Wild Blueberry
FACT SHEET
THE UNIVERSITY OF MAINE Cooperative Extension

Commercial Bumble Bee (*Bombus impatiens)* Management for Wild Blueberry Pollination

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Introduction

Maine blueberry growers have three commercially available pollinators: honey bees[1], alfalfa leaf cutting bees[2] and bumble bees. Research conducted at the University of Maine indicates that a commercially available bumble bee, *Bombus impatiens*, is an excellent pollinator of wild blueberry in Maine and a good alternative to currently available pollinators. This commercial bumble bee handles flowers faster than honey bees or alfalfa leafcutting bees and is more faithful to the blooming crop, even if alternate forage is in flower at the same time. Other advantages of using commercial bumble bees include their ability to fly at cooler temperatures than honey bees or alfalfa leafcutting bees and their tendency to visit blueberry flowers even in moderate rain. No additional shelters, incubation equipment or nest materials are needed. Commercial bumble bees arrive from the supplier ready to be placed in the field. **However, one disadvantage is that they may be more expensive to use than honey bees or alfalfa leafcutting bees because they must be purchased and can not be used again.**

This Fact Sheet will provide you with guidelines for bumble bee handling in order to obtain the best results when using them for wild blueberry pollination.

[1] see *Honey Bees and Blueberry Pollination*, University of Maine Cooperative Extension Bulletin #2079.[1]
[2] see *How to Manage Alfalfa Leafcutting Bees for Blueberry Pollination,* University of Maine Cooperative Extension Bulletin #2413.

Ordering Bumble Bees

Orders need to be placed no later than mid-February to ensure that the supplier will have ample queen production for delivery in mid-May. Presently only one company supplies bumble bees for the eastern U.S., Koppert Biological Systemsâ. Information on Koppert and the company's sales representative in Maine is listed at the end of this fact sheet.

Bumble bees for field pollination come in groups of four colonies per wooden field unit or "quad." Each colony contains a queen, approximately 200 workers and some developing immature bumble bees, including males and new queens. Figure 1 shows the three castes: queen, worker and male (drone). The queens, approximately three-quarters of an inch long, are robust, large bees that remain in the quad laying eggs. Workers are about three-eighths to one-half inch long. Some workers will tend the immature bees, but most will be foragers that pollinate the wild blueberry plants while collecting pollen and nectar. Males are about one-half inch long, have an additional antenna segment (13 versus 12), yellow fuzz on their face, and the tip of their posterior has a genital capsule rather than a sting.

Stocking rate depends on the size of your field, the abundance of native pollinators, and whether honey bees or alfalfa leafcutting bees are also used. On the average, three to four colonies of bumble bees per acre is recommended if no other commercial pollinators are used. These estimates are based on 150 to 200 worker bees per colony. Because bumble bees are much more effective on a per bee basis than honey bees, one bumble bee is at least two to ten times more efficient than one honey bee. Thus, considerably fewer bumble bees are needed per acre. One colony of Bombus impatiens per acre may

suffice in fields that have nearly adequate native pollinators, based on an average of one native bee per square yard of bloom per minute.

Figure 1. The three bumble bee castes are, left to right: queen, worker and male (drone).

Figure 2. Bumble bee quad with electric fence.

Field Management

Quads may be set out just before bloom, but ideally should be placed in the field when five percent of blossoms are open. Each quad weighs about 30 pounds. This makes them easier to move than honey bee hives, which generally come on pallets of four to six hives each that can only be placed where a Bobcat forklift can go.

Place the quads on wooden pallets or logs so that they sit at least six inches above the ground. Avoid placing the quads near anthills, roads and honey bee hives. Also, avoid placing the quads near the borders of non-bearing fields that may be sprayed with insecticides that are toxic to bees while the bearing field is in bloom. Bear protection with electric fencing is necessary (Figure 2).

Unlike honey bees, bumble bees do not need a supply of water in order to cool the hive. You should watch the bees returning to their quads regularly during bloom to see if the workers are bringing back blueberry pollen, which is pale yellow. Throughout bloom, new workers should continue to emerge from the colonies to forage and pollinate blueberry. Newly emerged workers are most easily recognized by their healthy-looking wings, which show no signs of wear. Older bees will have worn and tattered wings. When blueberry bloom is nearly over, the new queens and drones may begin to emerge and forage. The new queens and drones look "fresh and new," with undamaged wings. Also, their pelts are vibrant and densely lush, not faded or balding like those of the aging workers and old queens.

Assessing Colony Strength for Pollination

Plot counts are a useful way to assess whether you have sufficient pollinators. Instructions for plot counts: Prior to peak bloom, measure out 10 one-square-yard plots evenly throughout the field stocked with B. impatiens. Mark each plot using stakes or flags. All plots should have good wild blueberry plant cover with abundant flowers. Observe each plot on three different days during bloom. These observations should last one minute under sunny, windless conditions, between 9 a.m. and 2 p.m. Approach each plot with care so as not to disturb the foraging bees. Stand about one foot from the plot to avoid blocking the flight path of the bees. Count and record the number of B. impatiens workers in each plot, then calculate the average for your observations. At a stocking density of three colonies per acre, there is an average of 0.1 B. impatiens per square yard, which equals one bee per 10 one-square-yard plots of bloom per minute. This would indicate you have adequate colony strength for wild blueberry pollination.

Because bumble bees are much more effective on a per bee basis than either honey bees or alfalfa leafcutting bees, considerably fewer bumble bees are needed per acre. As mentioned above, at a stocking density of three bumble bee colonies per acre, a plot count average of 0.1 Bombus impatiens workers per square yard per minute during bloom indicates good pollinator strength.

In contrast, the average density of honey bees required for adequate pollination is 1.0 honey bee per square yard of bloom per minute. In other words, only one bumble bee is required per 10 plots, but 10 honey bees are required in order to achieve good pollination. If you use fewer than three bumble bee colonies per acre, you should count foragers as they return to the quads with nectar and pollen in order to assess colony strength. For example, if you are assessing one quad on a sunny day, you should see at least two bumble bees returning and entering per minute, which is equal to 0.5/bee per colony per minute.

Example 1	Example 2
• On day one, you saw two *B. impatiens* workers in the 10 plots. The day one average is 2 bees/10 = 0.2 bees per square yard of bloom per minute.	• On day one, you saw only one worker in the10 plots. The day one average is 1 bee/10 = 0.1 bee.
• On day two, no workers were seen, so the day two average is 0 bees/10 = 0 bees.	• On day two, no workers were seen. The day two average is 0 bee/10 = 0.
• On day three, three workers were seen, so the day three average is 3 bees/10 = 0.3 bees.	• On day three one worker was seen. The day three average is 1 bee/10 = 0.1.
• Then add the daily averages: 0.2 + 0 + 0.3 = 0.5 bees.	• Then add the daily averages: 0.1 + 0 + 0.1 = 0.2 bees.
• Calculate the overall average: 0.5 bees/3 = 0.16 bees per square yard of bloom per minute.	• Calculate the overall average: 0.2 bees/3 = 0.06 per square yard of bloom per minute.
In this example, the average is more than 0.1 *B. impatiens* per square yard of bloom per minute. Therefore, the bumble bee colony strength was adequate for pollinating blueberry.	In this example, the average is less than the recommended 0.1 bumble bee. Therefore, colony strength was not adequate for pollinating blueberry.

Insecticides and Bumble Bees

Bumble bees, like all other bees, are susceptible to most chemical insecticides. During bloom, ***Bt*** is the only nontoxic pesticide that may be used. The Web site for Koppert, http://www.Koppert.com/ , includes information on the persistence and compatibility of pesticides with bumble bees and other beneficial insects.

Multiple Use of Colonies

Often colonies are very strong after pollinating blueberries. Research has shown that strong colonies can be moved to cranberry to provide excellent pollination of that crop. The management of bumble bees in cranberry beds is similar to that for blueberries.

If your colonies are still active after cranberry bloom, they should be moved to a field with abundant blooming wild flowers, preferably a blueberry field that will be in production the following spring. Under favorable conditions, the new queens produced may mate, hibernate during the winter, and emerge to

help pollinate next spring. They probably will not use the old quads but instead make new nests in the ground.

Moving Colonies to a New Location

Moving bumble bee colonies is similar to moving honey bee hives. Protective gear must be worn. Use a veil, gloves, a heavy-duty long sleeved shirt, and long pants. Over time the wood of the quads often warps, making the entrances difficult to close and often causing tears in the screening. The best way to seal the entrances and any tears is with heavy-duty duct tape. This should be done at night, ideally with two people: one person to seal up the front and the other to simultaneously seal the rear. Work quickly and gently so as not to stir up the bees. Transport the quads to their new location, which should be at least one mile away from the previous field. Set them up in the early morning while it is still cool so that the bees do not become heat-stressed.

Sustainable Pollination Strategy

A mixed or combination pollination strategy of two commercial pollinators, such as bumble bees and honey bees, may be the most sustainable approach to ensuring good pollination. Consider using some B. impatiens to ensure pollination, above background levels of native bumble bees in case it is a cool rainy spring.

A good combination to consider is: 1.5 bumble bee colonies to 1.5 honey bee hives, which will give you 1/2 B. impatiens and 1/2 honey bees. Ideally, set the bumble bees and honey bees at opposite ends of the field to minimize robbing. Also, both bee yards will need electric fences to protect against bears.

Suppliers of B.impatiens:

John P. Wolf, Technical Advisor
Koppert Biological Systems
28465 Beverly Road
Romulus, MI 48174
Phone: 734-641-3763 Fax: 734-641-3793
Web: http://www.koppert.com/

Local Representative:
Jon Antil
Harmon Mountain Farm
HCR 71, Box 231, Route 192
Northfield, ME 04654
Phone: 207-255-4010

Biobest
Richard Gerhart
International Technology Services
Phone: 303-661-9546
Email: its@intertechserv.com

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Fact sheet prepared by C. S. Stubbs, F. A. Drummond, and D. E. Yarborough, The University of Maine, Orono, ME 04469. January 2000. (Revised April 2002)

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