

Honey Bees and Winterkill

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[Best management practices](#) | [Pest management](#) | [Acetic acid fumigation of dead outs](#)

After the unusually high overwintering losses during the winter of 2006-2007, beekeepers were concerned about honey bee health and what should be done to reduce bee winterkill. Because winterkill can be attributed to several possible causes, best management practices have been developed to provide beekeepers with some options to minimize the amount of winterkill in any given year.

Best Management Practices

Keep bee colonies strong: The management of bee colonies should be dynamic based on the type of operation, either honey production or pollination services. At times, beekeepers make many splits to replace their dead outs and to increase their number of colonies. This process could weaken the parent colonies and affect the bee population buildup. Additional feeding of pollen supplement and sugar syrup to bee colonies is required to offset some of these negative effects.

Queen presence in colonies: Beekeepers should make every effort to ensure that a healthy, mated queen is present in each colony. Poor acceptance, superseding and old queens could affect colony performance and the ability to overwinter. Only healthy populous colonies with abundant healthy young winter bees that are headed with young queens should be prepared for winter.

Development of winter bees: Beekeepers need to make enough room in August and September for the queens to lay eggs to produce winter bees. Winter bees are physiologically different from summer bees. They have a tolerance to withstand the winter. These winter bees should be protected from any damage caused by pathogens. Thus, they will be able to perform their duties as needed.

Feeding bees: The method of feeding bees and the types of bee food used to feed bees varies considerably among beekeepers. In Alberta, a large percentage of beekeepers feed bees sugar syrup using open drums full of the syrup. Other beekeepers use inner frame feeders, top hive feeders and pails.

Regardless of the type of feeder, beekeepers should provide the feed as quickly as possible and ensure that bees are able to complete feeding before cold weather arrives. Medicated feed should be protected from exposure to the sun to protect medication from any deterioration. To successfully survive the winter, bees must feed and store all medicated feed in the bee colonies.

When considering feeding protein supplements, beekeepers must ensure there is enough of a natural pollen supply for the production of young bees. Traditionally, pollen sources have been abundant. However, changing agricultural practices, planting new crops, increasing monoculture crops and the increasing number of colonies moved for pollination services of various crops have made it difficult for bees to have enough sources of pollen through the year. Additionally, poor flying conditions and drought may also cause pollen shortages. Therefore, the feeding of protein

supplements should be seriously considered by beekeepers in some operations and regions.

Pest Management

Chemical use in bee colonies: Beekeepers should check the annual recommendations provided by their Apiculture Program, Alberta Agriculture and Food, for important, useful information on pest management. Reports have shown that the incorrect application of chemicals can cause high kill and sub-lethal effects on honey bees. Follow the label instructions and apply only the recommended dose at the proper time to achieve full control of bee pests and to keep honey bees healthy.

Integrated pest management practices: Use an Integrated Pest Management (IPM) approach for pest control in honey bee colonies. This approach requires the following elements:

- **Pest identification:** It is critical for beekeepers to identify pests and diseases that could affect their colonies. Beekeepers must continually investigate and learn about new threats and become familiar with how to identify them. For confirmation of correct pest identification, beekeepers might consider sending samples to accredited laboratories for identification.
- **Monitoring pest and disease population:** Monitor the pest population in bee colonies through the year to determine infestation levels. Beekeeping has become complicated and requires more expertise than in the past. Once a beekeeper identifies a potential pest problem, monitoring the population and the spread in the bee operations becomes the key component for the development of IPM to control this pest. A beekeeper who monitors does not experience the anxiety of either worrying about the efficacy of applied treatments or the health status of colonies throughout the winter.
- **Action thresholds:** Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. Please check the Apiculture Program's annual recommendations, noted above, for defined action (or economic) thresholds for pests.
- **Control actions:** Once identification, monitoring, and action thresholds indicate that pest control is required and preventive methods are no longer effective or available, beekeepers then evaluate the proper control method both for effectiveness and risk. Effective pest controls are chosen to ensure the protection of bee health at the proper time.

Varroa mites: Varroa remains the most destructive honey bee pest. Recently, varroa mites have been implicated in transmitting viruses that could cause seriously high colony kill. Many of the pesticides currently used are failing, and mites are out of control in some regions. Beekeepers need to keep varroa under control by taking the following steps:

- Monitor the mite population in bee colonies to determine mite levels reaching defined thresholds, treatment time and control methods.
- Monitor before and after treatment to compare results and ensure that treatment was effective.
- Test varroa mites for resistance to Apistan and CheckMite before using either one for control of mites.

- Choose a combination of effective control methods as needed.
- Do not delay treatment. It is important to protect winter bees from any damage caused by mites.

Nosema: It has been reported that *Nosema apis* and *Nosema ceranae* have been found in Alberta. The Alberta survey showed that nosema is another possible serious cause of high winterkill. Beekeepers need to examine their bees for nosema and determine the infection levels. Beekeepers should consider taking serious steps to control nosema in their bee colonies throughout the year. The following steps are recommended:

- Survey bee colonies to determine nosema infection levels.
- Feeding fumagillin in sugar syrup in spring and fall should be considered by all beekeepers to keep the nosema levels below the economic threshold. Failure to feed bees medicated syrup in the fall highlights a major problem in the method of applying fumagillin to bee colonies. The cold prevents the bees from feeding and storing enough medicated syrup in bee colonies. Therefore, finding effective methods for applying fumagillin to the colonies has become necessary to avoid the failure of treatments for nosema.
- Ensure that bees will take all medicated feed before wintering. When the weather gets cold, bees will not be able to fly and feed on the medicated syrup in drums. Beekeepers should then consider using top hive feeders or inside hive feeders to ensure that bees will feed on medicated syrup before wintering. If the brood boxes are plugged with honey, beekeepers are advised to replace three honeycombs with empty combs to make room for the bees to store the medicated sugar syrup for winter use.
- Disinfect dead outs using irradiation or acetic acid before re-using in the operation. Dead outs could have combs infected with nosema and other pathogens, so it is possible that re-using infected dead out boxes will infect the new colonies.
- Research has shown that a simple method to kill nosema spores on combs or in hive boxes is to use 60 per cent acetic acid with approximately 2 ml per liter volume of the hive box. For example, if a hive box has a volume of 25 liters, then 50 ml of 60 per cent acetic acid would be used. The acetic acid is put in a dish in an empty box placed on top of a stack of dead out boxes. The top box is closed with a lid, and the acid is allowed to evaporate to disinfect the combs and boxes. Other research suggests 80 per cent acetic acid, and after fumigation, equipment should be aired for at least two days. See the last section in this factsheet for more information on this method.

American Foul Brood (AFB): Follow the annual recommendations from the Apiculture Program for the control of AFB. Do not let neighboring colonies rob out AFB-infected colonies. Remove dead outs as soon as possible from apiaries to reduce the chance of robbing these hives. AFB-infected colonies are on the rise, and neglected dead outs are scattered throughout the countryside. Antibiotics are only used to treat the active form of AFB, which does not affect spores. Consider burning infected hives, irradiation and shaking bees on new foundations as a long-term solution to the problem.

- Do not combine a sick colony with a healthy one. The sick colony will contaminate or infect the strong, healthy colony. Treat and strengthen the sick colony until it is cured.

- As a general rule of thumb, use alternative management approaches to minimize the use of chemicals in bee colonies, to lessen bee exposure to potentially toxic chemicals and to reduce the risk of contaminating honey with antibiotic residues.

Many beekeepers are already using some of these recommendations. Beekeepers will find that the above integrated approach of recommendations will reduce any stress or combination of stresses (pathogens, chemicals, genetics, varroa, etc.) on their bee colonies. These stressors can suppress a bee's immune system and potentially cause high winterkill.

It is best to address all aspects of colony health, so honey bees survive and continue to be productive.

Acetic Acid Fumigation of Dead Outs

Acetic acid is known to be effective as a sterilizing agent against nosema and also helps with the problem of waxmoth. The acid will kill both the eggs and adult waxmoth, but not necessarily the bigger larvae. Acetic acid fumigation is the simplest way for beekeepers to sterilize combs contaminated with nosema spores. It is suggested that beekeepers use acetic acid as a normal routine preventative method to help guard against nosema.

When using the acid, remember:

1. It is corrosive and will attack metal and also concrete.
2. It needs careful handling; use the correct personal protective equipment.
3. It is recommended that beekeepers in Alberta use 80 per cent acetic acid (Shimanuki in *The Hive and Honey Bee* published by Dandant & Sons, Inc., 1992).
4. Store in the original, labeled container.

Acetic acid is used in the following way:

1. Stack five brood/super boxes with combs to be sterilized on a board or a solid hive floor with the entrance blocked off. The fumes of acetic acid are heavier than air and will travel from the top to the bottom of the stack and pour out of the bottom if there is a gap or holes.
2. Place a non-metallic tray (saucer or similar container) on the top of the frames of the top box, and place 600 ml of 80 per cent acetic acid in the tray (120 ml/box). Then, place an empty hive box on the top of the stack.
3. Close off the empty box on the top of the stack with a hive cover. Seal any joints between the boxes with wide adhesive tape to stop fumes escaping.
4. Leave the stack for about one week for the fumigation to proceed. Then, carefully remove the acid trays from the top box.
5. Allow the brood/super boxes to air off thoroughly for at least two days before use.