

Fall and Winter Management of Alfalfa Leafcutting Bees - 2020

*D.W. Goerzen, Research Scientist
SLA / SASPDC - Saskatoon*

Removing Alfalfa Leafcutting Bee Nests from the Field

Alfalfa leafcutting bee nests are generally removed from field shelters once they reach a level of 70-80% capped tunnels; this protects the nests from weather, rodents, and birds, and prevents re-drilling into capped tunnels by female leafcutting bees. Depending on the date, and on the number of working female bees still present in the field, filled nests may be replaced with empty nests; this is a management decision which becomes easier with experience. Too much available nesting space will result in high numbers of partially completed tunnels, necessitating extra work in harvesting these nests with little return. Too little nesting space may result in loss of potential bee reproduction. Producers are generally advised to allow two or three tunnels per female bee and to add new nests after the filled blocks have been removed from the field.

Once alfalfa bloom is finished and the bee population has noticeably decreased, most of the remaining nests may be removed from the field. The nests with fewest capped tunnels are the last to be removed. In a cool wet season, nests should be brought in promptly since mould problems will develop rapidly; this is not as critical in hot dry weather conditions.

Nest Storage Period Prior to Bee Cell Harvesting

The minimum storage temperature required for development from the alfalfa leafcutting bee egg stage to the prepupal diapause stage is about 20 degrees C. Nests should be stored for three weeks at this temperature, or less time at a higher temperature, in order to allow all of the developing bee larvae to finish the process of feeding and spinning their cocoons. Leafcutting bee cells will then be rigid enough to withstand normal harvesting procedures. Bee cells should feel dry and hardened, not soft or moist.

Mould Control during the Fall Nest Storage Period

It was once recommended that nest backing material be removed and nests stacked on their sides in order to allow for air movement and evaporation of excess moisture from polystyrene nest blocks (especially in humid weather), thus reducing the potential for mould problems. However, while removal of nest backing material can be useful in controlling mould build-up, it also creates the potential for re-parasitism by making bee cells accessible to chalcid parasites, which can enter the storage area as adult parasites in the nests or emerge from parasitized cells during the fall nest storage period prior to bee cell harvesting. A compromise between effective mould control and control of re-parasitism can involve maintaining nests with the backing on during the initial three-week warm storage period, then removing the nest backing once the temperature is cooled, so that any late-emerging parasites are inactivated by the cooler temperature (below 15 degrees C). Air circulation, exhausting of moist air, and the use of dehumidifiers may be necessary to lower moisture levels in polystyrene nest blocks.

Drying Alfalfa Leafcutting Bee Nests

As noted above, polystyrene nest blocks may require drying through air circulation or through active dehumidification in order to facilitate harvesting of bee cells. The nests should be kept at a cool temperature under conditions which promote drying until bee cells can be easily removed from tunnels throughout the entire nest.

Polystyrene nest blocks easily take up moisture, and producers who have left the blocks in winter storage until April or May often find that the blocks are once again very moist and the bee cells difficult to harvest, with resulting crush damage to the cells. Producer experience suggests that the best time to harvest bee cells from nests is between November and March. Nests must be stored until bee cell harvesting at normal winter storage temperatures of 5 - 8 degrees C both before and after bee cell removal, so the spring bee incubation period is not adversely affected.

Fall Parasite Control

Chalcid parasites found in alfalfa leafcutting bee nests during the fall storage period represent a threat to the alfalfa leafcutting bee population since they will attempt to parasitize developing bee larvae and diapausing prepupae, causing a decrease in bee cell live count and an increase in numbers of parasitized cells. Unfortunately, the practice of removing nest backing material in order to dry the nests also allows for easy access by parasites to bee cells exposed at the uncovered backs of polystyrene nest blocks. As discussed previously, the removal of nest backing material is not recommended until after the initial three-week warm storage period is completed and the storage temperature has been lowered to below 15 degrees C.

Deployment of ultraviolet light / water-traps in the alfalfa leafcutting bee nest storage area will help to control chalcid parasites in the fall. For ultraviolet light / water traps to be effective, the storage area should be insect-proof and light-proof. Emerging second generation adult bees will also fly to the ultraviolet light / water traps, as will moths and other insects. Studies on the use of dichlorvos resin strips for fall parasite control have indicated that exposure of polystyrene nest blocks with backs removed to dichlorvos resin strips at a rate of 0.75 strip per 1000 cubic feet for up to seven days will not harm alfalfa leafcutting bee prepupae within the nest blocks.

Harvesting, Tumbling, and Storage of Bee Cells

Once all bee larvae have spun their cocoons, the storage temperature is reduced to below 15 degrees C to prevent further development, and emergence of second generation bees and parasites. Alfalfa leafcutting bee cells should be harvested, tumbled, and placed in cold storage as soon as possible to avoid problems with mould, parasites, stored product pests, and mice. Temperature fluctuation may affect the alfalfa leafcutting bee live count and should be avoided.

There are many methods of harvesting cells from alfalfa leafcutting bee nest laminates and nest blocks. During the bee cell harvesting process, it is important to ensure that bee cells are not crushed or damaged, and that the nest laminates / nest blocks are not chipped or broken. Tumbling of harvested bee cells will help to remove empty cells and leaf debris, thus reducing the volume of material to be stored. Tumbling also assists in the removal of pollen balls, mouldy cells, bee cadavers, and stored product pests. A major problem with many bee cell tumblers is the mould spores and dust which they release into the air. Producers may find themselves becoming more sensitive to this dust each year and in some cases serious allergies can develop. It is recommended that tumbling be done outside or in an open shed with good ventilation, or that the tumbler be connected to a vacuum system which vents outside. Face masks or respirators should also be worn for added protection.

Commercial alfalfa leafcutting bee cell breakers are also available. The cell breaker breaks sequences of bee cells into single cells, allowing the emerging leafcutting bees to chew out of their individual cells without having to pass through other cells and possibly contact developing bees or diseased bee cadavers. The alfalfa leafcutting bee cell breaker is also useful in reducing bee cell volume by removing leaf debris, empty cells, pollen balls, and bee cadavers. The cell breaker must be carefully adjusted to avoid damaging or crushing the bee cells.

Bee cells which pass through a cell breaker should be decontaminated the following spring to destroy fungal spores which may be spread over bee cell surfaces during the bee cell-breaking process. After completion of the harvesting and tumbling operations, alfalfa leafcutting bee cells should be placed in containers and then held in cold storage. Cardboard boxes, cardboard drums, plastic pails, and large plastic bags have all been used to successfully store bee cells. Containers should have an adequate seal so that the cells do not absorb moisture. Cells should be stored at 5 - 8 degrees C to maintain diapause and render stored product pests inactive.

Containers of alfalfa leafcutting bee cells should be loosely stacked to allow for adequate air flow among the containers. A lack of air circulation within a tight pile of containers can allow bee cells in the centre of the pile to begin heating, causing bee prepupae to break diapause and begin development. Once diapause has been broken due to accidental heating, re-cooling of the bee cells will cause mortality in many of the prepupae which have begun to develop. Stored alfalfa leafcutting bee cells should be checked regularly for problems with heating and moisture build-up. If the bee cells become damp or mouldy during winter storage, they may be spread out to dry and then re-packed when they feel dry and hardened.

Sampling Alfalfa Leafcutting Bee Cells for Quality

Sampling bee cells from the alfalfa leafcutting bee population is an important part of maintaining and increasing the quality of the bees. Bee cell lots can be mixed together or kept separate according to the type of nest material used, field location, or individual shelter location. A random sample of each bee cell lot should be kept for analysis after the bee cells have been harvested, tumbled, and stored.

Producers can submit alfalfa leafcutting bee cell samples to the Canadian Cocoon Testing Centre (Brooks, Alberta) for independent analysis. Information on the Canadian Cocoon Testing Centre may be found on the SLA / SASPDC web-site (<https://www.saspa.com>). Bee cells can also be analysed by the producer. To do this, several bee cell samples are weighed out and analysed, with the results then used to calculate the number of bee cells per unit weight. Each bee cell is carefully cut open to determine the cell contents; razor blades and utility knives work well for this purpose. The cells are separated into various categories, such as the following:

- live bee prepupae
- parasitized bee cells
- pollen balls
- dead bee larvae / prepupae
- second generation bees

The "live bee prepupae" totals are used to determine the number of healthy bee cells per unit weight. The alfalfa leafcutting bee cell live count is then calculated using the appropriate formula as outlined below, with examples given for sampling 30 grams of bee cells (2 x 15 gram samples) and for sampling 60 grams of bee cells (4 x 15 gram samples):

$$\begin{array}{l} \text{Number of live bee prepupae per 30 grams} \times 15.14 = \text{Live count per pound} \\ \text{Number of live bee prepupae per 60 grams} \times 7.57 = \text{Live count per pound} \end{array}$$

In addition to determination of live count, alfalfa leafcutting bee sex ratio can be determined by incubating a random sample of bee cells. Small incubation trays can be constructed from 10 x 10 grids of egg crate light diffusion material, covered on each side with a piece of glass or plexiglass; each tray will hold 100 cells. Incubation of the bee cells is then undertaken in an enclosed space where a constant temperature of about 30 degrees C can be maintained. Bee cell incubation tests should be done after December 31 in order to give alfalfa leafcutting bee prepupae an adequate cold storage period; without sufficient time in prepupal diapause, the period of incubation to adult bee emergence will be prolonged.