Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Animal Biosecurity

Alfalfa Leafcutting Bee Producer Guide to the National Bee Farm-Level Biosecurity Standard

Growing Forward
A federal-provincial-territorial initiative

Canada

Acknowledgments

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About This Document

Why a National Standard?

The National Bee Farm-Level Biosecurity Standard forms the basis of a comprehensive voluntary program designed to provide practical guidance for owners or managers involved in the three main Canadian bee sectors; honey bees, alfalfa leafcutting bees, and bumblebees.

The objective of a National Standard is to provide a consistent, country-wide approach to the implementation of biosecurity practices for both small-and large-scale operations. The development of farm-level biosecurity standards is a national initiative within and across agriculture industries, including both animals and plants. Beekeeping was identified as a priority sector for the development of a voluntary farm-level biosecurity Standard.

Value of the Canadian Bee Industry

Many crops are reliant on pollination by managed bee species. The pollination value of bees, including alfalfa leafcutting bees, is difficult to estimate, but is in the hundreds of millions of dollars. Alfalfa leafcutting bees are used to pollinate alfalfa seed fields in Alberta, Saskatchewan, and Manitoba – a crop that is valued at $40 million. Alfalfa leafcutting bees also provide about half of the pollination required for hybrid canola seed production – a crop that is valued at $325 million in farm-gate receipts annually – along with other legume seed crops and lowbush blueberries.

Who is this document for?

The National Standard has been developed as a tool for all people and businesses handling and keeping bees. This Producer Guide provides practical guidance to alfalfa leafcutting beekeepers on how a series of target outcomes, associated with each topic covered by the National Standard, may be achieved.

What is biosecurity and why is it important?

Farm-level biosecurity is a series of management practices that are designed to minimize the introduction and spread of disease-causing pathogens, parasites, insect pests, and predators (referred collectively as “pests”) onto, within, and beyond the farm.

An effective biosecurity program is based on the understanding and application of measures to minimize the transmission of pests in animal and plant populations, including their introduction (bioexclusion), spread within the populations (biomanagement), and release (biocontainment). When a component of the program has a weakness, or where biosecurity

measures are not fully implemented, it provides a route by which pests might enter or remain in a bee population.

The risk of exposing healthy bees to pests occurs when infected or infested bees, or equipment, are introduced to an operation. This can occur through intentional introductions or unintentional mixing of bees from other operations. Training, monitoring, preventative management practices (including equipment and facilities design), and timely treatment interventions are necessary to mitigate these risks.

Canadian Loose Bee Cell Management System

The loose bee cell management system, developed in Canada and used by Canadian producers of alfalfa leafcutting bees, is the cornerstone of leafcutting bee biosecurity management in this country. This system requires that bee cells are extracted from nests, allowing for treatment and sanitation practices to be followed for bees and bee equipment, thus enabling the control of biosecurity risks, including pathogens, parasites, and insect pests.

What are the benefits?

Some of the potential benefits of enhanced biosecurity management to the industry and individual beekeeping operations are as follows:

- less risk of exposure, introduction, and spread of pests
- less time and money spent on treatments
- better bee reproduction by healthier bees
- reduction in bee mortality during storage
- improved domestic and international marketability of bee cells
- improved reputation for healthy bees; a benefit if selling bee cells, used equipment, or providing pollination services
- less chance of developing treatment resistance
- less chance of devastation from the introduction of a new risk
- improved ability to trace back the sources of pests and thus apply management practices to other at-risk bees in a beekeeper's operation.
- continuation of inter-provincial and international trade if there were a serious outbreak elsewhere
- avoiding unnecessary management through appropriate pest monitoring, testing, and treatment evaluation.
- earlier detection of biosecurity risks
- less risk of errors when administering treatments
- less time spent on equipment repair and replacement
- preventing entry of rodents that can cause damage to bee equipment, consume bee cells, and increase susceptibility to pests
- reducing exposure of bee cells to unfavourable temperature, humidity, and air circulation conditions during storage
- preventing the degradation of treatment products
- improving cleaning and disinfection efficacy.
- less time and money spent on treatments
- less requirement for culling equipment and supplies

Document development

The background work that was carried out for the *National Bee Farm-Level Biosecurity Standard* and respective producer guides prioritized the biosecurity interventions that have the most effect on reducing the risk of spread of contagious pests. This program is based on clear and scientifically justified principles. It details a range of measures that are intended to prevent pests from entering or leaving a location where bees are kept. The Standard addresses management practices that promote general bee health.

A set of target outcomes, described in this guide, were developed with significant contributions from representatives of the various beekeeping sectors, including the Bee Biosecurity Advisory Committee (BeeBAC), whose membership represents all potential users of this document. The Committee identified areas of practical effective controls, using an objective, impartial approach that drew on published research, existing regulations, recognized management practice manuals, and treatment recommendations.

Development of the Standard and Producer Guides involved participation, consultation, and review from

- all provincial apiarists
- producer associations
- The Canadian Honey Committee (CHC)
- alfalfa leafcutting bee industry associations (Alberta, Saskatchewan, Manitoba)
- bumblebee industry experts and researchers
- Office of Animal Biosecurity (Canadian Food Inspection Agency [CFIA])

Direct producer input was achieved through

- a series of on-farm case studies.
- comprehensive management practice benchmark consultations. All identified active producers in the honey bee and alfalfa leafcutting bee sectors in Canada were invited to participate. Over 600 honey beekeepers (10% of over 6000 beekeepers) and 86 alfalfa leafcutting bee producers participated (28% of over 300 producers).
- selected interviews with suppliers and users of bumblebees for pollination of greenhouse and field crops.
- selected participation in document review teams.

How should this document be used?

The alfalfa leafcutting bee industry is dynamic. Undoubtedly, new strategies, products, and techniques to combat pathogens, parasites, and insect pests will evolve as the science behind beekeeping continues to advance. New risks will emerge. This document should therefore be considered a living document. The onus is on producers to continually update their knowledge and to consider current recommendations when implementing biosecurity management practices in their operation.

This Producer Guide does not provide a full and complete listing of all methods that can be used to address alfalfa leafcutting bee biosecurity, but it does include some existing beneficial practices and other examples to facilitate meeting the Target Outcomes of the National Bee Farm-Level Biosecurity Standard, while providing the flexibility required for a variable and complex beekeeping industry.

Not all of these principles will be applicable or practical for every situation, or every beekeeper.

Beekeepers should focus on achieving a satisfactory level of control in each component on their farm. However, for those who are new to the concept of biosecurity, those with limited resources, or where it is not practical or applicable to fully achieve each of the target outcomes, the Producer Guide provides a set of examples of measures that can be taken to meet the Target Outcomes.

This guide is meant to complement, not replace other resources such as alfalfa leafcutting bee production manuals, fact sheets, and recommendations from associations and alfalfa leafcutting bee specialists.

Keeping this in mind, the National Bee Farm-Level Biosecurity Standard and this Producer Guide have been organized into two sections.

- Bee Health Management
- Operations Management

Each section is subsequently divided into subsections that are introduced by a Target Outcome. Each Target Outcome represents a goal that all beekeepers, regardless of the size of their operation, should try to implement to protect their bees from introduction and spread of pathogens, parasites, and insect pests.

This is followed by a detailed description of the biosecurity topic, including applicable definitions.

Next, there is an explanation of the risks associated with the subtopics.

We describe the recommended practices used to reduce exposure or otherwise mitigate the impact of these risks. Finally, the suggested record-keeping processes are detailed.

Appendix A provides a list of additional resources, some regionally specific information, for farm-level bee biosecurity. Appendix B lists the provincial contacts. Appendix C provides a sampling protocol, and Appendix D outlines disinfection techniques. Appendix E is a sample record-keeping spreadsheet. Appendix F includes an annual beekeeping cycle diagram, as it relates to biosecurity practices, providing a visual reminder of how these practices fit into a beekeeping operation. Appendix G is the biosecurity checklist for alfalfa leafcutting bees. Appendix H lists the names and affiliations of BeeBAC members and Project Advisors.

Glossary

General terms used throughout this Producer Guide are defined below. Additional definitions are provided as "*key words*" that apply to specific topics.

Adult bee: An adult bee is a fully developed bee that has emerged from its cocoon.

Alfalfa leafcutting bee specialist: An individual who acts as a resource for alfalfa leafcutting bee producers in a region. The specialist may provide advice on production issues, biosecurity management practices, suppliers, etc. Specialists include alfalfa leafcutting bee researchers, provincial apiarists, and representatives of the alfalfa leafcutting bee industry associations.

Approved: When used in reference to chemicals such as pesticides, means approved by the appropriate regulatory authority for the specific usage mentioned in the text. Not all products are approved for use, but rather are recommended by industry for use. Refer to the definition of "Recommended" for further information.

Bee: May be used to describe a bee in any stage of its life cycle. This includes larval, prepupal, pupal, and adult bees.

Bee cell: A structure made of leaf material where eggs are laid, and where a bee subsequently develops. Bee cells are referred to more often in this producer guide, as opposed to cocoons, but the handling of bee cells is equivalent to handling cocoons.

Bee cell processing: Processing describes the extraction of bee cells from nest blocks, breaking strings of bee cells into single cells and removing excess leaf material present on the cells. Equipment includes nest block rollers, bee cell extractors, cell breakers, tumblers, conditioners, conveyers, augers, and other equipment.

Bee cell storage containers: Any container that is used for the storage of bee cells after they have been extracted from nest blocks.

Bee equipment: Any equipment that is used by bees for constructing nests and laying eggs, including nest blocks, nest backing material, boards and strapping used to assemble nests. Bee equipment also includes bee cell trays and shelters.

Beekeeper: A generic term used to identify anyone who owns or is in possession of bees. The person may be the owner/operator, a trained beekeeper, staff, family member, or bee broker. In the alfalfa leafcutting bee industry, a beekeeper may also be referred to as a producer.

Bee operation: All aspects of the beekeeping, bee product production and pollination operations that the beekeeper is responsible for, regardless of where the bees are placed; comparable to the "farm" in other types of agriculture.

Biosecurity program: A risk reduction program that conforms to CFIA national standards and is designed to prevent and control the introduction and spread of pathogens.

Biosecurity risk: An activity, condition, or situation that, without mitigation, increases the risk of potential introduction or spread of a hazard in the form of a pathogen, parasite, or insect pest.

Biosecurity standard: A high level, consistent set of principles and Target Outcomes that apply to all beekeepers (alfalfa leafcutting bees, honey bees, and bumblebees) at the farm level. The goal of the standard is to minimize the introduction and spread of pathogens, parasites, and pests onto a farm, within a farm and beyond the farm.

Building: Any indoor facility used in the beekeeping operation for the purpose of storage, bee cell processing, incubation, treatment, or maintenance.

Canadian Cocoon Testing Centre (CCTC): Testing centre for alfalfa leafcutting bee cocoons, located in Brooks, Alberta, and operated under governance of alfalfa leafcutting bee organizations in Alberta, Saskatchewan, and Manitoba. In this document, CCTC is meant to identify the CCTC, or any industry-recommended testing facility that replaces or supplements the CCTC in the future.

Canadian Loose Bee Cell Management System: An alfalfa leafcutting bee management system, where bee cells are extracted from nests and incubated as loose bee cells, and allows for treatment and sanitation practices to be followed for bees and bee equipment, thus enabling the control of biosecurity risks including pathogens, parasites and insect pests.

Chalkbrood: *Ascosphaera aggregata*, a pathogen that is unique to alfalfa leafcutting bees, in either its sporulating or non-sporulating forms.

Clean: Free of any visible accumulation of organic matter and debris or other residues. See also sanitation.

Cocoon: a protective covering that encloses a bee in the diapausing prepupal stage. A cocoon is further enclosed in leaf material - refer to bee cell.

Composite sample: A sample that consists of two or more discrete individual samples that are collected in a common container.

Cultural method: A non-chemical method for managing pests. Examples include: bee equipment management, sanitation.

Debris: Loose material including empty bee cells, dead bees and bee parts, bee feces, dead parasites, and other discarded material typically collected in trays or on nest blocks.

Disease: A condition in the bee, caused by a biological agent such as bacteria or fungal pathogen that may result in death or morbidity.

Disinfection: The process of killing pathogenic organisms or rendering them inert. This is often done with a disinfecting agent like bleach, or through heat or fumigation treatment, and may be undertaken in conjunction with sanitation.

Efficacy: the effectiveness of an intervention or treatment in suppressing or eliminating a pathogen, parasite or pest.

Elevated response plan: A farm-level plan that is triggered by the suspected or confirmed presence of high risk, exotic or unfamiliar disease, parasite, or stored product pest in the beekeeper's operation, local area, or country.

Endemic: An organism restricted to an area.

Exotic: An organism not native to an area. The organism has typically come from another area.

Farm/farm level: Refer to Bee Operation.

Gallon: A unit of measure for alfalfa leafcutting bee cells. A gallon, by definition, is 10,000 healthy alfalfa leafcutting bee prepupae.

Incubated bee: Bees that have undergone incubation and have either emerged from their cells as adults or are in the final developmental stage prior to emergence from their cells. Incubated bees are taken to the field for release.

Infected: A living host organism (for example a bee or bee cell) that is affected by a pathogen.

Infested: The presence of a living parasite or insect pest, at any stage of its life cycle, on or in a living host organism (for example a bee or bee cell or nest).

Insect pest: An insect that poses a direct risk to a bee, generally through infesting the nest, laying eggs, and eventually consuming bee eggs, or larvae. Insect pest may also represent other types of predators that consume bee larvae. For alfalfa leafcutting bees, insect pests include stored product pests, although there are potentially other insects that may be covered by this definition. See "Stored Product Pest."

Inspector: A person who inspects beekeeping operations for compliance with regulations, or pathogen, pest, and parasite management.

Lot: A collection of bees that can be identified as a unique group within a beekeeping operation, often having common characteristics (quality, field history, treatment history) and defined quantity (number of containers, nests).

Management: Practices followed by beekeepers to manage bees, and manage their environment and risks (including biosecurity).

Nest: The nest structure that is placed in field shelters. Nests are assembled by strapping (or otherwise securing) one or more nest blocks to a backing that is composed of nest backing material and a board.

Nest assembly: The process of assembling nests.

Nest block: A block often made of polystyrene or wood laminate with nest holes throughout. A typical nest block will contain several thousand nest holes.

Nest holes: Round holes or tunnels in nest blocks, which alfalfa leafcutting bees use to construct bee cells with leaf material, provisioning the cells with pollen and nectar, and then laying eggs. Alfalfa leafcutting bees will construct multiple bee cells in a nest hole, creating a string of bee cells within each nest hole.

Federally reportable or notifiable: A legal requirement for laboratories to inform the CFIA of the suspected or confirmed diagnosis of a specified bee disease caused by a pathogen, parasite, or pest. Currently there are no federally reportable or notifiable pests of alfalfa leafcutting bees.

Nuisance pest: A pest that causes a nuisance. A nuisance pest may disturb bees, damage the nest blocks, nest in or near the nest block, thereby causing susceptibility to parasites and insect pests. Nuisance pests may be a risk to bees in the field and in buildings. Nuisance pests include rodents such as mice and some birds. The goal of nuisance pest control is to protect bees by using traps, poison, or through cleaning and maintenance.

Other equipment: Other equipment is a catch-all description in this document that is used to describe all other equipment used in alfalfa leafcutting beekeeping that is not described in bee equipment. It includes, but is not limited to, bee cell processing equipment, assembly equipment, scales, racks, disinfecting and sanitation equipment, and other treatment equipment.

Parasite: An organism that is dependent upon the host for its survival. Common parasites of alfalfa leafcutting bees include chalcid parasites.

Pathogen: An organism causing a disease, for example, a fungus (chalkbrood, foliar moulds).

Personal equipment: Includes items that are considered an extension of the beekeepers person and may come in contact with infected or infested bees, debris, or bee equipment. Examples include brushes, gloves, and coveralls.

Pest: *A pest is an unwanted organism. A pest may be a parasite, or pathogen, or insect pest.* Pest does not include Nuisance Pests for the purpose of this guidance document.

Premises: An indoor facility or outdoor location used for the beekeeping operation. Premises include locations where the following are kept or used: bee cells, nest blocks, personal equipment, processing equipment, and beekeeping supplies, etc.

Producer: The terms producer and beekeeper are both used in this document to describe a person that keeps and manages bees and bee equipment. See beekeeper.

Producer guide: Voluntary guidelines directed toward producers for implementing biosecurity management practices at the farm level. Guidelines are specific to an industry subsector (in this case, alfalfa leafcutting bees).

Production input: Production inputs include "consumable" products such as treatment products for diseases, parasites and pest control, and products used for cleaning and disinfection. Production inputs exclude bee cells and reusable bee equipment such as nest blocks, tools, and protective clothing.

Protocols: A required or recommended procedure, or series of steps to be followed to implement biosecurity management practices.

Provincial apiarist (PA) or apiculturist: Provincial government employees who study, educate, and administrate in the fields of apiculture and pollination. Typically responsible for enforcing the Apiary Act, Bee Act, or equivalent. For alfalfa leafcutting beekeepers, PAs are included with researchers and other resource personnel who are labelled Alfalfa Leafcutting Bee Specialists, as not every province has a PA that supports the industry.

Racks: Stands that are used to hold trays during incubation.

Recommended: Something that is advised by an Alfalfa Leafcutting Bee Specialist, government, or industry association for use or management of alfalfa leafcutting bees. It may include equipment, treatment products, supplier, or a management practice. Something that is recommended will generally include "approved" products, in addition to equipment, treatment products, suppliers, and practices that do not require any approval for use.

Release: The process of taking incubated bees to the field where they will begin their foraging, nest construction, nest provisioning, and egg laying.

Sample: A selection of bees that have been drawn from a population (lot), where the sample is meant to represent the characteristics of the population for testing.

Sanitation: A set of practices that reduces the presence of organic material/debris and reduces the presence, survivability, and infectivity of disease agents from an object or surface. Forms of sanitation include physical or mechanical removal and (power) washing and may be done in conjunction with disinfection.

Shelters: Structures in which nest blocks are placed in the field. Shelters serve to protect the nest blocks and bees from the environment, and provide orientation for bees to find their nests.

Stored product pest: Stored product pests are insect pests that feed on bee larvae while the nests are in the field or in storage. Examples include Dried Fruit Moth, Black Carpet Beetle, Long-Tongued Blister Beetle, Checkered Flower Beetle, Indian Meal Moth, and Sunflower Beetle. Refer to Insect Pests.

Target outcomes: Goals that all beekeepers, regardless of the size of their operation, should try to implement to protect their bees from introducing and spreading pathogens, parasites, and pests.

Threshold: A measurable level of a factor that contributes to bee susceptibility to pests, or a level of infection or infestation at which intervention should be taken to limit negative impact on bee health and cause economic loss.

Trays: Shallow containers used to hold bee cells during incubation and during any treatments applied during or before incubation. The trays are often screened on the top or bottom, or both. Trays are also used to transport incubated bees to the field for release.

Summary of Target Outcomes

Putting preventive measures in place to keep bees healthy forms a biosecurity plan that should address bee management, bee health, as well as access and movement.

1.0 Bee Health Management

1.1 Exposure to pests is minimized by introducing bee stocks of known health status. Sources are documented to enable traceability.

1.2 Factors are managed to reduce the bees' susceptibility to pests. A response is implemented when threshold levels are reached.

1.3 Direct and indirect contact with infected or infested bees is minimized.

1.4 Pests and their signs are accurately diagnosed. Bee operations are monitored to assess the risk of pests.

1.5 A standard response plan is in place to address treatment thresholds, options and rotation plans, notification procedures, record keeping, and followup actions.

1.6 An elevated response plan is in place, and the conditions under which it will be implemented are understood.

2.0 Operations Management

2.1 Only recommended production inputs are utilized and are obtained from known and reliable sources.

2.2 The degradation and contamination of production inputs is prevented by safe and secure storage and disposal.

2.3 Bee equipment is obtained from known and reliable sources. Used equipment is accompanied by proper permits, if required, and is cleaned and disinfected or treated upon arrival as needed.

2.4 Bee equipment is regularly inspected and, when necessary, action is taken to minimize negative impact to bee health.

2.5 Precautions are taken to minimize the spread of pests through human contact with bees and equipment.

2.6 Facilities are constructed to allow for ease in cleaning, are bee-tight if needed, and are consistent with government standards if applicable. The facilities have appropriate lighting and climate control for safe storage of bees and production inputs, and enable monitoring and pest management.

2.7 A sanitation and maintenance program is implemented for all premises, buildings, vehicles, and other equipment.

2.8 An integrated management program for weeds and nuisance pests is implemented.

2.9 All those working in a beekeeping operation or utilizing bees are trained and regularly updated on biosecurity risks and protocols.

Bee Health Management

1.1 Bee Sources

Target Outcomes

Exposure to pests is minimized by introducing bee stocks of known health status. Sources are documented to enable traceability.

Description

Alfalfa leafcutting bees can be sourced in various forms (own bee cells, purchased loose bee cells, purchased bee cells in nest blocks, and purchased incubated bees), which influences biosecurity risk. The level of documentation and knowledge about the health status of bees and the location from which the bees are sourced influence biosecurity risk.

The Risks

Chalcid parasites and chalkbrood, the biggest biosecurity risks to alfalfa leafcutting bees, are mainly spread on/in bee cells, or on nest material.

Sourcing bees for use in a beekeeper's operation without documentation or knowledge of disease, parasite, or insect pest levels within the bees increases the biosecurity risk. Documentation includes sampling and testing records for diseases, parasites and insect pests, and record keeping of management practices that shows where and how bees are produced, which will help enable trace-back and understanding of biosecurity risks.

Sourcing bees from regions with known elevated levels of diseases or parasites increases the potential that those biosecurity risks will be introduced into a beekeepers operation.

In general, bees sourced from within one's own operation represent a lower level of risk than other sources; however, if one's own bees are not accompanied with documentation, and if bees are being produced in a region with elevated levels of diseases and parasites, these bees might represent a significant risk for the introduction and spread of biosecurity risks.

Purchasing loose bee cells generally represents low levels of biosecurity risk, as they can be adequately sampled and tested for biosecurity risks.

Purchasing filled nest blocks or incubated bees represents higher risks, as proper sampling and testing cannot be adequately performed on these bees. Diseases, parasites, and insect pests can also be spread on nest blocks, and thus purchasing filled nest blocks increases the potential for introducing these risks to one's operation.

Regardless of the source, it is critical to have a good plan for how to handle bee cells from various sources.

Recommended Practices

1. Supplier and Stock Selection

a. Follow the Canadian loose bee cell management system.

b. When purchasing bees

i. whenever possible, purchase loose bee cells.

ii. try to avoid purchasing filled nest blocks and incubated or adult bees.

iii. avoid purchasing filled drilled boards.

c. Purchase bees from suppliers that you know and trust, and from suppliers with established biosecurity control programs.

d. Select a supplier that can provide test results from the Canadian Cocoon Testing Centre (CCTC). If purchased bee cells are not accompanied by a test from the CCTC, then it is recommended that a sample be drawn and sent to the CCTC for testing when the bee cells are received.

e. Investigate unfamiliar suppliers before purchasing:

i. Visit their operations, observe (or interview by phone), and ask questions about their disease history, management practices, and record keeping.

f. When uncertain, speak to an alfalfa leafcutting bee specialist about supplier and stock selection.

2. Establishing Lots

a. Ideally, beekeepers establish lots. A good lot system allows the producer to identity disease parasites and insect levels, and to develop a plan for treating problem lots over the coming production season.

b. Establishing lots may not be required for producers with smaller focused operations where

i. no bees are purchased from external sources.

ii. bees are placed on a limited number of fields.

iii. the beekeeper has a low prevalence of diseases, parasites, and insect pests.

c. Ideally, lots are created for filled nest blocks and loose bee cells, representing risk profiles that differ as follows:

i. each purchased source
ii. nest block type and year purchased
iii. field or crop type
iv. pollination client
v. percent of nest block fill
vi. processing dates
vii. treatments applied
viii. incubation group

d. Producers may identify a maximum lot size for their own operation.

3. Sampling

a. Once a lot has been created, sampling and testing help identify disease, parasite, and insect pest problems, enabling the development of treatment and handling procedures. Section 1.5 describes treatment protocols.

b. Though samples can be drawn from filled nest blocks, conduct more extensive sampling on loose bee cell lots.

c. Carry out sampling in a manner that is repeatable and consistent within a beekeeper's operation.

d. Draw a composite sample of loose bee cells for testing. A smaller sample is then drawn from the composite sample and used for testing. A sample can be drawn as processing occurs or after bee cells have been placed in storage/packaging containers. The following are acceptable techniques for drawing a composite sample:

i. Use an automated in-stream sampler that periodically pulls from the stream of bee cells that are being conditioned, and just before bee cells are placed in packaging or storage containers.
ii. Periodically sample bee cells that are being conditioned by hand, and before bee cells are placed in storage containers. Sample can be drawn directly from storage container either by hand or using a probe. A producer can establish sampling guidelines for how to draw samples from containers. Appendix C provides examples.

e. Sampling problems may be the result of

i. too much material in a sample or composite sample. Draw a subsample (e.g. cutting the composite sample) in a manner that ensures the subsample is consistent in quality with the composite sample.
ii. a probe that is too small, which may result in no representative type of sample.
iii. a probe that damages bee cells.

4. Testing

a. The following are acceptable methods for testing bee cell samples drawn from lots of filled nest blocks and loose bee cells:

i. Send samples to the CCTC for testing:

1. Testing at the CCTC is the recommended practice for all loose bee cell lots. The test helps identify problems early and allows producers to develop a treatment protocol to minimize their risk.
2. The following CCTC tests are particularly relevant to biosecurity:
   a. parasites
   b. predators/stored product pests
   c. chalkbrood
3. The importance of testing at CCTC is increased if high levels of disease, parasite, or insect pests, as defined by each individual beekeeper, are suspected.

ii. Cut open and visually inspect bee cells for dead larvae, and signs of chalkbrood, chalcid parasites, or stored product pests.

This method may be

1. preferred by producers with few sources of bee cells, and where there is a low prevalence of diseases, parasites, and insect pests.
2. useful if testing samples drawn from filled nest blocks are used as an early indication of disease, parasite, and insect pest concerns.
3. used to help determine where to store nest blocks, or how to treat nest blocks in fall storage for stored product pests, or for processing, treating, and incubating in the winter and spring.
4. supplemented with CCTC test if high levels of disease or parasites are found, to more accurately identify the magnitude of the problem.

b. Beekeepers and staff are updated and trained to recognize risks that are both common and uncommon to the operation, potentially posing a biosecurity risk. (Refer to section 2.9).

c. Beekeepers are aware of current developments and alerts, and follow emergency protocols that are recommended by industry organizations, industry experts, and/or the provincial apiarist.

d. The supplier is notified of any inconsistencies between the CCTC tests provided and any new tests undertaken by the producer who receives bees.

5. Regulations and Compliance for Importing Bees

a. Federal

i. Importing alfalfa leafcutting bees is not permitted under federal regulation at this time, but beekeepers should be familiar with, and follow, current federal import regulations and protocols administered by the CFIA.

b. Provincial

i. Beekeepers are familiar with, and follow, current provincial import and transport regulations as defined by the applicable bee acts. Note, there are no interprovincial transport regulations for alfalfa leafcutting bees.

Record Keeping

Record keeping should be done in a manner that allows producers to identify biosecurity risks, track the risks forward and backward, and manage or maintain bees with different risk profiles separately if required. Appendix E provides examples of record-keeping templates. The following is an example of information to maintain on alfalfa leafcutting bee sources:

- lot number or name;
- test results from the lot;
- lot quantity (quantity of bees, quantity of nest blocks);
- additional details may include
  - —nest block type, year purchased, percentage of fill.
  - —field, crop type, client from past year.
  - —field placement for current year (crop type, shelters, location, number of bees placed).
  - —treatment applied to bees or equipment.
  - —extraction date.
  - —storage location.
  - —nest construction details.
  - —traying details.
  - —incubation details.
- If bees are purchased, keep the following records:
  - —name of seller or broker; and
  - —weight, live count, gallons.

1.2 Prevention: Minimizing Susceptibility to Pests

Target Outcomes

Factors are managed to reduce the bees' susceptibility to pests. A response is implemented when threshold levels are reached.

Description

The term "pest" refers to pathogens, parasites, and insect pests.

Alfalfa leafcutting bees may be compromised by factors that can effectively be managed within the beekeeping operation. These factors increase a bee's susceptibility to pests.

The main causes of increased susceptibility are as follows:

Storage and incubation conditions: Pests proliferate, if bee cells are not stored under specified conditions. Producers need to ensure that the storage conditions for filled nest blocks and loose bee cells limit the spread of these pests, including maintaining cool temperatures, humidity, and air flow. Rodent control in storage will also help to reduce nest block damage, and reduce susceptibility to parasites and insect pests. (Nuisance pest control, including rodents, is discussed in section 2.8.)

Nest construction: Tight nest construction limits access of parasites and insect pests. Limiting access of these risks to nests and to bee larvae reduces both the susceptibility and exposure of bees.

Shelter conditions: Maintaining shelters in good condition can limit damage to nests, which, in turn, limits susceptibility to pests. Moulds can develop when nest blocks get wet and remain damp. Shelters may provide a home for rodents, increasing the possibility of nest damage, increasing susceptibility to parasites and insect pests. Repairing holes in shelter roofs and implementing a rodent control program help reduce this risk. (Section 2.7 discusses nuisance pest control, including rodents.)

Bee drifting: *Stocking rates, timing of release, shelter placement, shelter orientation, adequate nest material, and field health:* Bees that have access to adequate pollen, nectar, and leaf material are less likely to drift to other shelters, to have other bees drift to their shelters, or, generally, to mix with other bees or bee equipment. Drifting increases both the susceptibility and exposure of bees to pathogens, parasites, and insect pests. Forcing bees to fly further for cell provisions increases the chance of contact with other bees or nest material that may carry pathogens, parasites, or stored product pests. Section *1.3 Prevention: Minimizing Exposure* discusses this topic in detail.

Irrigation considerations: Placing shelters relative to irrigation and minimizing exposure to irrigation water may be a consideration, particularly when using pivots. Keeping nests dry and free of mud reduces the susceptibility to moulds and keeps bees from drifting to other shelters and nests.

A susceptibility threshold is a measurable level of a factor at which intervention should be taken.

The Risks

The intensity and exposure to the factor affect the risks associated with susceptibility. If left unmonitored, these conditions can cause significant economic loss due to larval mortality.

Recommended Practices

1. Storage and Incubation Conditions

In the Storage Facility

a. Control the temperatures in the facilities:

i. Control and monitor the temperature in storage facilities in the fall when filled nest blocks are brought in from the field. (This is an important time for both bee development and insect pest control.)

ii. Maintain temperature of 4°C–10°C for the remainder of winter storage.

b. Be aware that a region with high humidity may require dehumidifying of the facilities to allow for proper dry-down of bee nests or bee cells. Under Canadian prairie winter conditions, high humidity is usually not a significant concern. However, high humidity may lead to growth of foliar moulds, and cause problems with bee cell extraction, damaging bees and reducing the effectiveness of treatments.

c. Provide air circulation and ventilation, as required, to maintain consistent temperature. (Refer to section 2.6.)

d. Store and stack nest blocks off the floor, and in a way that allows for good air flow. Air flow ensures that a more even temperature and moisture is found throughout nest blocks, and limits the proliferation of pathogens, parasites, and insect pests.

Stacking ideas may include

i. wooden spacers

ii. staggering blocks

iii. nest blocks on their side, leaving space between blocks

e. Store loose bee cells in containers in a way that limits the potential for heating or moisture buildup, which are conditions that harm bee cells and encourage the development of pathogens, parasites, and insect pests.

f. Monitor temperature and humidity with thermometers and humidity detectors. (Refer to section 2.7.)

In the Incubation Facility

a. Construct facilities to allow for air circulation and ventilation (*refer to section 2.6*).

b. Monitor temperature and humidity with thermometers and humidity detectors (*refer to section 2.7*).

2. Nest Construction

a. Use nest backing material in nest construction to limit nest accessibility to parasites and insect pests.

b. Remove damaged sections of nest blocks prior to constructing nest blocks (section 1.4).

c. Strap, or otherwise secure, nest blocks, nest backing material, and boards tightly together to limit access to parasites and insect pests.

3. Shelter Maintenance

a. Set up shelters and perform maintenance on shelters in advance of placing bees. This includes repairing holes in shelters, and removing debris and weeds from the shelter.

b. Secure nest blocks to the shelters, and off the ground.

4. Bee Drifting: Refer to section 1.3.

5. Irrigation Issues

a. Manage irrigation to minimize the impact on bees:

i. Locate shelters away from paths of wheels, and not directly in line with nozzles.

ii. If possible, avoid irrigating in front of shelters, or install curtains on shelters to limit direct water exposure to bees.

iii. When possible, irrigate when bees are inactive, at night, or on cool days.

iv. Limit the frequency of watering (one bigger watering, as opposed to several smaller ones).

b. Locate shelters in areas that are not prone to flooding.

Record Keeping

The following records that relate to temperature control, nest construction, shelter maintenance, and irrigation may be used to help improve overall management of alfalfa leafcutting bees:

- storage temperature and humidity by date
- incubation temperature and humidity by date
- nest construction details
- shelter maintenance and treatment notes

1.3 Prevention: Minimizing Exposure

Target Outcomes

Direct and indirect contact with infected or infested bees is minimized.

Description

The first line of defence against infection or infestation of healthy bees is to minimize exposure to bee pests. This includes direct contact between bees, direct exposure to pests, as well as indirect contact through contaminated equipment, handling, etc.

Direct contact refers to direct bee-to-bee contact or bee to egg/larva contact, whereby an infected bee passes the pathogen directly to healthy bees, eggs, larvae, or cell provisions. Direct contact can increase when bees have no adequate visual cues, or are in search of available nest tunnels, and travel to new shelters potentially spreading pathogens from one shelter to another. Parasites are capable of parasitizing completed bee cells that contain larvae and/or prepupae, while stored product insect pests may damage bee cells containing larvae and/or prepupae, or lay their eggs in nest material. Managing the nest blocks to limit the exposure of bees to parasites and insect pests reduces this risk.

Indirect contact occurs when an infected or infested host bee leaves behind a pathogen on some surface or in some material such as bee cells, and the pathogen survives long enough to be transferred to another bee. Bee cells that contain pathogens are the biggest source of this indirect contact. Bees may contact emerged bee cells left in shelters or near shelters transferring pathogens, which are subsequently passed on to new bee cells under construction or to eggs, nectar, and pollen in the cells.

Another form of indirect exposure occurs when parasites and insect pests are not controlled during storage and incubation. Parasites and insect pests may be present in bee equipment and, if not controlled through proper storage or treatment protocol, can further damage bee cells.

Risks and recommended practices that address minimizing exposure through indirect contact with bee equipment and other equipment are discussed in section 2, Operations Management.

Intermixing occurs when bees of two beekeepers are placed in the same proximity, or when one bee species mixes with bees of another species (e.g. alfalfa leafcutting bees and honey bees). Feral bees and wild leafcutting bees also represent potential intermixing. Mixing healthy bees with infected or infested bees could potentially spread pathogens, parasites, and insect pests. This can occur when bees of two sources are placed on the same or adjacent fields. For alfalfa leafcutting bees, the risk associated with intermixing is relatively low. When placed in fields, alfalfa leafcutting bees generally travel limited distances and pose little risk to bees on adjacent fields. Beekeepers should be aware of new risks and of the legitimate risk that exists with respect to interspecies movement of pests, and thus prevent undue exposure to bees from other operations and to unmanaged bees.

The Risks

Table 1 describes the associated risks with the most common pathogens, parasites, and insect pests of alfalfa leafcutting bees in Canada. Beekeepers should also be aware of new risks in their area.

TABLE 1 Common pathogens, parasites, and insect pests

Pathogen, Parasite, or Pest	Biology	Direct Contact	Indirect Contact				Inter-mixing
			Bee Cell Storage and Incubation	Emerged Bee Cells	Bee Equipment	Handling	
Chalcid Parasites *(Pteromalus venustus)*	Female adult chalcid parasites pierce the leafcutting bee cell surface and cocoon, anesthetize the bee prepupae, and lay eggs. The eggs hatch, and young larvae feed on the bee prepupae, completely consuming them.	Direct contact does not result in chalcid parasite transmission.	High: Parasites can persist in storage and incubation environments, parasitizing bee larvae and prepupae. Under optimum temperature conditions, parasites can rapidly develop into adults, and re-parasitize bee cells. Cooler temperatures can limit parasite development, and traps and chemicals can be used to control adult populations.	Very Low	Moderate: proper construction and maintenance of bee equipment help to control chalcid parasites. It is unlikely that used equipment which does not contain bee cells will continue to harbour these parasites.	Very Low	Low to Moderate: Chalcid parasites present in other alfalfa leafcutting beekeepers populations (or feral bees and wild leafcutting bee populations) and when located near your bees, can increase the risk of transmission.

Pathogen, Parasite, or Pest	Biology	Direct Contact	Indirect Contact				Inter-mixing
			Bee Cell Storage and Incubation	Emerged Bee Cells	Bee Equipment	Handling	
Chalkbrood, (also Foliar Moulds)	Fungal spores picked by female alfalfa leafcutting bees are passed to the nests where eggs are laid. Young alfalfa leafcutting bee larvae consume the spores, which germinate in the gut and kill the developing bee larvae.	High: Transferred from female alfalfa leafcutting bees to the pollen/nectar provisions on which eggs are laid in the nests.	Moderate: Chalkbrood that remains on the surfaces of bee cells can be passed on to emerging bees as they crawl through the leaf material. Treating bee cells and equipment to control chalkbrood spores will limit exposure to bees.	High: Chalkbrood spores can survive for long periods of time on bee cells. When left in shelters, or near shelters, bees may have a tendency to revisit trays with emerged cells and pick up chalkbrood spores, passing on to developing bee larvae.	Moderate: Chalkbrood spores can live on surfaces for years, and bees will brush over surfaces and pick up the spores. The transfer of spores by adult females leads to increased larval bee mortality. Trays and nest material, in particular, pose the highest risk.	Low to Moderate: Spores remain viable on surfaces for years, and can be passed on by handling. The risk is high when handling infected equipment for incubation and nests and equipment that are brought to the field for bee release. The risk is lower with equipment handling in the fall and winter, as there is time to treat cells and equipment for chalkbrood prior to incubation and release, and chalkbrood does not pose an immediate risk to bees if it is on the surface of cells during storage.	Low: Chalkbrood present in other alfalfa leafcutting beekeepers populations (and feral and wild leafcutting bees) and when located near your bees, can increase the risk of transmission.

Pathogen, Parasite, or Pest	Biology	Direct Contact	Indirect Contact				Inter-mixing
			Bee Cell Storage and Incubation	Emerged Bee Cells	Bee Equipment	Handling	
Stored Product Pests	While there are differences in the biology of each stored product pest, both adults and larvae of these insect species may be present inside nests, where they will damage bee cells and consume alfalfa leafcutting bee larvae and pollen provisions.	Direct contact does not result in stored product pest transmission.	Moderate: Stored product pests can persist in storage environments, consuming larvae and pollen provisions within bee cells. Under certain conditions, stored product pest can develop quickly into adults, lay eggs in nest material, and eventually consume bee larvae. Cooler temperatures will limit stored product pest activity; traps and chemicals can be used to control stored product pest populations.	Very Low	Moderate: Proper construction and maintenance of bee equipment help to control stored product pests. It is possible that used equipment, which does not contain bee cells, will continue to harbour these pests.	Very Low	Low to Moderate: Stored product pests present in other alfalfa leafcutting beekeepers populations (and feral and wild leafcutting bees) and when located near your bees, can increase the risk of transmission.

Recommended Practices

1. Minimize Exposure During Storage and Incubation

a. Use preventative treatments and traps to reduce exposure to parasites and insect pests in storage and incubation. (Refer to section 1.5 for treatments.)

b. Limit the depth of cells placed in trays to 1–1.5 inches, and use screens on trays during treatment and incubation.

c. Maintain storage temperature of 4°C –10°C to limit growth of parasites and insect pests. If pests are known to exist, maintain temperatures in the lower end of this range.

d. Limit light to storage areas.

e. Ensure adequate air flow to help maintain even temperature and humidity throughout storage and incubation.

f. Stack nests, nest blocks, and bee cell containers in a manner that permits adequate air circulation.

g. Monitor temperature and humidity to maintain targets values.

h. Store known diseased, parasitized, and insect pest-infested lots separately from healthy bee cells.

i. Incubate and treat known diseased, parasitized, and insect pest-infested lots separately from healthy bee cells.

2. Emerged Bee Cells and Trays (Emerged bee cells are the empty shells of leaf material that remain after bees emerge from the cells during or just following incubation.)

a. Where possible, remove the trays and emerged bee cells from shelters following complete emergence of bees.

b. Ideally, collect emerged bee cells in a container and remove from the field.

c. Acceptable disposal methods for emerged bee cells

i. Burn

ii. Send to landfill

iii. Compost

iv. Incorporate or bury into a field or garden away from bees

3. Bee Drifting and Intermixing

- Take precautions to avoid drifting and intermixing of bees.
- Manage infected or infested bees in a manner that limits their exposure to healthy bees.

a. Shelter, Shelter Placement, Shelter Orientation, Stocking Rates

i. Provide visual cues on shelters and nest material to ease the bees' return to the same shelter.

ii. Place larger shelters with better visual cues in the center, which may help to keep some bees from drifting to the edges. (Generally, bees drift to the outside of fields.)

iii. If bees are to be placed adjacent to bees of another source, work with other beekeepers to create an awareness of the health status and disease and pest management practices.

iv. Where possible, avoid excessive exposure to bees of other species, including honey bees and bumblebees.

v. Ideally, maximize the distance between fields where bees are kept, and the distance to other known bee populations or feral bees, wild alfalfa leafcutting bees, and other species of bees.

vi. Follow applicable pollination stocking rate recommendations.

vii. If the health status of the neighbours' bees is suspect, or conditions exist that encourage intermixing, increase the shelter distance from the field edge and increase monitoring.

viii. If the health status of many bees is suspect, or if they are known to contain higher levels of pests than thresholds set by an individual beekeeper, then, those bees should be managed as a unique lot throughout production.

b. Release Timing and Field Health

i. Time bee release to when fields have adequate bloom to support bee foraging.

ii. Manage field health appropriately to provide bees with a healthy population of leaf material, pollen, and nectar.

iii. If adequate leaf material is unavailable in the field, provide supplemental leaf material near shelters (e.g. planting buckwheat).

c. Filled Nests Removal

Inadequate access to nesting tunnels may cause bees to move to other shelters or to overfill nest blocks. This results in additional work for female bees, and may increase the possibility of exposure to pathogens:

i. Place an adequate number of nests in shelters at the beginning of the season. (There should be 1.5 nest holes for each live female bee placed in the field.)

ii. Monitor nest blocks for fill during the season.

iii. Remove nests from shelter, and transport to fall storage facilities as they become filled, or close to filled, and replace with unfilled nests.

iv. Add additional empty nests to shelters when nest blocks fill up.

4. Drying, Processing, and Conditioning Cells

The operations of drying, extracting, processing, and conditioning bee cells can minimize the biosecurity risks to bees. Properly drying bee cells in nest blocks enables cells to be extracted and conditioned more effectively. These effectively processed cells make effective treatment of pathogens possible, and expose bees that emerge from cells to fewer pathogens.

5. Minimize Exposure During Transport

a. Close trays for transport, use screens, and, if necessary, cover trays during transport.

b. If moving bees in season, transport at night or in cooler conditions.

c. Avoid transporting with bees of another source of unknown quality.

d. If transporting bees for release, or transporting in season, disinfect trucks after transporting bees with known elevated levels of chalkbrood.

Record Keeping

The following records related to storage, processing, field placement, and transport can be used to help improve overall management of alfalfa leafcutting bees:

- storage temperature and humidity by date
- incubation temperature and humidity by date
- field placement, tray removal, and nest-removal details
- bee cell processing details
- nest construction details

1.4 Diagnosis and Monitoring

Target Outcomes

Pests and their signs are accurately diagnosed. Bee operations are monitored to assess the risk of pests.

Description

The term "pest" refers to pathogens, parasites, and insect pests.

Monitoring is one of the cornerstones of biosecurity. There are three related but different types of monitoring:

1. **Monitoring to trigger an investigation into the cause and to rule out non-infectious/ infestation causes before treatment:**
   a. unexpected declines in bee productivity, percentage of nest fill; and
   b. visual signs of dead bees.
2. **Monitoring to identify and confirm disease, parasite, or pest presence:**
   a. visual signs of diseases:
      i. dead larvae, chalkbrood cadavers.
   b. visual signs of parasites and insect pests:
      i. adult insect pests or parasites
      ii. larvae of pests or parasites
      iii. bee larvae that have been consumed
   c. CCTC test results for presence of disease, parasites, or pests.
3. **Monitoring to evaluate treatment effectiveness and trigger re-treatment, if necessary.**

The Risks

The risks of NOT monitoring for alfalfa leafcutting bee pests are as follows:

- persistence and spread throughout a beekeepers operation
- spread to neighbouring beekeeping operations
- unnecessary treatment applications

Recommended Practices

For alfalfa leafcutting bees, it is difficult to identify and control problems in the field. While in-field monitoring is recommended, a thorough sampling and testing protocol as described in section 1.1 is the most critical strategy to monitoring the status of pests.

Monitoring Principles:

1. **Sampling methods are thorough enough to represent the entire beekeeper's operation.**
2. **Samples should be sent to CCTC for testing, although visually inspecting cells is also appropriate, and can provide a quicker diagnosis of potential problems.**
3. **Samples are identified by lot.**
4. **There is awareness of, and participation in, voluntary inspection programs.**
5. **Records are maintained on observations, dates, and data.**
6. **There is recognition of early visual signs that may indicate a problem. Further investigation into the cause is triggered to avoid unnecessary treatments.**
7. **Monitoring of storage conditions or other factors that may impact biosecurity takes place.**
8. **Beekeepers and staff are trained and updated to recognize common and exotic diseases, parasites, and insect pests, as well as their signs.**
9. **Treatment efficacy is assessed, and ineffective treatments are modified before future use.**
10. **There is regular attention paid to area outbreaks and alerts.**

Table 2 describes identification and monitoring methods for the main diseases, parasites, and pests affecting alfalfa leafcutting bees.

TABLE 2 Identification and Monitoring Methods for the Main Diseases, Parasites, and Pests Affecting Alfalfa Leafcutting Bees

Pest	Identification/ Monitoring
Chalkbrood	Inspections of bee cells will identify chalkbrood-infected larvae by cutting open and inspecting bee cells for chalkbrood cadavers. However, it is recommended to send bee cell samples to CCTC for identification. Identifying chalkbrood in the field is difficult, as there are no signs on adult bees for identification purposes.
Foliar Moulds	Inspections of bee cells will identify foliar moulds in infected larvae by cutting open and inspecting bee cells for dead larvae. However, it is preferred to send bee cell samples to CCTC for identification. Identifying foliar moulds in the field is difficult, as there are no signs on adult bees for identification purposes.
Chalcid Parasites (*Pteromalus venustus*)	Inspecting bee cells will identify chalcid parasite-infected larvae by cutting open and inspecting bee cells for the presence of chalcid parasite larvae (multiple larvae in a cocoon). It is preferred to send bee cell samples to CCTC for identification. Monitor storage facilities, incubation rooms, and shelters for the presence of adult chalcid parasites (although they will be difficult to spot in the field) by visually looking for adult chalcid parasites, and by setting up and monitoring traps. Acceptable traps include black light water traps, fly strips, and sticky boards. To identify these parasites in the field is difficult, as adult bees show few visible signs.
Stored Product Pests	Inspections of bee cells will identify damage caused by stored product pests. Damage is normally found as consumed bee cells (larvae, pollen). Bee cell samples should also be sent to CCTC for identification. Monitor storage facilities and shelters for the presence of adult-stored product pests (although they will be difficult to spot in the field) by visually looking for adult insect pests, and by setting up and monitoring traps. Acceptable traps include black light water traps, fly strips, sticky boards, and the checkered flower beetle night trap. Identifying these pests in the field is difficult, as there are few signs on adult bees for identification purposes.

CCTC = Canadian Cocoon Testing Centre

Threshold Guidelines

Once results are obtained, consult your own treatment thresholds to decide on actions. While there are no standard thresholds developed for alfalfa leafcutting bee pests and parasites, the following are some examples of how threshold levels may be set.

- If chalkbrood/foliar moulds are found, treat
  - —bee cells (> 0%).
  - —nest material and trays (> 0%).
  - —shelters, storage facilities, incubation rooms, and processing equipment (> 0%).
- If chalcid parasites are found, carry out the following:
  - —Use recommended pesticide in storage and incubation facilities (> 0%).
  - —Use traps in storage and incubation facilities (> 0%).

—Implement environmental control in storage facilities (> 0%).

- If stored product pests are found, the following should take place:
  —Use pesticide and/or traps in storage facilities (> 0%).
  —Implement environmental control in storage (> 0%).

Record Keeping

Effective management systems include record keeping on the following:

- sampling and testing records, including test results; and
- parasite and insect pest observations.

1.5 Standard Response

Target Outcomes

A standard response plan is in place to address treatment thresholds, options and rotation plans, notification procedures, record keeping, and followup actions.

Description

Key Terms

A **response** is an intervention – such as proper disposal, cultural methods, and treatments – to prevent, eliminate, or reduce levels of infections and infestations in alfalfa leafcutting bees.

A **standard response** refers to interventions that address pests that are commonly encountered in the operation or the general area. A standard response *trigger* means that the pest has been confirmed or that the level of infection or infestation has been determined to reach a treatment threshold.

An **elevated response** is addressed in the following section. An elevated response is triggered when a high risk, exotic or unfamiliar disease, parasite, or pest is suspected or where its presence is confirmed.

A **response plan** is in place that includes procedures for isolation, equipment culling, cultural and pesticide treatments, communication, and notification.

Standard response planning entails

- keeping up to date with recommended management practices.
- understanding environmental influences that could reduce treatment effectiveness.
- understanding and following product labels.
- knowing the timing and scope of treatments.
- rotating and alternating treatments.

- coordinating treatments with sanitation and disinfection procedures to avoid re-exposure.
- keeping records of treatments and results.

Response planning requires training for beekeepers and their employees on the procedures that are necessary to implement the plan and on when and how to contact the alfalfa leafcutting bee specialist.

Biological method: A method of controlling a pest with another organism; for example through predation, parasitism, or with a pathogen.

Chemical method: A method of controlling a pest, using chemical-based control products.

Contaminated: The presence of a pathogen, living parasite, or insect pest on a surface or in debris that may be transmitted directly or indirectly to a living host organism (e.g. bee or brood).

Mechanical method: A non-chemical method for managing pests (e.g. barriers or traps).

Physical method: A non-chemical method for managing pests (e.g. heating).

Fumigant: A control that works in the vapour (gas) stage (e.g. paraformaldehyde).

Trap: A device used to attract an insect pest.

Synthetic pesticide: A pesticide that is made synthetically (e.g. dichlorvos resin strips, paraformaldehyde).

The Risks

The risks associated with NOT having a standard response plan that follows recommended treatment procedures and product label directions are:

- reduced treatment efficacy or outright treatment failure.
- the more rapid spread of the disease, parasite, or insect pest, both within the operation and to other beekeepers' operations.
- greater likelihood of re-infection or re-infestation.

Recommended Practices

It is not the intent of this Producer Guide to detail treatment recommendations.

The primary recommended standard response practice is to obtain and follow treatment recommendations from alfalfa leafcutting bee specialists, provincial industry associations, or provincial apiculture departments. This includes being aware of new product registrations, changes to product use procedures and treatment thresholds, as well as new cultural practices. Some associations publish recommendations in the form of fact sheets or bulletins that are updated as required. If a province does not publish recommendations, contact an alfalfa leafcutting bee specialist for advice.

1. Principles of Treating with Chemicals

a. Be aware of, and follow, treatment thresholds for a beekeeper's own operation.

b. Read all labels before applying any disease or pest control products to bees:

i. Use chemicals and other treatments at the recommended rate or dose.

ii. Use products only if registered for that use.

iii. Pay attention to temperature and/or humidity constraints regarding treatments.

iv. Dispose of treatments (e.g. pesticide strips) according to label directions.

v. Avoid using products after their expiry date.

vi. Take all the appropriate safety measures (equipment, clothing) as recommended by the label directions when mixing/applying treatments.

c. Be thorough and consistent. Treat all bees in the same manner.

d. Apply at the right time, particularly for treatment in the incubation room to avoid harm to bees.

e. Use chemical treatments, in conjunction with cultural and sanitation/disinfection methods, when feasible.

2. Technique for Control of Specific Pests

Table 3 describes control techniques for Chalkbrood, Foliar moulds, Chalcid parasites, and stored product pests.

TABLE 3 Control techniques

Chalkbrood and Foliar Moulds	Chalcid Parasites	Stored Product Pests
• The best cultural defences against disease are to limit susceptibility factors and to avoid exposure to biosecurity risks. • Cultural techniques for disease control are also discussed in Sections 1.1–1.3, 2.3, 2.4, and 2.6. Techniques involve identification, disinfection, and/or culling equipment. • Routine inspection of nest blocks and nest material, and regular replacement of damaged nest blocks are effective in reducing pests. • Disinfection of bee cells, bee equipment, trays, shelters, processing equipment, and facilities can effectively control pathogens. Appendix D details the disinfection techniques.	Cultural techniques may not eliminate the need for chemical treatments altogether, but may reduce the parasite levels below the treatment threshold: **a.** Use new or well-maintained nest blocks. **b.** Cull damaged nest blocks. **c.** Tightly secure nest blocks to nest backing material and boards with strapping. **d.** Ensure temperature is between 4°C –10°C in bee cell storage. If chalcid parasite levels are high, cooler temperatures within this range will help to control parasite development. **e.** Use black lights and water traps. **f.** Watch for second generation emergence later in the incubation cycle, and squash or vacuum adults. If treating with dichlorvos resin strips **a.** ensure adequate air circulation in storage facilities and incubation rooms. **b.** stack nest blocks and trays, and use screened trays to allow for adequate air circulation. **c.** ensure timely removal of pesticide during incubation, as bees exposed to dichlorvos resin strips may die. **d.** keep bee cells in trays to depths of 1–1.5 inches	Cultural techniques may not eliminate the need for chemical treatments altogether, but may reduce the pest count below the treatment threshold: **a.** Use new or well-maintained nest blocks. **b.** Cull damaged nest blocks. **c.** Tightly secure nest blocks to nest backing material and back board with strapping. **d.** Ensure temperature is between 4°C–10°C in bee cell storage. If stored product pests levels are high, cooler temperatures within this range will help to control pest development. **e.** Use black lights and water traps . **f.** Use fly traps, sticky boards, and other mechanical methods to control adult stored product pests If treating with pesticides **a.** ensure adequate air circulation in storage facilities and incubation rooms. **b.** stack nest blocks and trays to allow for adequate air circulation.

Record Keeping

Effective management systems include record keeping on the following:

- Treatment records for bees, bee equipment, buildings, and other equipment.

1.6 Elevated Response

Target Outcomes

An elevated response plan is in place, and the conditions under which it will be implemented are understood.

Description

An elevated response is triggered when a high-risk exotic or unfamiliar disease, parasite, or insect pest is suspected or where its presence is confirmed. At present, no such risks have been reported for alfalfa leafcutting bees, but awareness of practices to follow in the event of a serious unknown problem may mitigate the impact on a beekeeping operation and on the industry.

An elevated response plan is triggered by

- alerts that an exotic pest has entered the country, or has been found in a province or a local area are issued by the federal or provincial governments, or producer associations.
- informal communication about unusual or elevated area outbreaks. These reports could come from neighbouring producers, producers that place bees for custom pollination near where your bees are placed, from farmers where your bees are placed, or companies that contract custom pollination services.
- presence of disease, parasites, or insect pests in a beekeeping operation is confirmed by an alfalfa leafcutting bee specialist, provincial association, or a provincial apiarist.
- some change in bee populations, activity, etc. is observed that cannot be readily explained or has not been seen before.
- signs of disease, or the presence of parasites or insect pests that have not been encountered before are observed.
- a less-than-expected efficacy after treating for a pest. This could signal that the pest has been misdiagnosed or that an application technique, or the conditions under which the treatment was applied, were not optimal.

Key Terms

Quarantine: A specific order applied to a particular premises, bees, or equipment by a recognized authority to prevent further spread or to detect a risk or concern. Note: no quarantine scenario exists for alfalfa leafcutting bees, but a new risk could lead industry to develop quarantine orders.

Quarantine area: An area specified by a recognized authority, or designated person, in which there are additional efforts by industry and/or government to prevent further spread or to detect the risk of concern.

Recognized authority: A recognized authority might include a provincial government department, such as the Apiculture department, or a county or municipal government.

The declared quarantine area and individual quarantine order specify the applicable boundaries, the reason for issuance, and the actions required, permitted, and prohibited. They remain in effect until lifted by the issuing authority.

The Risks

The risks associated with NOT having an elevated response plan that follows notification requirements, communication with other beekeepers, recommended treatment procedures, and product label directions are

- potentially significant economic loss, if you are not prepared to take appropriate action on short notice or if there is no treatment available.
- a possible quarantine order placed on fields, facilities, or areas that remains in effect for an extended period.
- possible disruptions to bee and supplies purchase or sale, and bee transportation associated with quarantine areas.

Recommended Practices

An elevated response plan:

1. Communication and Notification

The plan includes communication with each of the following:

a. staff;

b. provincial industry association, alfalfa leafcutting bee specialist, provincial apiarist, where applicable;

c. suppliers or customers of bees, or equipment that could transmit the risk;

d. between beekeepers where there is a possibility of spreading the disease, parasite, or insect pest; and

e. farmers who have your bees placed on their fields or custom pollination contractors.

The plan includes:

a. an accessible up-to-date directory of contact names, email addresses, and telephone numbers

b. the primary trigger to communicate with government is regulatory for notifiable risks. (Note: there are no notifiable risks at present, but this remains a possibility for future risks.)

2. Bee Management Protocol

a. If a risk is suspected but not yet confirmed

i. contact a provincial industry association, alfalfa leafcutting bee specialist, and provincial apiarist, where applicable.

ii. suspend bee and equipment movements, if any scheduled.

iii. restrict access to facilities or fields where suspected risks are located.

iv. suspend bee and equipment sales (if applicable).

v. look through records for potential lots that may be from the same source or treated in a similar fashion to suspect bees.

vi. increase monitoring and inspection frequency and sampling.

vii. set traps, if applicable.

viii. require beekeepers and staff who enter or leave areas where the risk has been isolated to remove protective clothing and footwear, and replace with a spare set of clothing and footwear.

ix. take extra precautions to disinfect, for example, vehicles, forklifts, nets, facilities, bee equipment, personal protection equipment after handling infested or infected bees, bee cells, and bee equipment.

b. If a risk is confirmed, include these additional procedures:

i. implement recommended actions, including destruction, disposal, or treatments as soon as possible.

ii. extend treatments to all bees and bee cells in an operation, depending on the risk.

iii. increase cultural procedures, as needed.

3. Quarantine Protocols

a. Follow all requirements of the quarantine order or declared area such as

i. restrictions on movement;

ii. prior requirement for official approval before movement of bees, bee cells, and equipment occur;

iii. specific destruction and disposal protocol; and

iv. record keeping.

4. **Visitor Protocol**

   a. Maintain a visitor log that includes the following:

      i. name
      ii. organization
      iii. contact information
      iv. location
      v. visitor's previous location and destination
      vi. purpose of visit
      vii. date and time of visit

   b. Require that visitors who enter or leave the premises (as applicable) inspect or remove protective clothing and clean footwear, and provide a spare set of clothing and footwear.

5. **Signage**

   a. Meet any signage requirements to identify quarantine boundaries.

   b. Install reminder signs for staff and visitors regarding the extra precautions to take at identified entry and exit points.

   c. Ensure suspect or confirmed shelters, fields, or buildings are marked as such.

Record Keeping

As part of an elevated response plan, beekeepers should develop a contact list for use if significant problems were to occur.

To implement an elevated response plan requires that beekeepers maintain records such as a visitor log.

Operations Management

2.1 Obtaining Production Inputs

Target Outcomes

Only recommended production inputs are utilized and are obtained from known and reliable sources.

Description

Key Terms

Production inputs include "consumable" products:

- treatment products (disease, parasite, and insect pest control products, including chemical treatments); and
- cleaning and disinfection supplies.

Production inputs exclude bees (see section 1.1), and reusable bee equipment, other equipment, clothing, gloves, etc. (Refer to sections 2.3, 2.5, and 2.6).

Recommended: Advice provided by an alfalfa leafcutting bee specialist, government, or industry association to use or manage alfalfa leafcutting bees.

Known and reliable sources: Applies to acquiring production inputs from sources that are known providers of input products which are not expired (applicable to some treatment products) and are accurately labelled. Supplier lists for known and reliable sources of production inputs may be identified by industry associations or provincial apiculture programs, where applicable.

The Risks

The risk associated with using production inputs that are not recommended or obtained from known reliable sources:

Reduced Treatment Efficacy

- Purchasing and/or using expired treatment products may reduce treatment efficacy.

- Using treatment products that are not recommended for use with alfalfa leafcutting bees may be less effective than recommended treatments, and present a legal risk to the beekeeper.

Recommended Practices

1. **Domestic Sources for Production Inputs**
   - **a.** Where available, purchase from recommended suppliers or through recognized bee supply companies, as identified by a provincial industry association or provincial apiarist, where applicable.
   - **b.** Purchase production inputs from known and trustworthy suppliers.
2. **Recommended Products**
   - **a.** Only obtain treatment and sanitation products that are recommended for use with alfalfa leafcutting bees, as stated on the product label, minor use registration, or as prescribed by an alfalfa leafcutting bee specialist, provincial industry association, or provincial apicultural department, where applicable.
   - **b.** Ensure the date on products is not expired, if applicable. Follow storage instruction if the product requires special storage conditions (e.g. temperature, light, humidity).

Record Keeping

No records are required for production inputs in alfalfa leafcutting bees.

2.2 Handling and Disposal of Production Inputs

Target Outcomes

The degradation and contamination of production inputs is prevented by safe and secure storage and disposal.

Description

Production inputs include "consumable" products:

- treatment products (disease, parasite, and insect pest control products, including chemical treatments); and
- cleaning and disinfection supplies.

The Risks

Biosecurity risks associated with improper handling and disposal of production inputs:

- reduced efficacy of treatments, if treatment products are degraded or expired.

Recommended Practices

Handling and Disposing of Treatment Products:

a. Store, if applicable, chemical treatments according to label instructions

b. Use a "first in/first out" inventory management system for supplies; that is, use older inventory before newly acquired inventory.

c. Dispose of, according to the label instructions, any expired or excess products that will not be used.

Record Keeping

No records are required for handling production inputs in alfalfa leafcutting bees.

2.3 Obtaining Bee Equipment

Target Outcomes

Bee equipment is obtained from known and reliable sources. Used equipment is accompanied by proper permits, if required, and is cleaned and disinfected or treated upon arrival as needed.

Description

Key Terms

Bee Equipment

- includes reusable nest material (nest blocks, nest backing, boards and strapping), as well as trays and shelters.
- excludes production inputs (refer to section 2.1), processing equipment, tools, vehicles, and other equipment, which are addressed in section 2.5.
- may be purchased new or used.

The following are all acceptable types of bee equipment. All will require good handling and sanitation practices for continued use in a bee operation.

Nest blocks

- **a.** polystyrene blocks
- **b.** wood laminates
- **c.** polystyrene laminates

Nest backing material

- **a.** bonded polyester fill
- **b.** landscape cloth
- **c.** upholsterers' cotton
- **d.** foam

Trays

- **a.** wood
- **b.** plastic
- **c.** cardboard or waxed cardboard
- **d.** top and/or bottom screens should be considered when replacing old trays. Screens help increase air circulation, ensuring good incubation temperatures and increasing effectiveness of chemical treatments.

Shelters

- **a.** Generally, most shelter types are appropriate for use, including those made of plastic, tarps, wood, and metal.

Recommended: Advised by an alfalfa leafcutting bee specialist, government, or industry association for use or management of alfalfa leafcutting bees.

Known and reliable source: Applies to acquiring bee equipment from sources that are known as providers of quality products. Supplier lists for known and reliable sources of new bee equipment may be identified by industry associations or provincial apiculture programs, where applicable.

Treatment: Means disinfection by chemical, heating, or other methods to kill any living organism that could infect or infest healthy bees. Different pests require different treatments.

The Risks

The primary risk associated with introducing used bee equipment to the operation is the exposure of healthy bees to pests brought in with the used equipment. (Refer also to Bee Health, section 1.1, and 1.3). The risk is particularly high for chalkbrood; though the vegetative stage of the disease may be inactive, spores on the equipment can be viable for several years. Bee equipment reused in an

operation also carries a risk of spreading pests and should be treated in a manner that removes risks before reuse.

Damaged or broken equipment also increases the vulnerability of bees to parasites and insect pests. Damaged or broken equipment includes cracked nest blocks and mouse damage. The primary control method for parasites and insect pests is using new equipment, or equipment in good repair, tightly constructed nests, and nuisance pest control (section 2.8).

Recommended Practices

1. Purchasing Bee Equipment

- **a.** Whenever possible, purchase new equipment from known reliable sources.
- **b.** Avoid purchasing bee cells in nest blocks (section 1.1)
- **c.** Purchase new or used equipment from reputable bee supply companies, from known and trustworthy beekeepers, and from those with established biosecurity control programs. Avoid purchasing from third parties outside of the beekeeping industry or suppliers whose status cannot be verified
- **d.** Investigate unfamiliar suppliers before purchasing:
  - i. Visit their operations, observe (or interview by telephone), and ask questions about their disease history and management practices.
  - ii. Ask to see examples of their records and documentation provided.
  - iii. Ask for references from other customers, and follow up.
- **e.** Inspect and select new and used bee equipment, based on the following criteria:
  - i. nest blocks with no cracks or holes
  - ii. trays with joints that fit snugly, no cracks, and absence of debris

2. Receiving Used Bee Equipment

- **a.** Avoid acquiring used equipment.
- **b.** If necessary, only accept used equipment if the disease history is known.
- **c.** Segregate purchased used equipment from other equipment, and clean and disinfect prior to use.
- **d.** Refer to Appendix D for detailed descriptions on disinfection treatments.

3. Regulations and Compliance for Importing Used Bee Equipment

- **a.** Importing used alfalfa leafcutting bee equipment is not permitted, according to the *Health of Animals Regulations*, part 6, section 57.

Record Keeping

Effective management systems entail that record keeping occurs on the following:

- new and used bee equipment purchases
- treatment records for used equipment

2.4 Management and Maintenance of Bee Equipment, Dead Bees, and Bee Products

Target Outcomes

Bee equipment is regularly inspected and, when necessary, action is taken to minimize negative impact to bee health.

Description

Managing, cleaning, disinfecting, culling/disposal, and maintaining bee equipment in a manner that prevents or removes pests reduces biosecurity risk.

Key Terms

Bee Equipment includes reusable nest material (nest blocks, nest backing, boards and strapping), as well as trays and shelters.

Management includes handling, storage, cleaning, disinfection, and disposal.

Maintenance includes routine repair, inspection, and culling.

The Risks

Diseases can survive for years on surfaces of bee equipment, and in or on leaf cell debris and emerged bee cells. Other insect pests and parasites can survive for shorter periods in or on bee equipment. These can be transferred either directly or indirectly.

Recommended Practices

1. **Routine Inspection**
   - **a.** Look for signs of cracks, damage from predators such as mice, signs of vandalism, water damage, rot, or rust.
   - **b.** Thoroughly inspect all bee equipment for damage at least once per year:

i. Be aware that the ideal time for inspecting nest blocks is after bee cells have been removed, and before nests are prepared for placement in the field.

ii. Identify signs of damage from rodents in the field and before nests are brought in from the field.

iii. Increase the frequency of inspection when levels of parasites and pests remain at or above a beekeeper's treatment threshold.

2. Equipment Culling and Repair

a. Determine whether damaged equipment can be repaired or should be culled, and thus producers should consider the following:

i. The damaged area may require removal, and if this cannot be done in such a way that it leaves a clean edge for strapping to other nest blocks and allows the nest to be run through a bee cell extraction machine, then cull the nest block.

ii. Cull, rather than repair, all damaged nest backing material.

iii. Repair or cull damaged trays.

iv. Repair or cull damaged shelters.

b. Adopt a "Nest Block and Nest Back Filler Replacement Strategy" by, for example, replacing 20 percent of all nest blocks and 50 percent of nest back filler per year.

3. Cleaning and Debris Management

a. Remove debris, such as leaf material, dust, emerged bee cells, from bee equipment before proceeding with disinfection. Though debris can be disinfected, it will cover up or hide surfaces of equipment and reduce the effectiveness of disinfection. The following techniques can be used for cleaning:

i. scraping

ii. brushing or sweeping

iii. pressure washer

iv. compressed or forced air

b. Ideally, have a designated cleaning area for cleaning nest blocks, trays, and other equipment. A designated cleaning area will help to segregate the risk associated with cleaning debris and waste water to one area.

4. Disposal of Equipment and Debris

a. Keep culled materials segregated from the equipment still in use in the beekeeping operation, as well as from bee cell storage, incubation rooms, or other areas that may be exposed to healthy bee cells or bees.

i. Dispose of culled nest blocks, nest backing material, and trays, as well as debris by burning, burying, or sending to the landfill.

ii. If sending culled equipment and debris to the landfill, ensure proper handling of garbage to avoid contact with bees, insects, or rodents.

- Provide garbage bins at designated cleaning areas, in bee cell processing areas, equipment repair areas, or other areas where debris and damaged equipment is collected.
- Dispose of garbage regularly, in accordance with provincial and municipal regulations.

5. Equipment Disinfection

a. Disinfect yearly all bee equipment that is reused in a bee operation, regardless of its material.

b. Refer to Appendix D for a description on the various disinfection treatment methods.

6. Storage

a. Provide segregated storage for used equipment.

b. Keep garbage storage areas clean and maintained.

Record Keeping

Effective management systems will include record keeping on

- treatment records for equipment.

2.5 Personal Sanitation

Target Outcomes

Precautions are taken to minimize the spread of pests through human contact with bees and equipment.

Description

Human contact with bees may be direct via bare hands, or through contact with personal protective equipment.

Section 2.7 outlines the processing equipment, vehicles, forklifts, and pallets used in a beekeeper's operation.

The Risks

As the beekeeper moves between the storage, processing, and incubation facilities, there is a risk of spreading pathogens by hands, gloves, or via equipment. Overall, this risk is considered very low; however, the risk is considered higher when handling bee cells that have already undergone treatment and prior to bees' release in the field, or during bee equipment transfer to the field. This risk is only relevant to diseases and the spread of pathogens, specifically chalkbrood. The risk of spreading parasites and insect pests in this manner is low.

Recommended Practices

In general, if a producer has low chalkbrood levels, no practices need to be implemented. However, if high chalkbrood levels persist or if a new virulent pathogen enters the bee population, then, a producer should take extra preventative measures to control the spread of pathogens.

In general, producers should recognize that a potential for spreading pathogen through human transfer exists, and that there are scenarios under which increased management may be required to reduce the risk.

1. **Order of handling**
    - **a.** Ideally, people handle bees and equipment that have been cleaned and disinfected first before handling contaminated ones.
2. **Hand Washing (If Gloves Are Not Worn)**
    - **a.** Wash hands after handling infected equipment or bee cells.
    - **b.** Wash hands with water, soap, a mild bleach solution, or hand sanitizer.
    - **c.** Dry hands with paper towels or clean towel.
3. **Gloves and Clothing**
    - **a.** Wash and disinfect soiled reusable gloves before reusing to handle clean equipment or bee cells. Canvas gloves can be washed in a bleach solution. Rubber gloves can be scrubbed down with hand cleaner and a scouring pad or powder while being worn.
    - **b.** Wash coveralls or clothing regularly in a bleach solution and/or allow drying in the sunshine. UV rays from the sun can be effective in killing pathogens.

Record Keeping

No additional record keeping for personal sanitation practices is required.

2.6 Design of Facilities

Target Outcomes

Facilities are constructed to allow for ease in cleaning, are bee-tight if needed, and are consistent with government standards, if applicable. The facilities have appropriate lighting and climate control for safe storage of bees and production inputs, and enable monitoring and pest management.

Description

The term "pest" refers to pathogens, parasites, and insect pests.

Facilities should be designed to exclude pests, as well as to enable segregation, inspection, monitoring, treatment, and cleaning and disinfection, if there is a risk of introducing or spreading of pests.

Well-designed facilities with adequate climate control and dust control will limit exposure of bee cells in storage, and prevent degradation of production inputs such as treatment products. Storage with cold and heat control may also be used to effectively treat equipment, and to limit the growth of pests.

Dust control is particularly important in alfalfa leafcutting bee processing, as dust can contain chalkbrood spores and can re-infect clean facilities, nest blocks, or bee cells.

Facilities include

- nest, nest blocks, bee equipment, and bee cell storage facilities;
- bee cell processing facilities;
- incubation facilities;
- nest block construction facilities;
- storage facilities for bee production inputs, including treatment products, cleaning agents; and
- other storage facilities.

Facilities management extends to building exteriors and loading areas.

The Risks

Section 2.7 provides a description of the biosecurity risks associated with facility surfaces. While the risk of pest transmission to healthy bees via contact with the surfaces of facilities is relatively low, there are other risks to carefully consider:

- Bee cells in storage may be susceptible to stored product pests, parasites, rodents, lack of ventilation, and temperature.
- Stored treatment products may be degraded by high temperatures and light exposure, reducing efficacy.
- The effectiveness of some treatments may be impacted by temperature and ventilation. For example, the paraformaldehyde fumigation process requires temperature control, a vapour-tight facility, and ventilation.

- The inability to physically segregate disinfected or clean areas from dirty, dusty contaminated areas presents a risk of re-infection in the operation.

Recommended Practices

1. Building Design

Ideally, the following should occur:

a. Pave loading areas.

b. Grade and drain roadways and pathways.

c. Select rounded and smooth structural components such as post fittings, and lay out plumbing, electrical, and ducting pipes to limit the collection of dirt and debris (e.g. scrapings or dead bees) that are difficult to remove.

d. Apply light-coloured finishes that aid with visual inspection and cleaning.

e. Keep the exterior perimeter of the buildings clear of vegetation and debris.

f. Avoid covered ledges on building exteriors where pests could nest.

g. Ensure that filled nest blocks and bee cell storage facilities are large enough to prevent crowding, and to promote air circulation and even temperature and humidity throughout.

h. Locate bee facilities away from other farm or domestic animals.

i. Install effective dust control equipment in bee cell processing facilities.

j. Have buildings well insulated to help in controlling temperature.

2. Surface Materials

Ideally, the following should be carried out:

a. Design facilities with floors and walls that can be thoroughly cleaned and disinfected:

i. Acceptable materials include concrete, wood, drywall, metal, and plastic.

b. Select materials that are highly resistant to water, rust, corrosion, and rot.

c. Use light-coloured, non-toxic finishes that can withstand power washing:

i. Avoid packed dirt floors.

ii. Be aware that painted wood is better than unpainted.

iii. Use mouldings at edges of floor to prevent buildup of material in corners.

3. Ensure Facilities Limit Access to Rodents, Birds, and Insects.

Ideally, these actions should occur:

a. Ensure that doors are tight and have surrounding flaps to further limit entry of pests.

b. Ensure crevices and entry points around doors, windows, and utility service inlets, air intake and fan openings can be sealed or are plugged or caulked.

4. Provide Appropriate Temperature-Controlled Facilities.

a. Follow temperature requirements for storage and incubation. A refrigeration unit, heater, ventilation, circulating fans, and air conditioning unit may be necessary.

b. Maintain filled nest block and bee cell storage facilities at 4oC–10oC.

c. Install thermometers and humidity detectors on storage facilities and incubation facilities.

d. Consider installing electronic monitoring and alarm systems for temperature (and humidity) controlled storage.

5. Ensure Adequate Ventilation and Air circulation in Storage Facilities and Incubation

a. Install fans, ducts, air exchange/mixing rooms, and ventilation fans to facilitate air circulation and ventilation.

b. Install variable controls on air-handling equipment.

c. Plan adequate ventilation in each facility for the following:

i. incubation
ii. bee cell storage
iii. paraformaldehyde fumigation chamber

d. Plan adequate air intake in each facility for the following:

i. incubation
ii. paraformaldehyde fumigation chamber

e. Require adequate ventilation in facilities used for storage of paraformaldehyde.

f. Require sealed rooms for paraformaldehyde chambers.

g. Stack nest blocks, bee cells, trays, and other equipment in a way that allows for good air circulation.

h. Install back-up power systems.

6. Dust Control Should be Installed in Bee Cell Processing Facilities

a. Examples of dust collection equipment:

i. ducting and fans connected to a baghouse or cyclone
ii. air filtration system
iii. exhaust fans

b. Bee cell processing rooms should be sealed off from other storage and incubation facilities.

7. Lighting

Ideally, the following should be considered:

- **a.** Exclude as much light as possible in the bee cell storage facilities to suppress bee, parasite, and insect pest activity.
- **b.** Provide adequate lighting to enable inspections and other maintenance tasks in all facilities.

8. Segregation

Segregated storage can be achieved in separate buildings, separate rooms with doors that are sealed when shut, or by using plastic curtains.

Ideally, provide segregated storage areas for

- **a.** receipt purchased bees and equipment.
- **b.** infected, infested, or suspect bee cells.
- **c.** bee cell processing.
- **d.** repairing and preparing nest blocks.
- **e.** incubation.
- **f.** filled nests and bee cell storage.

9. Cleaning and Waste Disposal

Ideally, the following should take place:

- **a.** Have an adequate water supply for pressure washing and a liquid disposal system.
- **b.** Provide leak-, insect-, and rodent-proof garbage containers.

Record Keeping

No record keeping is required for facility design.

2.7 Maintenance of Premises, Buildings, Vehicles, and Other Equipment

Target Outcome

A sanitation and maintenance program is implemented for all premises, buildings, vehicles, and other equipment.

Description

Pests that survive on premises, buildings, vehicles, and other equipment can be directly spread to bees.

Managing, cleaning, disinfecting, and maintaining premises, buildings, vehicles, and other equipment in a manner that prevents or removes pests will reduce biosecurity risk.

Maintaining building systems (e.g. ventilation, temperature, humidity control, and lighting) help to reduce susceptibility and exposure of bee cells in storage.

The Risks

Pathogens can survive on many surfaces and in carrier substances such as leaf debris. If diseased bees or bee cells are handled by vehicles and equipment that are subsequently used to handle healthy bees, there is a risk of pathogen spread. Insect pests and parasites can usually survive on equipment, buildings, and unused bee equipment for only a short period of time, thus making the risk of spread through facilities and other equipment relatively low. A sanitation program that includes cleaning and decontamination of facilities decreases this risk further, which is most important for producers with high levels of pests in their operations.

Table 4 describes the levels of risk for site areas and surfaces.

TABLE 4 Site or surface levels of risk

Site or surface	Risks
Bee cell processing facilities, traying area	Moderate to high risk. Bee cell processing and traying creates a great deal of dust that can carry disease spores. Maintenance of dust control and continued cleaning and disinfecting are necessary practices.
Incubation facilities	Moderate. Healthy bees may be exposed to parasites or to infection through direct transfer from adult bees or secondary transfer by people, or equipment. Parasite control, along with cleaning, disinfecting, and maintaining buildings can reduce this risk further.
Premises	Low risk. While diseases, parasites, and pests can survive on equipment in yards, the risk of spreading these risks to bee cells is low. This would happen due to secondary transfer by people, nuisance pests, or equipment. The absence of unused equipment, control of weeds, and general maintenance of yards reduces this risk further.
Filled nest block and bee cell storage facilities	Low risk. Healthy bee cells may be exposed to infection from secondary transfer by people or equipment. Rodent damage can increase bee vulnerability and exposure to parasites and pests, and other pests can feed on bee cells. Clean, disinfected, and well-maintained buildings can reduce this risk further.
General storage and other buildings	Low risk. Nest material can be damaged by rodents, and treatments could be damaged in poorly maintained storage.
Transport vehicles and forklifts	Low risk: Disease, parasites and pests can survive for varying lengths of time on transportation equipment surfaces. Using clean disinfected transportation and forklifts for bee cells and bee equipment in incubation, or as bees are being taken to the field for release, can reduce the risk further.

Key Terms

Designated cleaning area: A location on a premises or in a building that has been designated for cleaning activities.

Other equipment: Equipment used for moving bee cells and nest blocks, and for processing bee cells

Mechanical removal (scraping, brushing, sweeping, vacuuming, air): Sanitation procedures to remove foreign material from surfaces, using a brush, broom, hand, or other object.

Sanitation (cleaning): Any activity that physically cleans and removes foreign material from an object or surface. Forms of sanitation include mechanical removal and (power) washing and may be done in conjunction with disinfection.

Disinfection (disinfecting): The process of killing pathogenic organisms or rendering them inert (e.g. bleach, heat, or fumigation).

Recommended Practices

1. Premises Maintenance

a. Remove any unused equipment and, where possible, any structures that could be used by pests.

b. Level and maintain roads and yard. Maintain good water drainage.

c. Remove weeds from around building, as they may encourage nuisance pests.

2. Sanitizing Buildings and Equipment

a. Thoroughly clean the filled nest block and bee cell storage, and bee cell processing and incubation facilities once per year before new production comes back from the field in the late summer. Remove debris, sweep floors where possible, and power wash floors, walls, and ceilings that can be cleaned.

b. If handling known infected equipment during incubation or spring release, clean forklifts, transportation vehicles, and other equipment before handling clean bee cells and bee equipment.

c. Clean the bee cell processing area daily to remove dust by vacuuming, air, or sweeping. The dust is removed from the building and is disposed of by taking to a landfill or burying it.

3. Disinfecting Buildings and Equipment

a. If vehicles, equipment, or buildings have been used to handle bee cells or bee equipment infected with disease, or if chalkbrood levels remain at or above thresholds established by a beekeeper, use the following techniques for disinfection:

i. First assure the surfaces of the building, vehicles, and equipment have been cleaned to remove dust, dirt, and debris.

ii. Disinfect with products such as bleach, or treat with paraformaldehyde (incubation room and equipment)

4. Building Maintenance

a. To ensure that buildings are kept in optimal condition, beekeepers should

i. annually check buildings to ensure that openings to rodents and other nuisance pests are sealed.

ii. monitor any storage and incubation facilities daily to ensure that heating, cooling, humidity, air circulation, and ventilation systems are functioning properly to maintain adequate air quality, including temperature and moisture. Use the following techniques to monitor these conditions:

- Install and tie thermostats and humidity detectors to an alarm system.
- Provide physical monitoring of the facilities at regular intervals.

5. Maintenance of a Designated Cleaning Area for Vehicles and Equipment

a. Vehicles and portable equipment are cleaned at designated cleaning areas and waste water is handled appropriately:

i. Drainage of waste water is contained or diverted away from where bees are kept. If possible, the designated cleaning area should be power washed after cleaning infected equipment and vehicles.

Record Keeping

Effective management systems include record keeping on the following:

- cleaning and sanitation notes
- treatment records for equipment and building
- premises, building, and equipment maintenance notes

2.8 Control of Weeds and Nuisance Pests

Target Outcomes

An integrated management program for weeds and nuisance pests is implemented.

Description

Key Terms

Weeds: Unwanted vegetation, including cultivated and volunteer crops, growing in and around the shelters or buildings.

Nuisance pests: Rodents such as mice and voles, skunks and raccoons, as well as some birds.

The Risks

Weeds growing in and around shelters and buildings can

- provide nesting sites for nuisance pests.
- hold moisture that can promote pathogens such as chalkbrood that thrive in high humidity conditions, and reduce the heat in shelters affecting bee foraging and health.
- obstruct the beekeeper from performing routine inspections and managing the bees.

A nuisance pest may

- consume bees and bee cells,
- disturb bees,

- damage bee equipment, and
- make nests.

Recommended Practices

1. Monitoring

With each visit to a shelter, monitor for weed growth, the presence of nuisance pests, and visual signs of infestation and disturbance such as

a. damage to or theft of bee equipment, and

b. the presence of weeds in the shelter and the growth of weeds and crop in front of shelters.

2. General Control

a. Keep shelters and surrounding area free of unused and broken equipment, garbage, and other attractants.

b. Be aware that many nuisance pests can be deterred by dogs or solar- or battery-powered motion-activated devices that set off flashing lights or a loud noise.

3. Weed Control

a. Mow a strip in front of shelter – though take care to avoid disturbing bees.

b. Use a weed eater or pull weeds inside the shelter.

c. If using herbicides, such as glyphosate, apply products safely for use around shelters, avoid application when bees are flying or when weeds are in bloom, and follow product labels.

d. Keep entrances and the perimeters of facilities clear of weeds and vegetation that could provide nesting sites for nuisance pests.

4. Rodent Control

a. For control of rodents in buildings or shelters

i. Set traps.
ii. Use recommended rodent poison.
iii. Complete regular building maintenance, and close, cover, or fix rodent entrances.
iv. Use cats or dogs, or other pets in buildings.
v. Set up a sonic device.
vi. Routinely monitor baits, traps, and poison, and replace baits and poison as needed.

5. Bird Control

a. Remove any nests from shelters or buildings.

6. **Vandalism and Theft**
    a. Monitor for signs of vandalism and repair or replace equipment when it occurs.
    b. Notify the police if the problem persists.

Record Keeping

Effective management systems will include record keeping on the following:

- nuisance pest control notes

2.9 Training and Education

Target Outcomes

All those working in a beekeeping operation or utilizing bees are trained and regularly updated on biosecurity risks and protocols.

Description

Key Terms

Staff: All those who work in the beekeeping operation, including the owner/senior beekeeper, family members, and hired employees.

A **Biosecurity Training Plan** is in place, resource material is sourced or developed, and training and updates are delivered to staff to address the purpose, principles, and processes associated with alfalfa leafcutting bee biosecurity.

Standard Operating Procedures or **SOPs** are developed for the beekeeping operation. These are written (and illustrated), using step-by-step explanations on how to perform a task from beginning to end.

The Risks

- exposure to and/or spread of diseases, and insect pests, and parasites to healthy bees;
- missed or delayed diagnosis and treatment of a disease, insect pest, or parasite, resulting in economic loss;
- incorrect diagnosis of a disease, insect pest, or parasite, resulting in unnecessary treatment;
- errors in administering treatments that could reduce efficacy of treatment, or otherwise negatively impact bee health; and
- risks to employee health and safety when administering treatments to address biosecurity risks.

Recommended Practices

It is recommended that beekeepers supplement their own knowledge and/or staff training program by

- joining their provincial beekeeping association
- accessing resources available through
  - —the provincial industry association
  - —their provincial government (where applicable)
  - —an alfalfa leafcutting bee specialist

1. Standard Operating Procedures

SOPs are developed and reviewed at least annually for the following processes:

a. monitoring and reporting (monitoring methods, and standard and elevated frequency and sampling percentage);

b. quarantine protocol;

c. prevention methods;

d. treatment administration;

e. record keeping; and

f. other SOPs, as identified by the beekeeper.

2. Depth, Scope, and Content of Training

The depth and scope of biosecurity training should be appropriate to the job scope of the employee, family member, or senior beekeeper; however, all working within the operation should have a good general understanding of the purpose, principles, and processes of biosecurity.

Biosecurity training should include knowledge of

a. biosecurity principles, risks, and why biosecurity is important to the operation and the Canadian industry; and

b. an understanding of

i. common, new, and exotic biosecurity risks and their life cycles,

ii. vectors or risk entry points to the operation,

iii. relationship to bee lifecycle,

iv. storage conditions and other factors that promote or impede spread of the risk, and

v. potential impact on bees and bee production.

c. monitoring and sampling procedures. (the senior beekeeper should be trained in advance and know when the implementation of standard and elevated response plans should be triggered. All staff involved in bee cell processing and receiving bee cells should be familiar with proper sampling protocol and lot creation procedures.)

d. recommended practices to prevent the spread of diseases, insect pests, or parasites while performing regular duties:

i. storage, stacking, and handling of nests and bee cells,
ii. bee cell processing,
iii. incubation practices, and
iv. cultural controls.

e. treatment application methods:

i. how to understand and interpret product label instructions
ii. accessing and following current industry treatment recommendations
iii. worker safety when handling and applying treatments

f. current regulations such as governing registration, bee cell purchase, sale and treatments

g. key contacts

h. record-keeping requirements within the operation.

i. system creating and recording lots, etc.

3. Timing and Frequency of Training

Staff are

a. trained for the jobs or tasks they will be doing.

b. given an annual update or refresher on biosecurity at the start of each season.

c. given updates as needed throughout the operating season.

4. Training Methods

Examples of training include the following:

a. in-house staff orientation training sessions or meetings;

b. on-the job training by working under direct supervision;

c. self-study; and

d. attending demonstrations, seminars, or workshops offered by the provincial government, industry associations, private organizations.

5. Support Materials

To improve comprehension,

a. training and support materials are illustrated, well-organized, and written in simple (non-scientific) language.

b. training and support materials are translated, as applicable.

Examples of support materials for use in training:

a. Bee Biosecurity Standard and this Producer Guide

b. written SOPs

c. videos

d. demonstrations

e. photos and illustrations

f. posters

g. examples with notes (e.g. product labels and report forms)

h. memo postings and emails

i. workbooks or self-assessment checklists (paper or electronic)

j. bulletins, newsletters, treatment recommendations, etc. (paper and online)

Record Keeping

Ideally, a record of training is kept for each worker.

Examples of records:

- title and/or certificate of attendance for seminars, workshops, courses attended;
- individual training records, detailing training given and dates; and
- a signed confirmation from each staff member that SOPs have been read and understood.

Appendices

Additional Resources

1. Alfalfa Seed & Leafcutter Bee Production & Marketing Manual, Alberta.

2. Alfalfa Leafcutting Bee Management and Alfalfa Seed Production Manual, Saskatchewan.

3. Alfalfa Leafcutter Bee Management in Western Canada, Agriculture Canada, Publication 1495/E.

4. The Saskatchewan Alfalfa Seed Producers Website, Alfalfa Leafcutter Bee Management Section:
   - http://www.saspa.com/beeManagement.htm
   - Articles and research prepared by Wayne Goerzen, Research Scientist
   - Information on management practices, lists of suppliers, diagnostic labs, pests and pest management, facility design, and alfalfa leafcutting bee research.

5. The Alfalfa Seed Commission (Alberta) Website
   - http://www.alfalfaseedab.com/
   - Information on diagnostic labs, and alfalfa leafcutting bee research

6. Chalkbrood Management: More than just turning the pans on, by David Ostermann, Pollination Apiarist

7. Federal Government

   a. Canadian Food Inspection Agency

   For bee industry information, follow Path to Animals-Terrestrial Animal Heath:

   - Biosecurity
   - Health of Animals Act and Regulations
   - Reportable Diseases, Immediately Notifiable and Annually Notifiable Diseases

   b. Health Canada, **Pest Management Regulatory Agency** (PMRA)

Provincial Contact Information (Where Applicable)

Province	Department	Telephone number
British Columbia	Ministry of Agriculture	604-556-3129 or 1-888-221-7141
Alberta	Alfalfa Seed Commission	403-362-4449
	Agriculture and Rural Development	780-415-2314 or 310-0000
Saskatchewan	Sask Leafcutters Association/ Saskatchewan Alfalfa Seed Production	306- 651-7275
	Agriculture	306-953-2304
Manitoba	Agriculture, Food and Rural Initiatives	204-945-4825 or 204-945-3861
	Manitoba Forage Seed Association	204-376-3309
Ontario	Ministry of Agriculture, Food and Rural Affairs	519-826-3595
Quebec	Agriculture, Pêcheries, et Alimentation	418-380-2100
New Brunswick	Agriculture, Aquaculture and Fisheries	506-453-2666
Nova Scotia	Agriculture	902-679-8998
Prince Edward Island	Agriculture and Forestry	902-314-0816
Newfoundland and Labrador	Department of Natural Resources Apiculture	709-729-3017

Sampling Protocol

Sampling intensity when sampling from storage containers (follow guidelines developed for the seed industry)

Number of bee cell containers	Number of primary samples
1–4	3 per container
5–8	2 per container
9–15	1 per container
16–30	15 primary samples
31–59	20 primary samples
60 or more	30 primary samples

Sampling intensity when stream sampling (follow guidelines developed for the seed industry)

Lot size	# of primary samples
< 500 kg	At least 5
501–3000 kg	1 for each 600 kg
3001–20,000	1 for each 1000 kg
20,001–40,000	1 for each 1500 kg
40,001–60,000	1 for each 2000 kg
> 60,001	1 for each 2500 kg

Suggest minimum size of composite sample (follow guidelines developed for the seed industry)

Type of test	Minimum Sample required for testing	Minimum Composite Sample Drawn
CCTC x-ray tests	100 g	400 g

CCTC = Canadian Cocoon Testing Centre

Disinfection Treatment Techniques

Bees, Bee Equipment, Buildings, and Other Equipment

a. Bleach (sodium hypochlorite)

i. **Caution:** Bleach is toxic; refer to product label, and use protective gear, including gloves and respirators when using.

ii. Require solutions at concentrations of 3%–5%.

iii. Dip bee cells in solution for 1 to 3 minutes. Add bleach to the solution after each successive batch of bee cells is treated. The solution will heat up and thus will need to be replaced after 5 to 10 batches.

iv. Dip nests blocks in the solution in a similar fashion to bee cells.

v. Spray nests, shelters, trays, building, and other equipment with a bleach solution; good coverage is important.

vi. Avoid using bleach on metal, especially with metal screens on trays. Bleach is corrosive to metal and may damage equipment.

b. Heat

i. Bee equipment, trays, and racks, and processing equipment can be heat treated to kill the chalkbrood spores.

ii. Expose to 93°C for 12 hours to kill chalkbrood spores. The core temperature of the room needs to be 93°C, exposing any equipment to this temperature for a full 12 hours is required for complete treatment.

c. Paraformaldehyde treatment of bee cells, bee equipment, and facilities can also be used to control chalkbrood. The following should be considered when using paraformaldehyde:

i. **Caution:** Paraformaldehyde is toxic. Read safety instruction and product labels thoroughly prior to use. Avoid entering a room once treatment with paraformaldehyde has started. Take precautions to ensure the room has been completely ventilated before entering after treatment, and wear a respirator and protective clothing when entering the room at the appropriate interval following treatment.

ii. Ensure that room, buildings, and containers are vapour-tight.

iii. Make sure rooms have good air circulation, temperature, and humidity control.

iv. For nesting material, trays and equipment, condition the nesting material for 48 hours at 20°C–25°C/ 60%–70% relative humidity before treating with paraformaldehyde. Stack nesting material, trays, and equipment to allow for good air circulation.

v. When treating bee cells, place in trays at depths of 1 to 1.5 inches, and use screens on trays to allow for good exposure to chemical. Ensure trays are placed to allow for good air circulation.

vi. Be aware that bee cells that have been thoroughly conditioned before treatment to remove excess leaf material will yield optimum treatment results.

Sample Record Keeping

Bee Release/Placement

Field ID	Location	Crop	Acres	Number of shelters	Number of trays placed	Source of bees placed on field (lot or notes)	Number of nests placed	Type of nest

Nest Storage

Lot name/ number	Date placed in storage	Storage location	Number of nests	Type of nests	Gallons (estimate)	Treatments applied	Date of treatment	Pest observations	Other observations

Bee Cell Processing and Test Results

Date	Number of nests processed	Source of nests (lot or notes)	Number of loose bee cell containers	Weight of containers	Total gallons or number of bees	Sample taken	Test Results				
							Chalkbrood	Parasites	Live count	Male/ Female	Other

Traying and Incubating

Traying date	Number of trays	Gallons of bees used	Source information (lot or notes)	Date of paraformaldehyde treatment (if appropriate)	Treatment notes	Date incubation started	Treatment used in incubation	Date treatment applied	Date removed from incubation	Observation in incubation

Appendix F

Flow Charts of Alfalfa Leafcutting Beekeeping and Risks

Figure 1: Overwintering

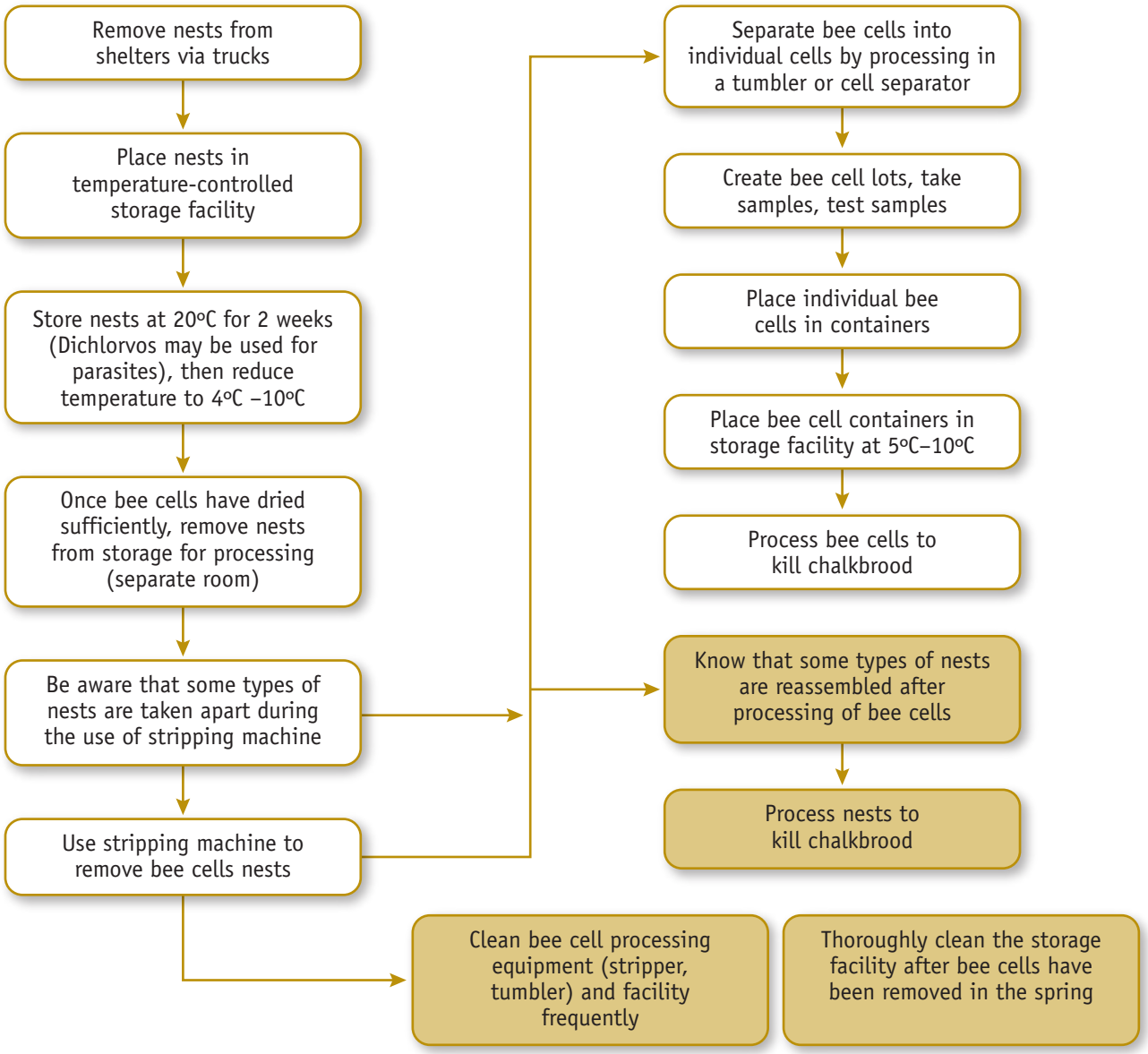


Figure 2: Incubate Prepupal to Adult

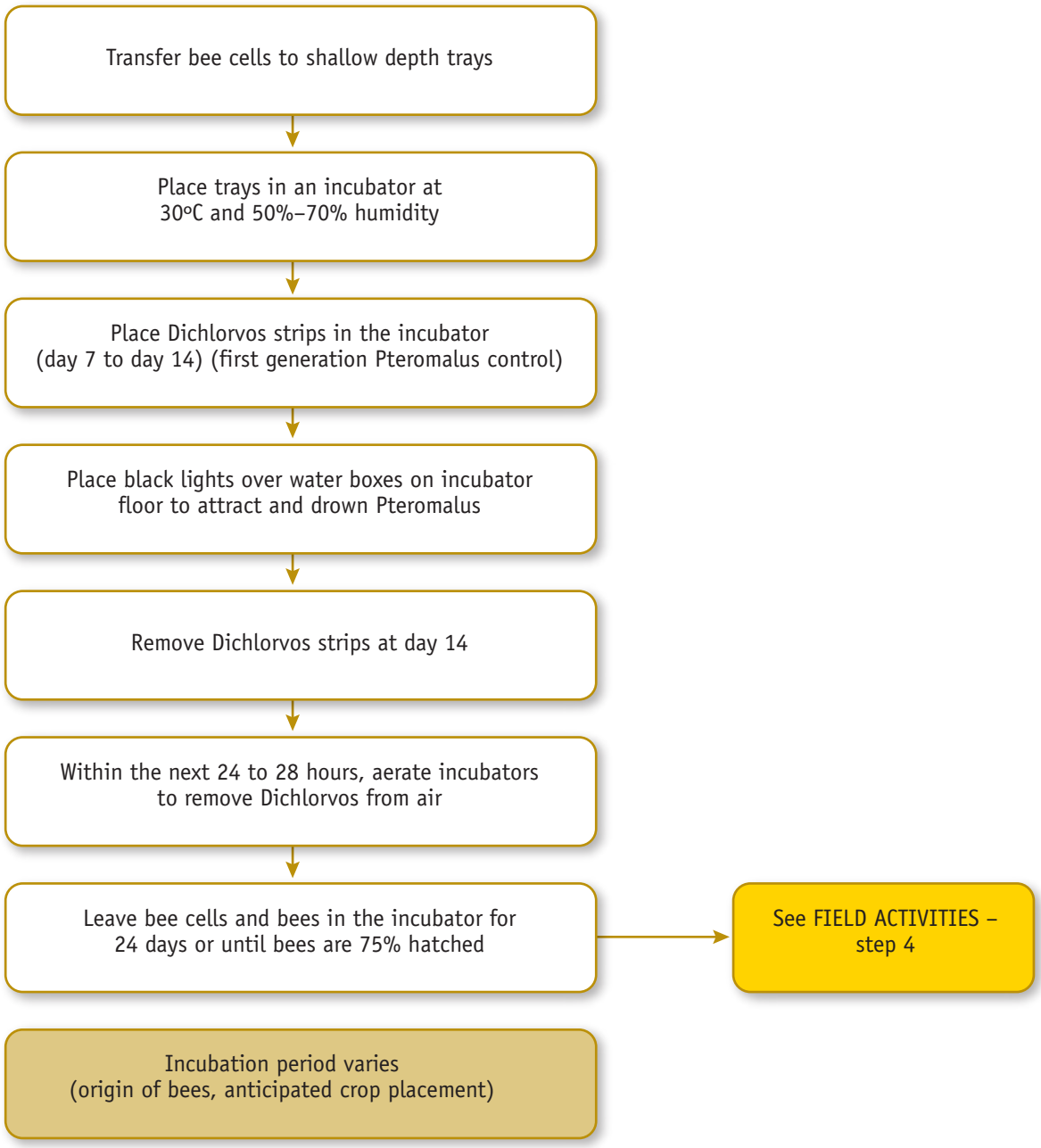


Figure 3: Field Activities

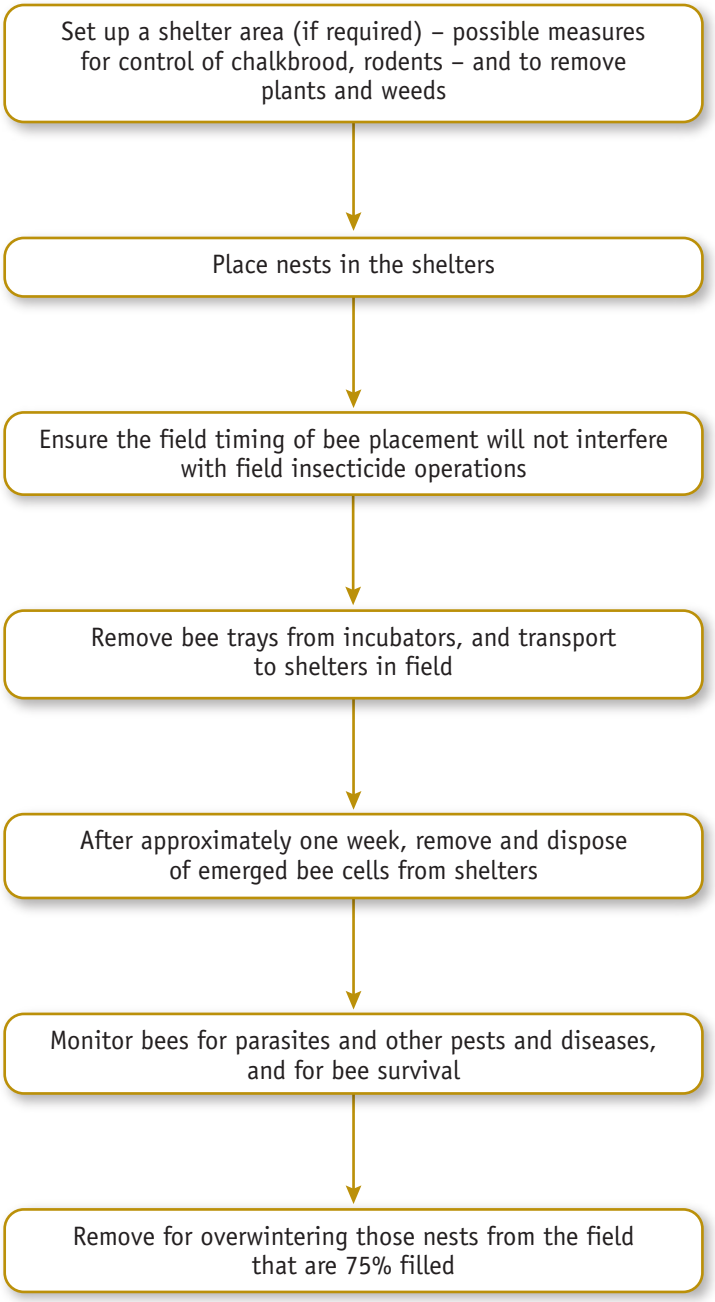


Figure 4: Shipping Bees

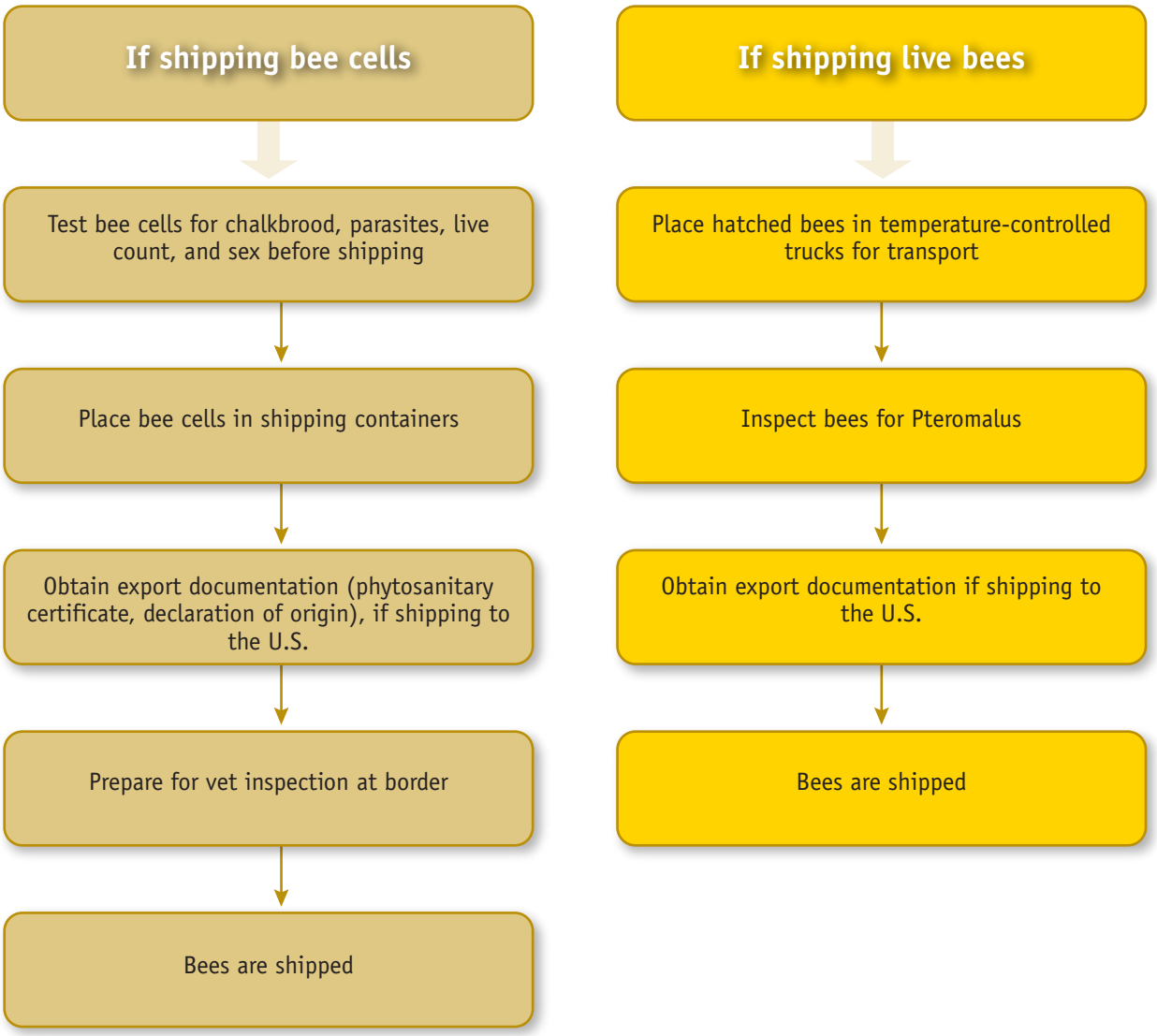


Figure 5: Receiving Bees

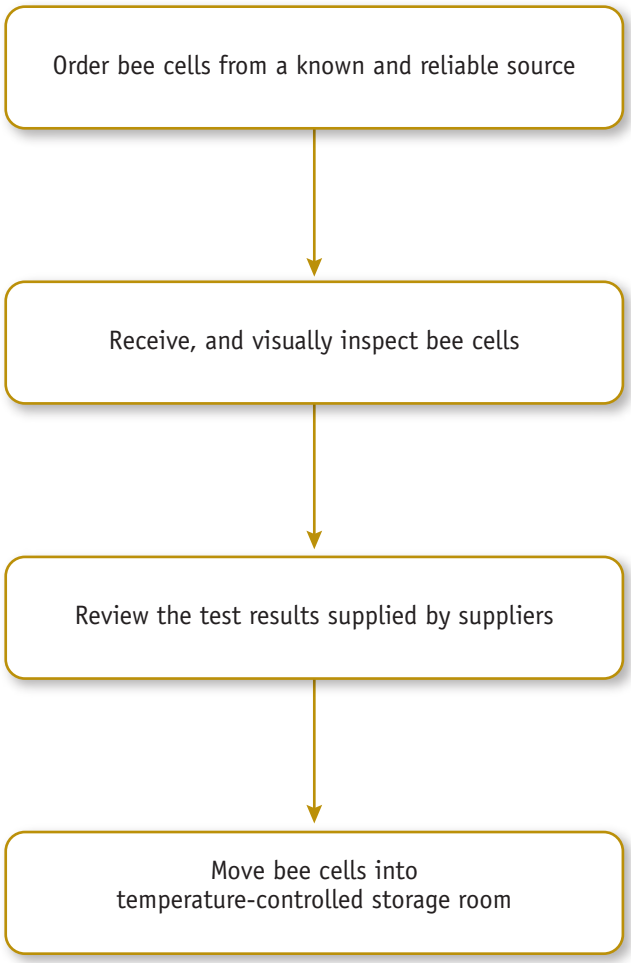


Figure 6: Receiving Supplies

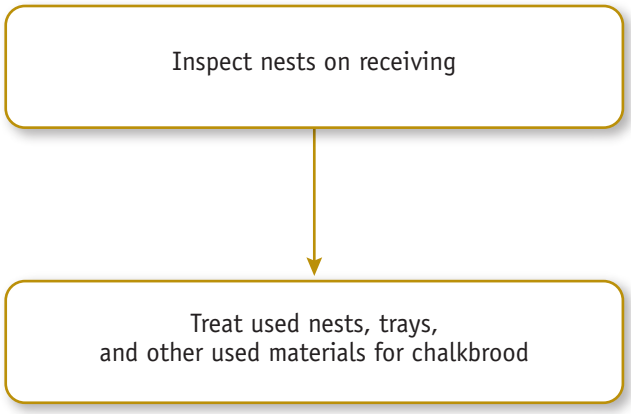


Figure 7: Facilities

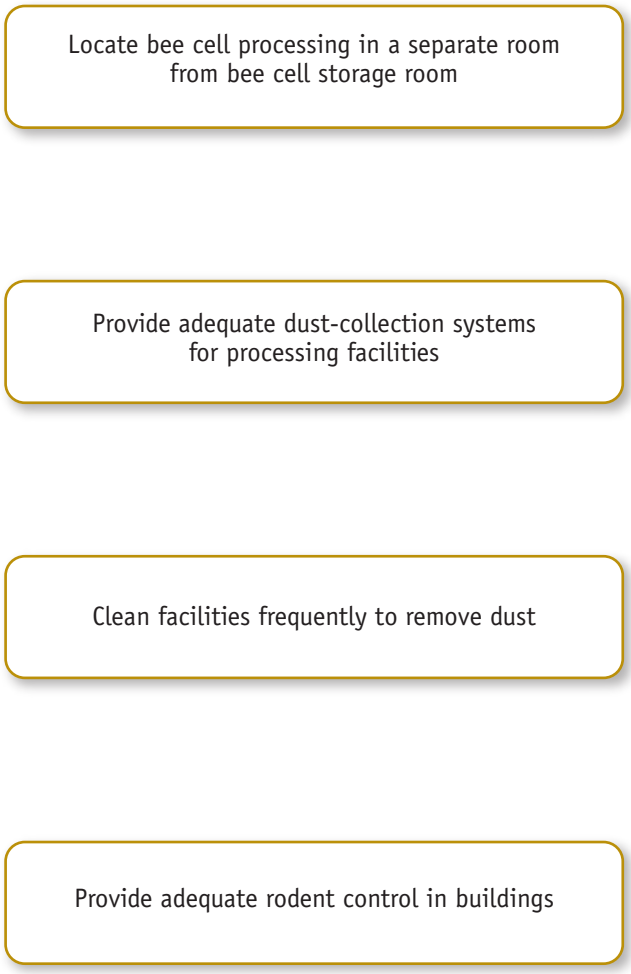
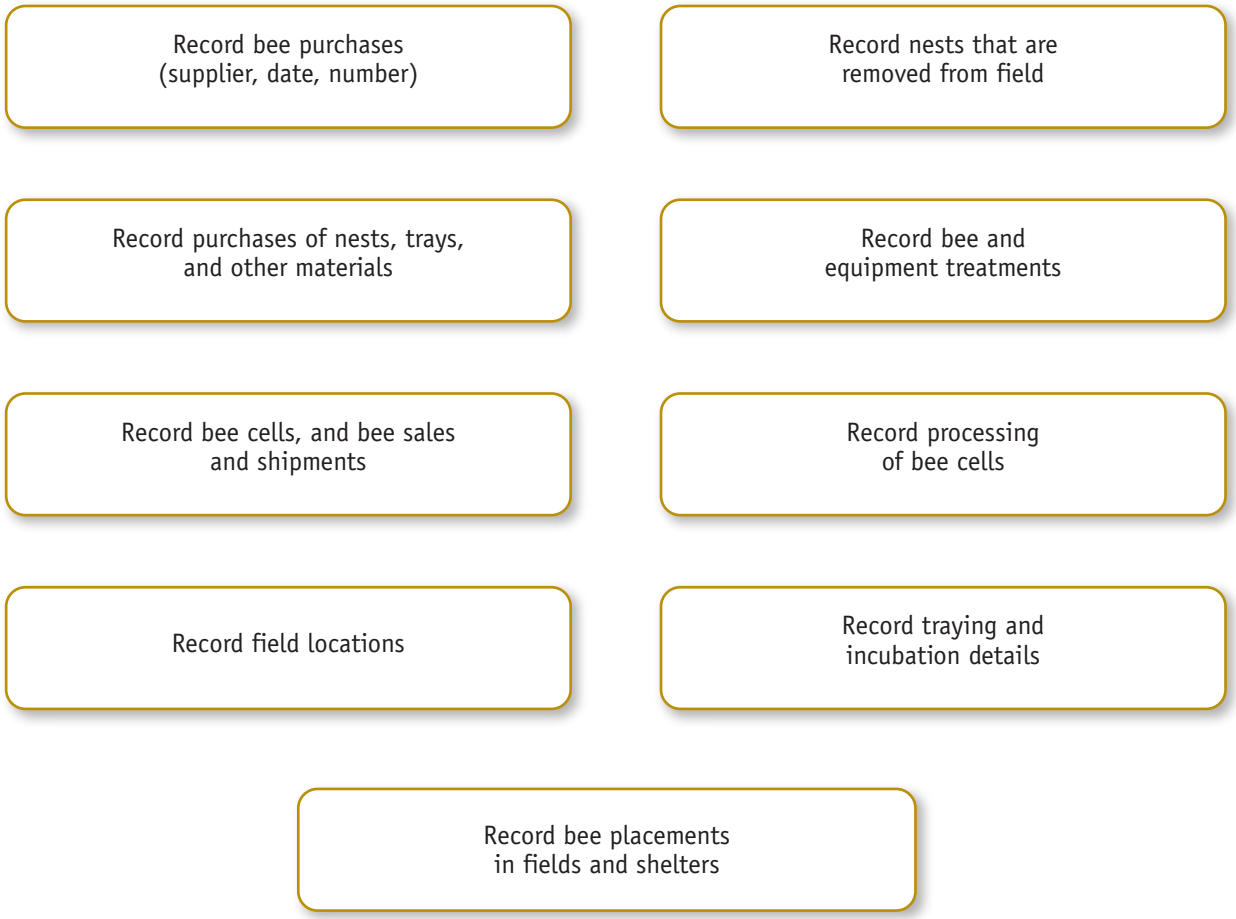


Figure 8: Recording



Alfalfa Leafcutting Bee Biosecurity Checklist

Section 1: Bee Health Management

1.1 Bee Sources
☐ The Canadian Loose Bee Cell Management System is followed
When purchasing bees ☐ purchase loose bee cells ☐ avoid purchasing filled nest blocks and incubated or adult bees ☐ purchase from trusted suppliers that can provide test results from the Canadain Cocoon Testing Centre (CCTC) ☐ establish lots, if suitable for your operation
Lots are based on ☐ source ☐ nest box type/year purchased ☐ crop ☐ client ☐ percentage of nest block fill ☐ processing date ☐ treatments ☐ incubation groups
☐ lots are sampled following recommended practice in a repeatable and consistent manner ☐ samples are tested either by a trained producer or the CCTC
1.2 Prevention: Minimizing Susceptibility to Pests
Storage and incubation facility control: ☐ temperature ☐ humidity ☐ air circulation/ventilation
☐ nest boxes are stored/stacked off the floor
☐ loose bee cells are stored in containers that limit conditions that encourage the development of pests
☐ nests and shelters are constructed and maintained in a state that limits access to pests
☐ bees are located in areas that minimize the impact of irrigation where applicable

1.3 Prevention: Minimizing Exposure

Exposure to pests is minimized during storage and incubation:

- ☐ preventative treatments and methods are used
- ☐ temperature, humidity, and air circulation is monitored and maintained
- ☐ light is limited
- ☐ known infected/infested lots and cells are stored and incubated separately from healthy ones
- ☐ emerged bee cells and trays are removed from shelters and disposed of in an acceptable way

Precautions are taken to minimize bee drifting and intermixing:

- ☐ visual cues are used for shelters and nests
- ☐ exposure to other bee species is avoided
- ☐ recommended alfalfa leafcutting bee pollination stocking rates are followed
- ☐ shelter distance to bees of other sources is maximized where possible
- ☐ known or suspect bee lots are treated separately
- ☐ bee release is timed to coincide with nectar and pollen flow
- ☐ nest boxes are monitored for percent filled tunnels
- ☐ full nests are removed and empty nests are added as required
- ☐ bee cells are effectively dried, processed and conditioned

Minimize exposure to pests during transport:

- ☐ cover or enclose trays
- ☐ use screened trays

1.4 Diagnosis and Monitoring

Principles:

- ☐ thorough sampling methods
- ☐ involvement with inspection programs where applicable
- ☐ establishing and acting on thresholds
- ☐ monitoring
- ☐ training
- ☐ treatment efficacy
- ☐ record keeping

1.5 Standard Response

- ☐ treatment thresholds are followed
- ☐ all treatment label directions are read and followed
- ☐ recommended products are used
- ☐ treatments are thorough and consistent
- ☐ treatment is timed
- ☐ cultural and biosecurity methods are incorporated

1.6 Elevated Response

- ☐ communication with staff, provincial apiarists, associations, suppliers, clients, government and other growers
- ☐ suspected and confirmed threat protocols are in place and are implemented if an elevated response is triggered (may include suspension of hive movement, restricted access, heightened monitoring and sampling)
- ☐ personal, equipment, and visitor biosecurity protocols are followed
- ☐ records are kept and maintained

Section 2: Operations Management

2.1 Obtaining Production Inputs

- ☐ production inputs are purchased from recommended and trusted suppliers
- ☐ production treatments are approved for use with alfalfa leafcutting bees and in good condition

2.2 Handling and Disposal of Production Inputs

- ☐ chemical treatments are stored according to product labels
- ☐ a “first in/first out” inventory system is used
- ☐ label instructions are followed for disposal of excess or expired products

2.3 Obtaining Bee Equipment

Considerations for purchasing bee equipment:

- ☐ new equipment is purchased
- ☐ reliable and trusted suppliers are used
- ☐ the purchase of bee cells in nest blocks is avoided
- ☐ equipment is inspected

Considerations for purchasing used bee equipment:

- ☐ used equipment is avoided
- ☐ if necessary, used equipment with known disease history is purchased
- ☐ used equipment is cleaned and disinfected in a segregated area
- ☐ alfalfa leafcutting bee equipment is not imported

2.4 Management and Maintenance of Bee Equipment, Dead Bees, and Bee Products

- ☐ inspection for condition and damage is conducted at least once a year
- ☐ damaged nest backing material is culled
- ☐ damaged trays and shelters are culled or repaired
- ☐ a nest block and nest back filler replacement system is used
- ☐ debris is cleaned and removed from equipment before disinfection
- ☐ a designated cleaning area is used, where possible
- ☐ culled material is stored in a separate area away from other operations
- ☐ materials and equipment are disposed of appropriately
- ☐ all reused equipment is disinfected once a year

2.5 Personal Sanitation

- ☐ bees and equipment that have been cleaned and disinfected are handled before dirty or contaminated bees and equipment
- ☐ healthy bees are attended to before suspect or diseased bees

Hands are washed where appropriate:

- ☐ after handling infected equipment or bee cells and subsequently handling clean bees
- ☐ if extra precautions are required in an operation due to persistently high levels of pathogens
- ☐ soiled reusable gloves are washed and disinfected before reuse where appropriate
- ☐ coveralls and clothing are washed regularly

2.6 Design of Facilities

- ☐ roadways and pathways are graded and drained
- ☐ facility exteriors are kept free from vegetation and debris

Interiors and exteriors of facilities are constructed and maintained to reduce exposure to pests:

- ☐ cleaning and disinfection is considered in the design
- ☐ temperature control is adequate
- ☐ humidity control is adequate
- ☐ air circulation/ventilation control is adequate
- ☐ access by rodents, insects, and birds is limited
- ☐ dust is controlled
- ☐ lighting is limited
- ☐ water supplies are adequate

Separate facilities exist for

- ☐ bee cell processing
- ☐ repairing and preparing nest blocks
- ☐ incubation
- ☐ filled nests and bee cell storage

2.7 Maintenance of Premises, Buildings, Vehicles, and Other Equipment

- ☐ filled nest blocks and bee cell storage, and bee cell processing and incubation facilities are cleaned thoroughly once per year
- ☐ all equipment used for handling infected material is cleaned
- ☐ bee cell processing area is cleaned once a day to remove dust

Building and equipment disinfection considers:

- ☐ contact with infected bee cells or equipment
- ☐ cleaning (removal of debris and dust)
- ☐ disinfection with an appropriate product

Buildings are maintained in optimal condition:

- ☐ rodent and nuisance pest checks occur annually
- ☐ environmental (temperature, humidity, and ventilation) monitoring is undertaken
- ☐ environmental alarm systems are used, if possible
- ☐ regular physical observation and monitoring occurs
- ☐ vehicles and portable equipment are cleaned at designated cleaning areas
- ☐ used water is contained or drained

2.8 Control of Weeds and Nuisance Pests

Regular monitoring occurs for:

- ☐ damage
- ☐ theft or vandalism
- ☐ presence of weeds
- ☐ unused or broken equipment
- ☐ garbage
- ☐ other attractants

Weed control:

- ☐ mowing
- ☐ weeding
- ☐ herbicides

Rodent control:

- ☐ traps
- ☐ cats and dogs
- ☐ recommended poison
- ☐ building maintenance
- ☐ monitoring

2.9 Training and Education

- ☐ A training/education program is implemented.

BeeBAC Members and Project Advisors

Member	Membership
Industry	
Rod Scarlett	Canadian Honey Council – Executive Director, BeeBAC
Gerry McKee	Canadian Honey Council – Chair and BC producer, BeeBAC
Corey Bacon	Canadian Honey Council – Former Chair and Saskatchewan producer, BeeBAC
Heather Clay	Canadian Honey Council – Former Executive Director and producer, BeeBAC
Lee Townsend	Canadian Honey Council – Vice Chair and Alberta producer, BeeBAC
Tom Trueman	Canadian Honey Council – New Brunswick producer, BeeBAC
Bryan Ash	Canadian Honey Council – Manitoba Beekeepers' Association and producer
Wayne Goerzen	Research Scientist / former Executive Director - SASPA / SASPDC- Alfalfa Leafcutting Bee Subcommittee, BeeBAC
Don Grieg	Manitoba Forage Seed Producers Association - Alfalfa Leafcutting Bee Subcommittee, BeeBAC
Gordon Frank	Alberta Alfalfa Seed Commission - Alfalfa Leafcutting Bee Subcommittee, BeeBAC
Darren Nikkel	Alberta Alfalfa Seed Commission - Alfalfa Leafcutting Bee Subcommittee, BeeBAC
Heather McBey	Manitoba Forage Seed Association - Alfalfa Leafcutting Bee Subcommittee, BeeBAC
Richard Ward	Biobest Canada – Bumblebee Subcommittee
Rene Ruiter	Koppert Biological Systems – Bumblebee Subcommittee
Iris Bitterlich	Canadian Horticulture Council – Bumblebee Subcommittee
Leanne Wilson	Canadian Horticulture Council – Bumblebee Subcommittee
Academia/Research	
Rob Currie	University of Manitoba, BeeBAC
Steve Pernal	Agriculture and Agri-Food Canada – Research Scientist, Apiculture, Officer-in-Charge, Beaverlodge Research Farm, BeeBAC
Kenna MacKenzie	Agriculture and Agri-Food Canada – Research Manager, Pacific Agri-Food Research Centre, Summerland, British Columbia, Bumblebee Subcommittee

Member	Membership
Provincial Government Apiarists or Veterinarians	
Paul van Westendorp	British Columbia
Medhat Nasr	Alberta
Geoff Wilson	Saskatchewan
Rheal Lafreniere	Manitoba
David Ostermann	(Assistant PA) Manitoba
Paul Kozak	Ontario
Claude Boucher	Quebec
Chris Maund	New Brunswick
Joanne Moran	Nova Scotia
Chris Jordan	Prince Edward Island
Krista Head	Newfoundland and Labrador
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Manon Racicot	Veterinary Program Specialist, OAB
Katie Clow	Veterinarian, OAB
Serecon Management Consulting Inc.	
Scott Ingledew	Project Manager and Leafcutting Bee Lead Consultant
Karen Paul	Honey Bee Lead Consultant
Markus Weber	Bumblebee Lead Consultant