Fertilizer types and rates will follow the soil report recommendations. For each research site, a minimum of 5 years of production data will be collected where possible.

Data Collection

Each site was visited frequently following planting to monitor for stressors such as drought, cold, heat and pests. Data to be collected during the season and at harvest time include;

- time of bud break (leaf and flower buds);
- time of bloom;
- fertilizer and irrigation requirements;
- pests observed and chemicals applied;
- yield per plant; per variety;
- berry weight per 100 count;
- length of fruiting period;
- fruit color and taste;
- pollinators observed, and;
- winter hardiness and survival.

Statistical Analysis

The research sites will be evaluated separately because of the known differences between geographical areas. Yield per plant and berry weight per 100 count between varieties at each site will be analyzed using ANOVA statistical method.

Results & Discussion

150 NL blueberry plants from Agriculture Canada were planted in field #1 at Pynn's Brook during early June 2013. Also in this field are 270 mainland blueberry plants that were planted in the summer of 2012. During two weeks in early July 2013, 1080 NL blueberry plants were planted in a 1 acre field#3 at the Wooddale Tree Nursery. Then from July 18 to August 7th 2013, 216 NL blueberry plants were planted in field #2 in Pynn's Brook.

The Agency also partnered with Mr. Calvin Samms of Howley (Field #4, 2013 and 123 NL blueberry plants) and Mr. Garland Smith of Grand Falls (Field #5, 2014 and 233 NL blueberry plants). During the first week of October 2013, 346.5, 231 and 70 grams per plant of 12-24-24 were applied to field #2, #3 and #4 respectively. All trial sites have been fenced to keep out wildlife. In the first 2-3 years following planting of the NL blueberry plants, flower buds will be removed to prevent fruit development and allow plants to mature. Therefore production data will not be available for several years.

Blueberry Field#1 Pynn's Brook (2013 results)

There were three mainland varieties of blueberry (Polaris, Chippewa and Northland) planted in field #1 in Pynn's Brook during the summer of 2012. These plants produced some fruit in 2013 and the following data was collected and observations made. Fruit was collected and weighed during 2 weeks of August starting on the 7th; there was insufficient fruit per plant to perform 100 berry count weights. It is anticipated that this measurement will be obtainable by 2015..

Leaf and flower bud break was observed in April and 50% early bloom was recorded on June 19th. There were very few pollinators (bees) observed during bloom and this may be due to unfavorable cloudy conditions throughout the summer (weather data to follow).

Of the 90 Polaris planted, 10 or 11.11% did not survive and 47 of the 80 remaining or 58.75% produced fruit. There was a total of 1844.26 grams (4.06 lbs) of fruit recorded which was an average of 39.24 grams per plant. Standard deviation (SD) is a measure of the dispersion of a set of data from its mean. The SD for the Polaris plants that produced fruit was 33.99.

Of the 90 Chippewa planted, 6 or 6.67% did not survive and 50 of the 84 remaining or 59.52% produced fruit. There was a total of 1562.12 grams (3.44 lbs) of fruit recorded which was an average of 31.24 grams per plant. The SD was 31.77.

Of the 90 Northland planted, 7 or 7.78% did not survive, 44 of the 83 remaining or 53.01% produced fruit and 4 of these showed signs of the disease witches broom caused by the fungus *Pucciniastrum goeppertianum*. The affected areas were pruned out of the plants. There was a total of 2074.31 grams (4.56 lbs) of fruit recorded which was an average of 47.14 grams per plant. The SD was 40.91. See Table#1 and Chart #1 & 2.

ANOVA Results attached as Appendix B.

Table 1. 2013 Fruit Yields Field#1 Pynn’s Brook

VARIETY	# heathy	# produced	% produced	Total (g)	Total(lbs)	Avg fruit/plant(g)	Standard Deviation
Polaris	80	47	58.75	1844.26	4.06	39.24	33.99
Chippewa	84	50	59.52	1562.12	3.44	31.24	31.77
Northland	83	44	53.01	2074.31	4.56	47.14	40.91

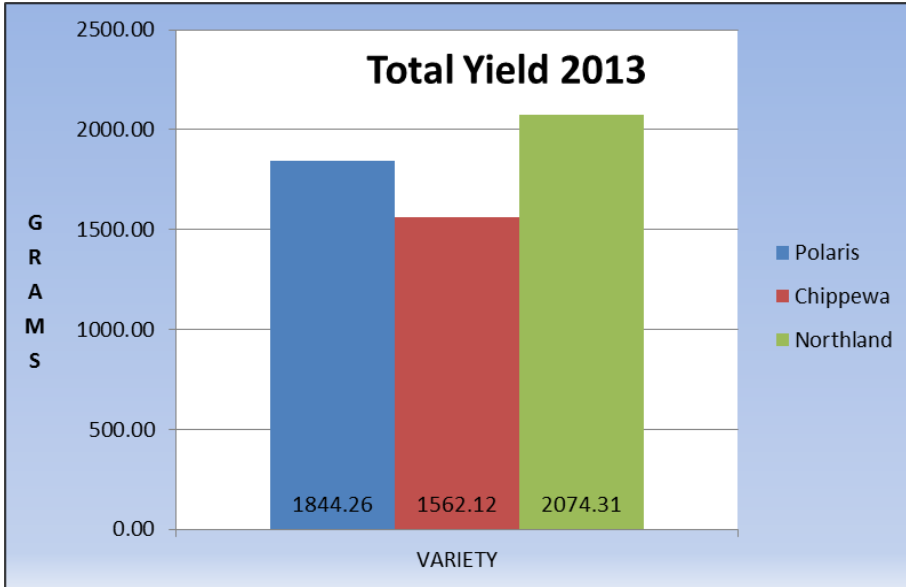


Figure 1. 2013 Total Fruit Yields Field#1 Pynn’s Brook

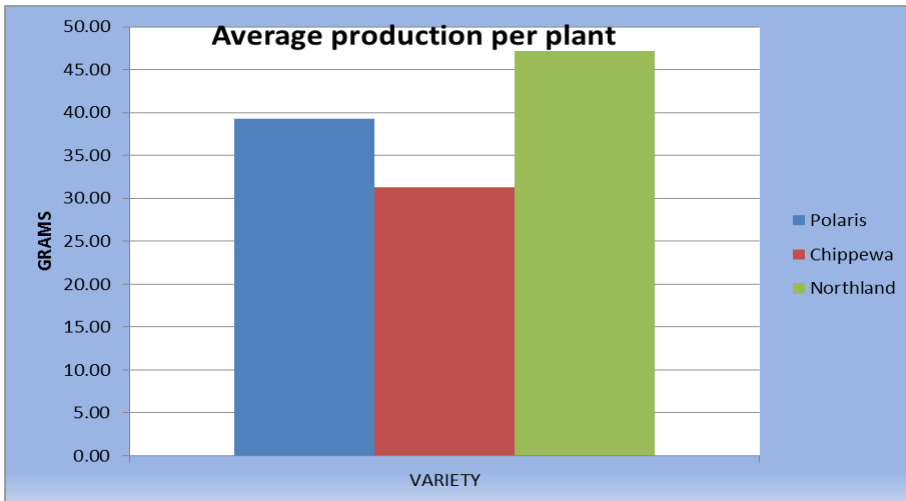


Figure 2. 2013 Avg. Fruit Yields Field#1 Pynn’s Brook

Blueberry Field#1 Pynn’s Brook (2014 results)

There were 22 plants that did not survive overwinter; 9,8 and 5 Polaris, Chippewa and Northland, resp. were replanted in June of 2014.

Fruit was collected and weighed during a three week period in August starting on the 11th; there was insufficient fruit per plant to perform 100 berry count weights. It is anticipated that this measurement will be obtainable by 2015.

The start of leaf and flower bud break was observed on May 21st and 50% early bloom was recorded on June 17th. There were numerous pollinators (bees) observed during bloom and throughout July.

For Polaris fruit yields were collected from 44 of 81 healthy plants; 54.32%. There was a total of 1756.27 grams (3.86 lbs) of fruit recorded which was an average of 39.92 grams per plant. Standard deviation (SD) is a measure of the dispersion of a set of data from its mean. The SD for the Polaris plants that produced fruit was 34.36.

For Chippewa fruit yields were collected from 34 of 82 healthy plants; 41.46%. There was a total of 1422.16 grams (3.13 lbs) of fruit recorded which was an average of 41.83 grams per plant. Standard deviation (SD) is a measure of the dispersion of a set of data from its mean. The SD for the Polaris plants that produced fruit was 31.73.

For Northland fruit yields were collected from 50 of 85 healthy plants; 58.82%. There was a total of 1496.87 grams (3.29 lbs) of fruit recorded which was an average of 29.94 grams per plant. Standard deviation (SD) is a measure of the dispersion of a set of data from its mean. The SD for the Polaris plants that produced fruit was 38.87.

Table 2. 2014 Fruit Yields Field#1 Pynn’s Brook

VARIETY	# healthy	# produced	% produced	Total (g)	Total(lbs)	Avg fruit/plant(g)	SD
Polaris	81	44	54.32	1756.27	3.86	39.92	34.36213
Chippewa	82	34	41.46	1422.16	3.13	41.83	31.72728
Northland	85	50	58.82	1496.87	3.29	29.94	38.87149

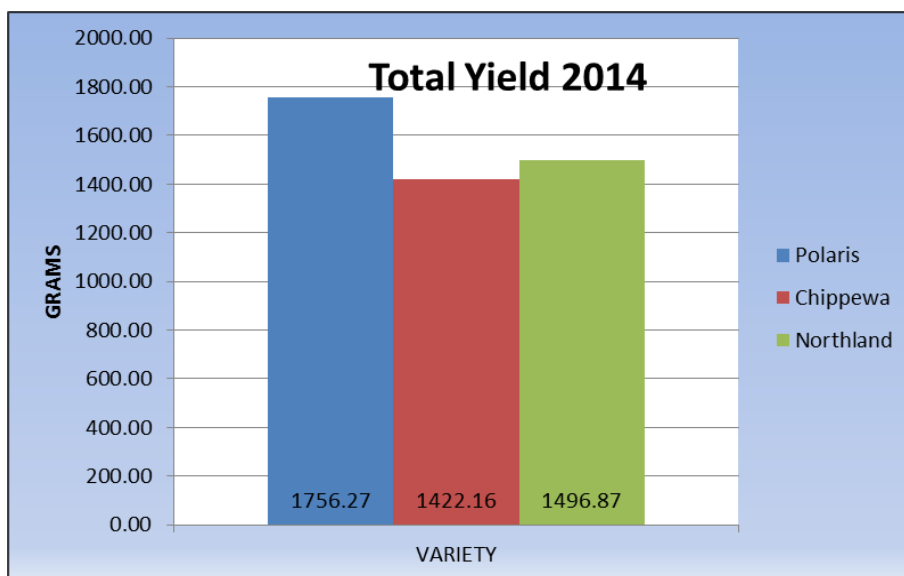


Figure 3. 2014 Total Fruit Yields Field#1 Pynn’s Brook

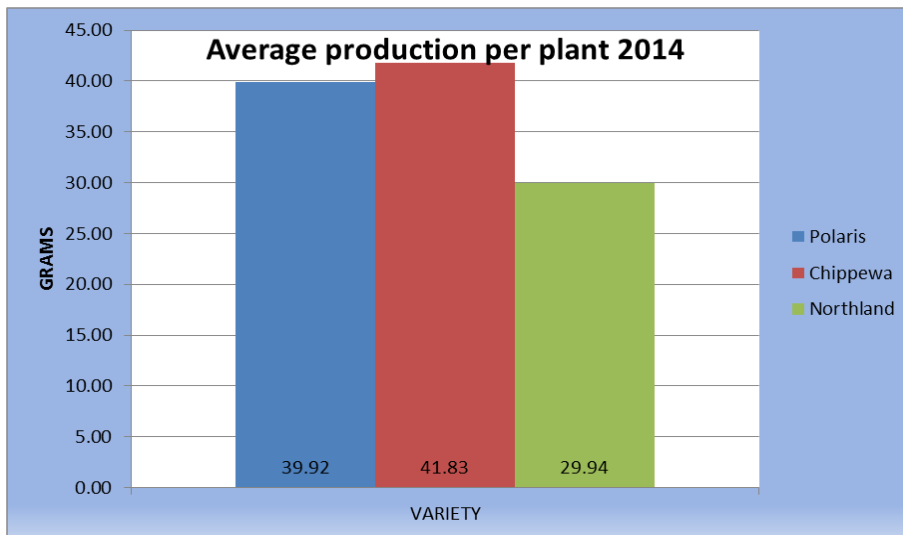


Figure 4. 2014 Avg. Fruit Yields Field#1 Pynn's Brook

Conclusion & Future Recommendations

Wild lowbush blueberry and wild lingonberry grow abundantly in the province and have exceptional taste, color and nutritional traits such as being very high in antioxidants. However on a national scale this province markets just 0.1% of total exported volume of blueberry to other countries (AAFC, Statistical Overview of the Canadian Blueberry Industry, 2010) and the number for lingonberry being even smaller. This untapped market creates considerable opportunity to grow these industries both provincially and nationally.

The Forestry & Agrifoods Agency has partnered with Agriculture and Agri-food Canada to carry out research trials of new blueberry and lingonberry plants. These half-high varieties of blueberry are a cross between non-native highbush type and native lowbush. Mainland varieties of half-high blueberry will also be investigated. The new lingonberry plants are a cross between European type and local wild type. These new plants can be established intensively using current farming methods. It is anticipated that these cultivated plants can increase the volume of blueberry and lingonberry crop marketed in the province with the possibility of retaining some of their exceptional characteristics.

There may be one or more cultivars of these new blueberry or lingonberry plants that prove to be superior to the others and applied research such as this will be a determining factor. The Forestry & Agrifoods Agency must continue to be engaged in research and development activities that look to improve our future and grow a competitive and sustainable agriculture industry.

REFERENCES

- Butt, E., Churchill, R.A., Gallagher, C.A., Hendrickson, P.A., Penney, B.G. 1995. The Wild Partridgeberry (*Vaccinium vitis-idaea* L. var. minus Lodd) Industry in Newfoundland and Labrador and the Potential for Expansion Utilizing European Cultivars. Agriculture and Agri-Food Canada & Government of Newfoundland and Labrador.
- Cline, B, Hanson, E., Isaacs, R.and.Schilder, A. A Pocket Guide to IPM Scouting in Highbush Blueberries.2011. (Publication E2928).
http://www.ipm.msu.edu/pubs_blue.htm.
- Deverna, Dr. J. 2012. Hobo Report Cy2012. Ocean Spray Cranberries Inc. Lakeville-Middleboro, MA
- Garcia-Salazar, C., Isaacs, R. and Wise, J. 2012. Time to prepare for fruitworm activity in blueberries. MSU Extension, Dept. of Entomology.
- Hanson, E. 2012. Blueberry Weed Control; Late Spring and Summer Options. MSU Extension, Dept. of Horticulture.
- Longstroth, M. Irrigating Blueberries, May 2012. MSU Extension.
- Longstroth, M. 2012. The annual cycle of growth of northern highbush blueberry. MSU Extension.
- Misra, Dr. M. 2012. Soil Test Report. Soil Feed Laboratory. Forestry & Agrifoods Agency. St. John's, NL.
- Ontario: Ministry of Agriculture, Food and Rural Affairs. 2011. Notes on Blueberry Diseases.
- Opal Consulting Inc. 2012. Southern Labrador Wildberry Study.
- Oram, R. 2010. Alternative Crops Initiative. Research Report. Govt. of Newfoundland and Labrador. Forestry & Agrifoods Agency.
- Penhallegon, R. 2006. Lingonberry Production Guide for the Pacific Northwest. Extension Horticulture Facility, Oregon State University.
- Schilder, A. 2012. Protect against blossom blights in blueberries. MSU Extension, Dept. of Plant Pathology.
- The Weather Network. 2012. Historical data collection. <http://farmzone.com>

APPENDIX A – Photos

Figure A1. The Alternative Crops Research Facility Greenhouse at the Wooddale Tree Nursery.



Alternative Crops Research Facility, Wooddale, NL

Figure A2. Unique NL lingonberry cultivars from Agriculture Canada, St. John's to be used in field trials at Pynn's Brook in 2015.



Figure A3. Unique NL blueberry cultivars from AAFC, St. John's which were planted in field trials in 2013 and 2014.



Figure A4. Polaris, Chippewa and Northland plants arrived in April and planted in June 2012.



Figure A5. Field#1, Pynn's Brook - 3 half-high varieties of mainland blueberry
Planted in June 2012.



Figure A6. Blueberry field #3 at the Wooddale Tree Nursery, planted July 2013.



Figure A7. Blueberry field #3 at the Wooddale Tree Nursery, July 2013.



Figure A8. Extension & preparation of Field #1 in Pynn's Brook for NL blueberries planted June 2013.



Figure A9. Extension of blueberry field#1.



Figure A10. Planting blueberry Field #2 in Pynn's Brook with NL blueberries, July 2013.



Figure A11. Blueberry Field#1 in Pynn's Brook with drip irrigation.



Figure A12. Irrigation of blueberry Field#3 in Wooddale.



Figure A13. Fruit in blueberry field #1, Pynn's Brook 2014.



Figure A14. Planting blueberries in Field #4, Howley September 2013.



Figure A15. The site of longstanding lingonberry trials, Pynn's Brook.



Figure A16. Propagated NL lingonberry plants, Wooddale Tree Nursery.



Figure A17. The renovated lingonberry site in Pynn's Brook, ready for prep and planting.



Figure A18. The site of longstanding cranberry trials, Pynn's Brook.



Figure A19. The renovated cranberry research site in Pynn’s Brook, ready for sand application.



Figure A20. Propagation of Mullica Queen, Crimson Queen & Demoranville at Wooddale Tree Nursery April 2014.



Figure A21. Renovated and replanted cranberry site in Pynn's Brook July 2014.



Figure A22. Renovated and replanted cranberry site in Pynn's Brook July 2014.

