Prince Edward Island CANADA

Agriculture and Forestry

Farm Extension Services

Pollination Demonstration Plots in P.E.I. Lowbush Blueberry Fields - 2003

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Background

Pollination is an important input which lowbush blueberry growers use to obtain maximum yields. Often times producers do not order their bees well in advance of their required date of delivery. In a time of short honey bee hive supply, a grower may end up not being able to access the quantity of bees required for pollination. Furthermore, when field prices for blueberries are low, growers try to streamline their expenses in order to make a profit. In many cases, pollination services tends to be one of the inputs to go. In its place, growers tend to rely on the native pollinating force to pollinate their crop. The advantage to this is that native pollinators do not create direct out-of-pocket expenses for the grower while still providing some level pollination. The disadvantage lies in the fact that native pollinators are not reliable and their abundance varies greatly from year to year.

Demonstrating the importance of introduced i.e. commercial pollinators for the production of maximum blueberry yields was the focus of this pollination demonstration. Its purpose was to demonstrate to growers that without pollination, lowbush blueberry yields are drastically reduced.

Methods

In 2003, pollination plots were established in four sites in P.E.I.: Mt. Vernon, Bristol, Rollo Bay and Mt. Stewart. Each site (field) contained six plots (three treatments with two plots per treatment). Each plot measured 4' x 6' for the following treatments:

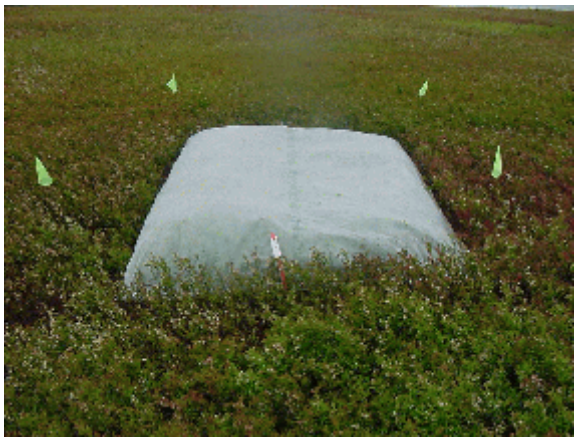
1. **Open Pollinated (Control) -** plots were never covered and therefore allowed to be open pollinated freely by native bees and honey bees and/or leaf cutter bees.

2. **Commercial Bees Excluded -** floating row covers (Agribon+™) were placed over plots and secured using 'U' shaped wire pins immediately prior to the introduction of commercial pollinators.

3. **Total Exclusion -** floating row covers (Agribon+™) were placed over plots & secured prior to blossoms opening. This prevented both native pollinators and introduced bees from pollinating the blossoms.

Field sites were selected for their uniformity of vine coverage and their intended use of supplemental pollinators. Bee management was left to the grower and the introduction of floating row covers was timed based on crop development and the estimated time of bee placement within the field.

Field plots were established when the flower buds were dormant. In each plot, the total number flower buds on 10 stems were counted to determine the yield potential per plot. For the total bee exclusion plots, floating row cover was placed over the blueberry stems prior to blossoms opening. For the commercial bee exclusion plots, floating row covers were introduced just prior to the introduction of either honeybees and/or leaf cutter bees. The control plots were not covered and therefore were pollinated by both native pollinators and/or honey bees/leaf cutter bees. The floating row cover was removed after all blossoms were spent. Total yield was determined for each plot by hand raking just prior to commercial harvest. Total yield per treatment was expressed as grams of berries harvested and then converted to lbs/acre total production.



Floating Row Cover used to exclude bees from plots.

Overview of plots during pollination.

Honey bee hives were introduced into Rollo Bay, Mt. Vernon, and Mt. Stewart fields.

Leaf cutter bees were introduced into the Rollo Bay and Bristol fields

A field with a high yield potential needs supplemental pollinators.

Maximum yields are obtained when bees are introduced during pollination.

Results

Table 1. Summary of pollination plot yield potential and use of commercial pollinators.

Location	Pollinator		Average # Flower buds / 10 stems[a]		
	Type	Stocking Rate / acre	Open Pollinated (Control)	Commercial Bees Excluded	Total Exclusion
Mt. Vernon	Honey Bee	3.2 hives	4.45	6.15	6.35
Bristol	Leaf Cutter	1 gallon	9.70	9.05	7.60
Rollo Bay	•Leaf Cutter & •Honey Bee	•2.14 gal •1 hive	7.60	7.80	5.75
Mt. Stewart	Honey Bee	3.2 hives	6.30	6.50	5.65
Average			7.01	7.38	6.34

Table 2. Summary of pollination plot yields.

Location	Average Treatment Yield (grams/48 ft^2)[a] (lb/acre equivalent)		
	Open Pollinated (Control)	Commercial Bees Excluded	Total Exclusion
Mt. Vernon	3,200.00 (6,398)	398.50 (799)	115.00 (227)
Bristol	2,837.00 (5,681)	251.00 (499)	23.50 (45)
Rollo Bay	7,630.50 (15,264)	435.50 (871)	198.50 (399)
Mt. Stewart	6,367.00 (12,741)	179.00 (354)	385.00 (771)
Average Yield of 4 Sites (by treatment)	5,008.63 (10,019)	316.00 (635)	180.50 (363)
Average Yield of 4 Sites (control vs. partial and total exclusion)	5,008.63 (10,019)	248.25 (499)	
Average # Flower Buds[b]	7.0	6.9	

[a] two plots per treatment in each of four fields (locations)

[b] Average # flower buds / 10 stems

Discussion

Lowbush blueberries are well known for their large variability both within and between fields. An attempt was made to minimize this variability by expressing the average for each treatment over all fields. The yield potential for both the open pollinated (control) and commercial bee exclusion plots was the same, 7.01 and 7.38 flower buds/stem, respectively. Theoretically, both treatments had the potential to produce the same yield. The bee exclusion plots averaged 6.34 flower buds/stem and therefore much lower potential to produce the same yield. However, bees were not allowed to work these plots therefore the lower yield potential should not have made a difference.

The open pollinated plots produced anywhere from 5,681 lbs/acre up to 15,264 lbs/acre equivalent berries with an average 10,019 lbs/acre produced over the four sites. In comparison, the plots where the commercial bees were excluded produced anywhere from 354 lbs/acre up to 871 lbs/acre with an average 635 lbs/acre blueberries produced. Totally excluding native pollinators and honey bees/leaf cutter bees resulted in a yield ranging from 45 lbs/acre up to 771 lbs/acre. An average 363 lbs/acre berries were produced when all bees were excluded during pollination over all four sites.

The effect of excluding bees (upper right side of picture) during blossom time. Note the increased number of berries (left side of picture) when bees are allowed to pollinate the crop.

It is difficult to draw conclusions on the total effect of native pollinators alone on the crop. When the commercial honeybees and leaf cutters were excluded, so were the native pollinators. In these plots, it is assumed that the berries produced came primarily from the effect of native pollinators up to the point when floating row covers were placed in the field prior to the introduction of commercial bees. As a result, both the yield potential and actual harvested fruit from both the treatments i.e. excluding commercial bees and total exclusion numbers were combined to provide an idea of the effect of native pollinators on the crop. This resulted in both treatments having the same yield potential, but producing very different crop yields.

The open pollinated plots produced an average 10,019 lbs/acre while the combined plots of commercial bee exclusion and total bee exclusion produced an average 499 lbs/acre. It is obvious that introducing bees has a beneficial effect in producing maximum yields. Yields in the open pollinated plots do appear to be somewhat exaggerated. This is due to the fact field plots were established in well-developed areas of each field. Poorly covered areas were avoided when plots were established. Therefore plot yields are larger than the actual field yield on a per-acre basis.

Conclusions

One of the flaws in the design of this project was trying to separate out the effects of native pollinators on yields of lowbush blueberry. This is very difficult to do because there was no barrier material available which would allow native pollinators to work the blueberry flower while excluding commercial bees at the same time.

This project was successful in demonstrating to growers that without commercial and native pollinators, yields of PEI lowbush blueberry fields are drastically reduced. It appears that although pollination is one of the largest input costs in producing lowbush blueberries, it allows the production of higher volume of berries from the same land base.