FALL AND WINTER MANAGEMENT OF ALFALFA LEAFCUTTER BEES 2011

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Removing Alfalfa Leafcutter Bee Nest Blocks from the Field

Alfalfa leafcutter bee nest blocks are generally removed from field shelters once they reach a level of 70-80% capped tunnels, primarily to protect them from weather, rodents, and birds, and to prevent re-drilling into capped tunnels by female leafcutter bees. Depending on the date and on the number of working female bees still present in the field, filled nest blocks may be replaced with empty nest blocks; this is a management decision which becomes easier with experience. Too much available nesting space will result in many partially completed tunnels, necessitating extra work in harvesting the nest blocks with little return. Too little nesting space may result in loss of potential bee reproduction. Most producers allow two or three tunnels per female bee and generally add new nest blocks 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 nest blocks may be removed from the field. The nest blocks with fewest capped tunnels are left to the last. In a cool wet season, nest blocks should be brought in promptly since mould problems will develop rapidly; this is not as critical in hot dry weather conditions.

Nest Block Storage Period Prior to Bee Cell Harvesting

The minimum storage temperature required for development from alfalfa leafcutter bee egg stage to the prepupal diapause stage is approximately 20 degrees C. Nest blocks 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. Leafcutter bee cells will then be hard enough to withstand normal harvesting procedures. Bee cells should feel dry and hardened, not soft or moist.

Mould Control during the Fall Nest Block Storage Period

It was once recommended that nest backing material be removed and nest blocks stacked on their sides in order to allow for air movement and evaporation of excess moisture from the polystyrene nest blocks, especially in humid weather, in order to reduce 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 either enter the storage area as adults in the nest blocks or emerge from parasitized cells during the fall nest storage period prior to bee cell harvesting. A compromise between effective mould control and re-parasitism control may be to maintain nest blocks with backing on during the initial three week warm storage period, then remove 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 Nest Blocks

As noted above, polystyrene nest blocks may require active drying either with air circulation or with dehumidifiers in order to facilitate harvesting of bee cells. The nest blocks should be kept at a cool temperature under conditions which promote drying until bee cells may be easily removed from tunnels throughout the entire block. 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 nest blocks is between November and March. The nest blocks 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 that the spring bee incubation period is not adversely affected.

Fall Parasite Control

Chalcid parasites found in alfalfa leafcutter bee nest blocks during the fall storage period represent a threat to the alfalfa leafcutter 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 the 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 leafcutter bee nest block 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 nest blocks with backs removed to dichlorvos rates of 0.75 strip per 1000 cubic feet for up to seven days does not harm the alfalfa leafcutter 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 any second generation bees and parasites. Alfalfa leafcutter 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 fluctuations, which may affect the live count, must also be avoided.

There are many methods of harvesting cells from leafcutter bee nesting 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 nesting laminates or nest blocks are not chipped or broken. Tumbling of harvested bee cells will help to remove empty cells and leaf debris, thus reducing volume. 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 dust and mould spores 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 strongly 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 repirators should also be worn for added protection.

Commercial leafcutter bee cell breakers are also available. The cell breaker breaks sequences of bee cells into single cells, allowing the emerging leafcutter bees to chew out of their individual cells without having to pass through a sequence of cells and possibly contact developing bees or diseased bee cadavers.

The leafcutter 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 cell surfaces during the cell-breaking process.

After completion of the harvesting and tumbling operations, alfalfa leafcutter bee cells should be placed in containers and then held in cold storage. Cardboard boxes, cardboard drums, plastic pails, and large garbage 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 leafcutter bee cells must be loosely stacked to allow for adequate air flow among the containers. The lack of air circulation within a tight pile of containers may 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 leafcutter 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 re-packed when they feel dry and hard again.

Sampling Alfalfa Leafcutter Bee Cells for Quality

Sampling the alfalfa leafcutter bee population is the only way to maintain and increase the quality of the bees. Bee cell lots may 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 tumbled and stored. Bee cell samples may be sent by alfalfa seed producers to the Canadian Cocoon Testing Centre (Brooks, Alberta) for independent analysis.

Bee cells may 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 expose 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
- dead bee larvae / prepupae
- second generation bees
- parasitized bee cells
- pollen balls

The “live bee prepupae” totals are used to determine the number of healthy bee cells per unit weight. The alfalfa leafcutter bee 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):

Number of live bee prepupae per 30 grams x 15.14 = Live count per pound

Number of live bee prepupae per 60 grams x 7.57 = Live count per pound

In addition to determination of live count, the alfalfa leafcutter 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. An incubator may be set up 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 to give alfalfa leafcutter bee prepupae an adequate cold storage period; otherwise, the bee incubation period will be prolonged.