



# Wild Blueberry FACT SHEET



## How To Manage Alfalfa Leafcutting Bees for Wild Blueberry Pollination

Fact Sheet No. 300, UMaine Extension No. 2413

Research conducted at the University of Maine has found the alfalfa leafcutting bee to be a good pollinator of wild blueberry. It is particularly suited for pollinating large, weed-free fields. This fact sheet is designed to give you step-by-step basic information on how to obtain, store, incubate and handle the alfalfa leafcutting bee for wild blueberry pollination in Maine.

### Step 1: Ordering Bees and Equipment

Generally, bee orders are placed in the early winter from suppliers located in the United States and Canada. A list of suppliers of bees and equipment is provided in this fact sheet.

Quality is an important factor to consider when ordering bees. The supplier should provide you with the following information about the quality of their bees: the percentage of females (sex ratio), parasitism and disease rates, and live count information (how many bees can be expected from one pound of leaf cells). Excellent quality bees have: a 1 female to 2 male sex ratio; low parasitism (less than 2 percent); no disease; and a live count of at least 4,700 bees/lb. of leaf cells.

You will need to order 2 gallons of leaf cells per acre. (One gallon contains about 10,000 developing bees) If, for example, you plan to pollinate a ten acre blueberry field, you would order 20 gallons of bees (leaf cells).

The supplier will send you alfalfa leafcutting bee prepupae, which are protected within their individual leaf cells. (Some suppliers refer to leaf cells as cocoons.) To make certain that at least 89 percent of the leaf cells contain healthy, living, developing bees, upon receipt of the prepupae, dissect a random sample (approximately 100 cells). One dissection method is the following: with a sharp razor blade cut the cap off one end of the leaf cell and, with forceps, gently remove the prepupae. Healthy prepupae are cream colored and move slightly when prodded at room temperature. If less than 89 percent of your sample is healthy, contact your supplier immediately.

A variety of shelter types and sizes as well as nesting materials are available from suppliers. You also have the option of making your own. (Figure 1 and 2 show examples of hand-made equipment commercially available). Factors to consider include costs, durability, heat retaining ability, and ease of transport. Each female bee will need a minimum of two nest tunnels. Painted designs on the front of nest materials help females locate their nests.



Figure 1. Handmade wooden bee shelter.



Figure 2. Commercially available bee shelter.

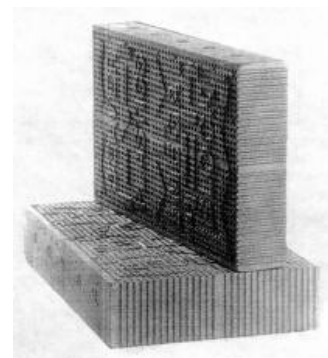


Figure 3. An example of commercially

## **Step 2: Cool Storage**

Prepupae need to be kept dormant until approximately one month prior to the onset of blueberry bloom. Cells can be stored anywhere that is cool, dry, and free of rodents and other pests. For both storage and incubation, maintaining the proper temperature and humidity are crucial. Prepupae must never be exposed to either sub zero temperatures or temperatures above 90 degrees F.

Producers of bees store their cells at 42 to 48 degrees F. Store leaf cells that have been exposed to varying temperatures during shipment at 48 to 50 degrees F. The humidity should be less than 50 percent at all times. Otherwise, the leaf cells may mold. During storage, monitor the temperature and humidity daily. Once a week, check the leaf cells to make certain that they are mold-free.

## **Step 3: Incubation**

Exposing the leaf cells to warm temperatures (incubation) breaks dormancy and causes the prepupae to develop into adult bees. At a constant temperature of 86 degrees F, bees will be ready for release in 24 days. For most blueberry producing areas of Maine, incubation should begin around April 11 or approximately 30 days prior to the onset of bloom. This will allow for the possibility of bloom starting earlier than usual.

The incubation area or room needs to be at least 2 ft x 4 ft. Install black lights with water traps (trays with water) to capture parasites. The additional references listed in this Fact sheet provide more details on incubator designs and set-up.

Remove the leaf cells from cool storage. Spread cells out to a depth of two inches in incubation trays. Leave the trays uncovered at this point in order to rear out, and kill the parasites that will emerge at least a week before any bees do. The leaf cells need to acclimatize before exposing them to relatively high temperature. After 8 to 10 hours at 68 to 72 degrees F, gradually increase the temperature to 80 to 86 degrees F.

Throughout the incubation process, maintain the 80 to 86 degrees temperature; fluctuations greater than these result in an uneven hatch. The humidity must be at least 60 percent (with 70 percent humidity being ideal) or the bees' wings will not develop properly. Check the temperature twice a day because temperatures above 90 degrees F are lethal to the bees. The bees produce heat as they develop with the center of tray becoming the warmest. Thus, throughout the incubation period it is necessary to stir the leaf cells every day so that all cells get the same amount of warmth.

For further parasite control in addition to the black light water traps, on Day 7 of incubation, place dichlorvos (Vapona™) strips in incubator (3/4 strip per 1000 cubic ft of incubator space). Parasites will emerge on Days 8 to 12. If parasites are not controlled, they will reinfest the leaf cells. Dichlorvos strips are lethal to emerging bees. Strips must be removed on Day 13 and the incubator thoroughly aerated. The incubation trays are now covered with aluminum screening (the bees can chew through fiberglass screen; use standard window screen size mesh).

On Day 14, native leafcutting bees, *Megachile relativa*, begin emerging. They are relatives of the alfalfa leafcutting bee and develop more rapidly. They should comprise no more than one to three percent of your bees. On this day, cut open 10 cells from each tray to check development. Male alfalfa leafcutting bees will be turning black and females will begin darkening in color. On Day 18, males begin emerging; on Day 21 females began emerging. Turn off black lights to reduce stress to the bees. On Days 23 to 24, 75 percent of the females should have emerged and bees are ready for release in the field.

An advantage of the alfalfa leafcutting bee is that there is leeway in the incubation process. If it appears that blueberry bloom will be delayed, then any time from Day 14 to 22 the incubation process can be slowed by lowering the air temperature to 60 degrees F. Never, however, reduce the incubation temperatures prior to Day 14. (See Table 1 for a summary of the incubation process).

## **Step 4: Field Release**

Before release, set up shelters with adequate nest materials. The shelter opening should face

east/southeast. The number of shelters needed and the spacing between shelters will depend on field size and the stocking density per shelter you decide on.

Shelters must be firmly secured to the ground to prevent winds from blowing them over. Shelters should not be placed near field-forest edges or near alternate forage plants because, just like the honey bee, the alfalfa leafcutting bee prefers flowers other than blueberry. Avoid locations near ant nests as ants prey on bees.

There must be at least five percent bloom in the field near the shelters or the bees will disperse; 10 percent bloom is ideal. If you can't release the bees right away, keep them at 50 degrees F in darkness for several days to prevent mortality.

Keep bees covered, cool, and in the dark during transport to the field. Cool, drizzly days are ideal, or as early in the morning as possible (before sunrise). Never release bees during high winds since wind will disperse the bees away from the shelter.

Cover the trays with 1/4 inch wire-mesh hardware cloth to prevent mice and birds from preying on the bees. Place the incubator tray or trays, depending on the shelter's capacity, in the shelter. Trays should sit in the path of sunlight, but not directly on the ground.

### **Step 5: The Pollinating Period**

Mating will take place for several days. Females begin bringing leaf material within the first week of release for nest production. Females actually begin pollinating almost immediately after release because they need to feed on pollen for their ovaries to properly develop.

**During bloom, check on the bees regularly.** Note when the first nest tunnels are capped. Remove the incubation trays after 7 to 10 days from the shelters.

Many insecticides are lethal to the alfalfa leafcutting bee. Residue on leaves must also be avoided because the bees use leaves for cell construction. Do not apply insecticides during bloom.

### **Step 6: Bee Management after Blueberry Bloom**

Individual females may live as long as three months, which is far longer than blueberry bloom. If you are interested in producing leaf cells for the following year, the bees must have alternate forage after blueberry bloom ceases. Examples of suitable forage plants are alfalfa, buckwheat, dandelion, and red clover. This new forage should never be sprayed with insecticides.

Bees can be moved to new forage in the evening. After the females stop flight for the day (generally before 7 p.m.), cover the nesting materials with plastic, such as large plastic garbage bags. Always make certain the bees are kept cool during transport.

### **Step 7: End of Season Handling**

Leaf cells must be kept at 70 degrees F for three weeks so that all eggs hatch, and larval feeding and cocoon spinning can take place. To determine the developmental stage, remove a few cells from the nesting materials and dissect them. After the cells are hardened off completely, they can be removed from nesting materials, tumbled to get rid of excess leaf material, and stored at 42 to 48 degrees F as described above.

### **Cost of Using the Alfalfa Leafcutting Bee**

Costs will vary depending on the price of bees per gallon and the amount and the type of equipment used. Your minimum investment will include:

Alfalfa leafcutting bees. On average bees have cost \$45 to \$50 per gallon for the past 10 years. We recommend a stocking rate of two gallons per acre.

**Nesting materials.** Commercial nesting materials range in price from \$17 to \$35 per acre (Figure 3). Home-made drilled blocks would cost less but lead to disease problems if not properly sanitized and phased-out periodically.

**Shelters.** Commercial shelters generally are designed for the pollination of five-acre tracts and range in price from \$140 to \$300. We have constructed plywood shelters designed for pollinating a one-acre tract for \$20 per shelter.

Approximate start-up costs for 10 acres:	
10 wooden shelters	\$200
20 nesting blocks	\$ 500
20 gal. leaf cells	<u>\$1000</u>
Total	\$1,700

After the first year, the only additional expense will be purchasing leaf cells. How many you will need to purchase will depend on how well the bees reproduced. (The above calculation does not account for costs associated with incubating the bees in the spring or stripping newly produced leaf cells in the late autumn.)

### **Additional Information on the Rearing, Handling and Management of Alfalfa Leafcutting Bee.**

Successful alfalfa leafcutting beekeeping is both a science and an art. This fact sheet provides you with the most information on how to use leaf cutting bees to pollinate blueberry plants. Always remember that proper temperature and humidity during storage and incubation are crucial to success.

**Practice Makes Perfect.** The first time you order alfalfa leafcutting bees, a "practice" or "trial run" is advised. We suggest that as soon as they arrive, you rear out some adult bees in a covered, small plastic tray from about 500 leaf cells. This can be done even at room temperature in your kitchen (no cooler than 72 degrees F.) Dissect 2 to 3 cells every three days. Although these "practice run" bees will develop more slowly than if incubated at 85 degrees F you will be able to follow and become familiar with all the stages listed in Table 1. (Do not use black lights, water traps or Vapona TM for the practice run. Preserve any emerging parasites in alcohol in a small vial for later identification by a bee specialist.)

**More Knowledge Increases Success.** You can increase your knowledge about these bees in several ways:

- consult with experienced personnel (Call the Bee Hot Line 1-800-897-0757);
- take a practical "hands on" course in their handling;
- read more about the bee's biology and the techniques involved in managing them.

The selected references listed below are a good place to begin. Also, ask suppliers if they will send you information.

### **Selected Alfalfa Leafcutting Bee References:**

Meyer, Ron and Dean McBride. 1989. "*Alfalfa Seed Production and Leafcutting Bee Management*". NDSU Extension Service, Fargo, North Dakota.

Murrell, Dorothy. 1990. "*Alfalfa Seed and Leafcutter Production in Saskatchewan*". Saskatchewan Agriculture and Food, Soils, and Crops Branch Bulletin (March 1990).

Peterson, Stephen S., Craig A. Baird, and Ron M. Bitner. 1992. "*Current status of the alfalfa leafcutting bee, *Megachile rotundata*, as a pollinator of alfalfa seed*". *Bee Science* 2(3):135-142.

Richards, Kenneth W. 1984. "*Alfalfa Leafcutter Bee Management in Western Canada*". Agriculture Canada Publication 1495/E.

Richards, Kenneth W. 1987. "Alfalfa leafcutter bee management in Canada". *Bee World* 68(4):168-178.

**Table 1.** Incubation and Bee Developmental Timetable  
 (Adopted from Dorothy Murell's "A Calendar of Incubation for Alfalfa Leafcutting Bees")

DAY	EVENT
1	Leaf cells containing prepupae are placed in incubator. Incubator is at 85 degrees F, 70 percent RH. Black lights and water traps are operational.
7	Place dichlorvos (Vapona TM) strips in incubator.
8	Final molt into pupal stage. Especially sensitive to temperature fluctuations, so no cooling at this time!
8 and 9	Parasites begin emerging.
10	Pupae at pink-eye stage.
13	Pupae at dark eye stage. Remove dichlorvos strips from incubator. Aerate incubator with exhaust and circulating fans for 24 to 48 hours.
14 and 15	Native leafcutting bees, <i>Megachile relativa</i> , emerge.
14 to 22	Safe period for slowing the developmental process by lowering incubator temperature to 60 to 65 degrees F.
16	Early hatching bees (males) are completely dark in color. Females (later hatching than males) are turning dark.
18 and 19	Males begin emerging.
21 and 22	Females begin emerging. Turn off black lights.
23 and 24	Peak emergence of females. Bees should be ready for field release.

### Suppliers of Alfalfa Leafcutting Bees and Nesting Materials

No supplier or product endorsement is implied, nor is discrimination intended against other sources.

**Beaver Plastics Ltd.**  
 12150 160 Street  
 Edmonton, Alberta  
 Canada T5V 1H5  
 phone: (403) 453-5961  
 fax: (403) 4533955

**Eggerman Farms Ltd.**  
 P.O. Box 242  
 Watson, Saskatchewan  
 Canada S0K 4V0  
 phone: (306) 287-3780  
 fax: (306) 287-3519

**Don Nikonetz**  
 Don Nikonetz Farms  
 Box 1469  
 Hudson Bay, Saskatchewan  
 Canada S0E 0Y0  
 phone/fax: (306) 865-3570  
 cell: (306) 865-7887  
 email: [doni@sk.sympatico.ca](mailto:doni@sk.sympatico.ca)

**International Pollination Systems** (for sales information call 1-800-990-1390)

**Ron Bitner, Ph.D**  
16645 Plum Lane  
Caldwell, Idaho 83605  
phone: (208) 454-0086  
fax: 2(08) 454-0092

**Paul Gregory, P.AG**  
Lee Gregory  
Box 190, Fisher Branch  
Manitoba, Canada R0C 0Z0  
phone: (204) 372-6290  
fax: (204) 372-6635

**Stephen Peterson, Ph.D.**  
6035 W. School Ct.  
Visalia, California 93291  
phone: (209) 289-3442  
fax: (209) 734-1136

**Northstar Seed Ltd.**  
PO Box 2220  
Neepawa, Manitoba  
Canada R0J 1H0  
phone: (204) 476-5241  
fax: (204) 476-3773  
e-mail: [northstar@mail.techplus.com](mailto:northstar@mail.techplus.com)

**The Barry Wolf Farm**  
PO Box 6  
Carrot River, Saskatchewan  
Canada S0E 0L0  
phone: (306) 768-3518  
fax: (306) 768-2636

**Canadian Leafcutters**  
Regina, Saskatchewan  
Canada S4T 6N4  
phone: (306) 585-3318  
e-mail:  
[canadianleafcutters@gmail.com](mailto:canadianleafcutters@gmail.com)

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