Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Animal Biosecurity

Honey Bee Producer Guide to the National Bee Farm-Level Biosecurity Standard

Growing Forward
A federal-provincial-territorial initiative

Canada

Acknowledgments

CANADIAN HONEY COUNCIL

MANITOBA FORAGE SEED ASSOCIATION

SASKATCHEWAN LEAFCUTTERS ASSOCIATION

ALFALFA SEED COMMISSION (ALBERTA)

CANADIAN HORTICULTURE COUNCIL

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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 Standard was developed in partnership with representatives from the Canadian Food Inspection Agency (CFIA), the Canadian Honey Council (CHC) – on behalf of provincial beekeeping and honey producer associations – provincial apiarists, and the Canadian Association of Professional Apiculturists (CAPA).

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

CANPOLIN, the Canadian Pollination Initiative[1] identifies Canada as the world's 12th largest producer of honey. The 2010 Canadian honey crop was valued at $146 million. An estimated 35,000 tonnes were produced by nearly 7700 beekeepers[2]. Average honey production in Canada is about 60 kg per hive, which is more than twice the world average. Bee products (e.g. wax) and sales of bees and equipment are also important economic contributors.

In addition to the value of Canadian honey and bee products, many crops are reliant on pollination by managed bee species. Canada has seen rapid growth in pollination-dependent crops such as canola, fruits, and vegetables. The annual contribution of honey bee pollination to crop value is estimated at $1.3 to $1.7 billion annually, which is 10 to 20 times that of honey.[2]

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 honey beekeepers on how a series of target outcomes, associated with each topic covered by the National Standard, may be achieved.

1 MelhimA, Weersink A, Daly Z, and Bennett B. (2010). Beekeeping in Canada: Honey and Pollination Outlook. CANPOLIN publication #6.

2 Statistics Canada Catalogue 23-221-X.

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 to 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 exposure of healthy bees to pests occurs when infected or infested bees, contaminated equipment, or feed are introduced to an operation. This can occur through intentional introductions or unintentional mixing of bees from other operations. Within an operation, pests can be spread through handling or sharing of water, feed and pollen sources. Training, monitoring, preventative management practices (including equipment and facility design), and timely treatment interventions are necessary to mitigate these risks.

What are the benefits?

Some of the benefits of enhanced biosecurity management to the industry and individual honey beekeeping operations may be

- improved food security through the supply of healthy crop pollinators
- better honey production and pollination by stronger colonies
- reduced losses and economic impacts from pests
- reduced risk of exposure, introduction, and spread of pests
- saving time and money on treatments and pest management
- improved domestic and international marketability of honey bees and bee products
- possible continuation or early resumption of inter-provincial and international trade in the event of a serious outbreak
- a marketing advantage if selling used equipment or providing pollination services
- improved treatment efficacy and pest-management effectiveness
- reduced chance of developing treatment resistance
- reduced chance of devastation from introducing a new biosecurity risk

Document development

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 Producer Guide addresses management practices that promote general bee health.

Background work for the National Bee Farm-Level Biosecurity Standard and this Producer Guide prioritized those biosecurity interventions with the greatest impact on risk reduction and the spread of contagious pests. A set of target outcomes 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 this Producer Guide involved participation, consultation, and review from

- all provincial apiarists
- the Canadian Honey Council that represents the provincial beekeeping associations
- other Members of BeeBAC representing the research and academic community
- CFIA's Office of Animal Biosecurity

Direct honey beekeeper input was achieved through

- a series of on-farm case studies.
- a comprehensive management practice benchmark consultation. All identified active honey beekeepers in Canada were invited to participate. Over 600 honey beekeepers (10% of over 6000 beekeepers) participated.
- selected participation in the draft Producer Guide document review team.

How should this document be used?

The Canadian honey bee industry is a broad target audience, consisting of the hobbyist, large-scale commercial honey producers, and custom pollinators. Understandably not all of the principles in this Producer Guide will be applicable or practical for every situation. Keeping this in mind, the National Bee Farm-Level Biosecurity Standard Honey Bee Producer Guide has been organized into two sections:

- **Bee Health Management**
- **Operations Management**

Each section is subsequently divided into subsections, introduced by a statement of **Target Outcomes**. Each Target Outcome represents a goal for all those who manage bees: achieve what is necessary to protect their bees from the introduction and spread of pests.

Each Target Outcome is followed by

- a detailed **description** of the biosecurity topic, including key terms;
- an explanation of the **risks** associated with the subtopic;
- a statement of the **benefits to the beekeeper**, if the recommended practices are followed;
- **recommended practices** to reduce exposure or otherwise mitigate the impact of these risks; and
- suggested **record-keeping processes**

The end of the document includes a number of annexes, one of which is a self-evaluation checklist for use in identifying those Target Outcomes that are being effectively addressed, as well as potential areas for implementing biosecurity practices in a beekeeping operation. Another offers sample record-keeping spreadsheets. Annual beekeeping cycle and monitoring diagrams related to biosecurity practices are provided as visual reminders of how these practices fit in with an operation. In addition, there are contact and resource lists for additional information that is relevant to farm-level bee biosecurity, some regionally specific.

The glossary defines certain terms that are used within the text.

All who manage bees should address biosecurity in each component of their operation. For those who are new to the concept of biosecurity, for those with limited resources, or in instances wherein it is impractical or applicable to fully achieve each of the target outcomes, the Producer Guide provides a set of examples of practices that can be implemented to meet the Target Outcomes.

The honey bee industry is dynamic. New strategies, products, and techniques to combat pests will undoubtedly evolve as the science behind managing bees continues to advance. New biosecurity risks will emerge. Therefore, consider this document a living document. The basic principles described in this Producer Guide will apply into the future. It is the responsibility of beekeepers to continually update their knowledge and consider current regulation and recommendations when implementing biosecurity management practices within their operation.

Glossary

The following defines the general terms used throughout this Producer Guide.

Apiary: The location and sum total of colonies, hives, and other equipment assembled at one site for beekeeping operations.

Bee equipment: Any structure, material, or enclosure and its related components that are provided by the beekeeper to protect and house bees, referred to as the (bee) hive. Includes the box or hive body, hive cover(s), bottom boards, and the brood chamber frames, and honey super frames that are contained within the box. Hive equipment may also include the queen excluder, bee escape board, foundation, and feeders.

Beekeeper: A generic term used to identify anyone who owns or is in possession of bees; utilizes pollination services; handles bees, related bee equipment, production inputs and outputs, as well as waste material. The person may be the owner/operator, a trained beekeeper, staff, or family member.

Bee industry authority: A provincial apiarist, bee inspector, veterinarian, or regulating authority, including the CFIA or Health Canada's Pest Management Regulatory Agency (PMRA).

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

Bee yard: See apiary

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

Biosecurity: Farm-level biosecurity refers to a set of practices used to minimize the transmission of pests in animal and plant populations, including their introduction (bioexclusion), spread within the populations (biomanagement), and release (biocontainment).

Biosecurity program: A risk-reduction program that conforms to CFIA national standards and is designed to prevent the introduction and spread of pests in bee operations.

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 (honey, leafcutting, and bumblebees) at the farm level. The goal of the Standard is to minimize the introduction and spread of pests onto a farm, within a farm, and beyond the farm.

Brood: For the purposes of this document, brood refers to the embryo or egg, and the larval and pupal stages in initial honey bee development.

Building: Any indoor facility used in the beekeeping operation, including storage, maintenance, over-wintering bees, and processing honey or other bee products.

Chemical control: Means of controlling a pest, using chemical-based control products, including acids, acaricides (miticides), pharmaceutical treatments, and disinfectants. Chemical-control programs encompass applicable treatment rotation plans and the timing of treatment applications.

Clean: Free of any visible accumulation of organic matter and debris or other residues. Also, refer to *disinfection* and *sanitation*.

Colony: Typically an aggregate of several thousand worker bees, drones, and a queen bee living together in a hive or in any other dwelling as one social unit. Also, refer to *Nucleus Colony*.

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 (i.e. bee or brood).

Cultural method: A non-chemical method for managing pests. Examples include hive equipment manipulation, introducing new bee stock, supplemental feeding, and sanitation.

Debris: Any loose material that may be capable of harbouring pathogens, parasites, or pests. Examples include dead bees and bee parts, feces, and dead parasites.

Disease: An unhealthy condition in the bee caused, for example, by a biological agent such as bacteria, a viral or fungal pathogen or parasite that may result in death.

Disinfection: Applying a physical or chemical process to a surface to destroy or inhibit the activity of micro-organisms. This is often done with a disinfecting agent, such as bleach, or by treatments including heat, irradiation, or fumigation in conjunction with cleaning.

Efficacy: The effectiveness of an intervention or treatment in suppressing or eliminating a pest.

Elevated response plan: A farm-level intervention plan that is triggered by the suspected or confirmed presence of a high-risk, exotic, or unfamiliar pest within the bee operation, local area, or country.

Endemic: Pests that are regularly re-occurring or whose causative agent is established within a region or population.

Exotic: Infectious pests that normally do not occur in the region, either because they have never been present there or because they were eradicated and then kept out by government control measures or agricultural practices.

Farm/farm level: Refer to *Bee Operation*.

Federally reportable and notifiable: A legal requirement to contact the CFIA if a specified reportable bee disease, caused by a pathogen, parasite, or insect pest, is suspected or if the diagnosis is confirmed. Only laboratories are required to contact the CFIA regarding specified notifiable diseases. Refer to the CFIA website for more information and a current listing of diseases applicable to the honey bee industry.

Hive: Human-constructed housing for bees. Also, refer to *Bee Equipment*.

Honey house: A building typically used for extracting honey, packaging honey, and storing supers.

Infected: A living host organism (i.e. bee or brood), 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 (i.e. bee or brood) or its hive.

Insect pest: Insect pests are predators that infest a hive, cause damage, and consume brood and food stores, resulting in economic loss. Primary insect pests of bees live part of their life cycle within the hive and can be spread with the movement of bees and equipment. Examples are small hive beetle and wax moths that infest honey bee colonies. See also *Nuisance Pest*.

Inspector: A person who inspects apiaries and bee shipments for compliance with regulations or insurance claims and who may offer advice or provide resources to beekeepers.

Integrated pest management (IPM): A management system for pests that uses all suitable techniques, in the context of the associated environment and population dynamics of the pest, to maintain pest populations at levels below those causing economic injury.

Managed bees: For the purposes of the Standard, managed bees include honey bees, alfalfa leafcutting bees, and bumblebees for which some form of artificial housing is provided (i.e. hive). Unmanaged native and wild bees are excluded.

Mechanical method: A non-chemical method for managing pests. Examples include barriers, traps, screens, fences, use of hive or nest stands, and removal of foreign material from surfaces using a brush, broom, hand, or other object.

Nucleus colony: Also referred to as a "nuc" or "nuclei colony." A small colony of bees often used in queen rearing, mating, or to increase colony numbers.

Nuisance pest: A nuisance pest may disturb the bees; cause distress; damage the hive; consume bees, brood and bee cells; rob food stores; spread pathogens and parasites, and result in weakened bees that are more susceptible to other bee pests. Nuisance pests include insects such as ants and wasps, rodents, racoons, skunks, and large mammals such as bears, as well as some birds, and pets. Also, refer to *Pest*.

Parasite: An organism that lives upon or within another living organism and may be dependent upon the host for its survival; for example, the *Varroa destructor* mite.

Pathogen: A biological agent, such as a bacteria (e.g. American foulbrood [AFB], European foulbrood [EFB]), virus (e.g. sacbrood), or fungus (e.g. Nosema, chalkbrood) that has the potential to cause bee disease; for example, through the spread of spores.

Permit: Applies to bees, bee equipment, bee products, and production inputs for which their importation, inter-provincial movement, purchase and/or use is regulated by the government and is permitted.

Personal equipment: Includes items that are considered an extension of the beekeeper's person and may come in contact with infected or infested bees, debris, feed, water, or hive equipment. Examples include the smoker, hive tool, grafting tool, brushes, gloves, veil, helmet, and coveralls.

Pest: A pest is an unwanted organism. A pest may be a parasite, disease pathogen, predator, or insect pest. Pest, used as a generic term in this document, refers to any of these living organisms.

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

Premises: A parcel of land with a continuous property boundary and defined by a legal land description or, in its absence, by geo-referenced coordinates. Premises include an indoor facility or outdoor location where the following are kept or used: bees, hive, and personal equipment, beekeeping supplies, bee products, moving, and handling and processing equipment.

Producer guidance: Voluntary guidelines and examples of beneficial management practices, directed to producers for implementing biosecurity measures as defined by the National Standard at the farm level. Guidelines are specific to the industry sub sector (in this case, honey bees).

Production input: Production inputs include "consumable" products such as feed, water, treatment products for pest management or control, products used for cleaning and disinfection, and some materials used in hives. Production inputs exclude live bees and reusable hive equipment, tools, and protective clothing.

Protocols: A code of conduct, defined procedure, or series of steps to follow when implementing biosecurity management practices.

Provincial apiarist (PA) or apiculturist: Provincial government employees who study, educate, and administer regulation in the field of apiculture. Typically responsible for enforcing the Apiary Act, Bee Act, or equivalent. The PA is typically also an inspector.

Quarantine: A specific order applied to a particular premises, bees, or equipment by the honey bee regulating authority to prevent further spread or to detect a biosecurity risk or concern.

Quarantine area: An area specified by the honey bee regulating authority, in which additional efforts are made by industry and/or government to prevent further spread or detect the biosecurity risk of concern.

Recommended: A product, treatment, or practice recommended by a bee industry authority. When used in reference to chemicals such as pesticides or pharmaceuticals, the term means products registered by the appropriate regulatory authority for the specific usage mentioned in the text.

Sanitation: A set of practices that reduce the presence of organic material or debris and the presence, survivability, and infectivity of disease-causing 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.

Target outcomes: Goals that all those who manage bees, regardless of the size of their operation, should try to attain to protect their bees from introducing and spreading pests.

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

Weed: Any unwanted vegetation, including cultivated and volunteer crops, growing in and around the apiary or buildings where bees are kept.

Summary of Target Outcomes[1]

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

1.0 Bee Health Management

1.1 Beekeepers minimize exposure to pests by introducing bee stocks of known health status. Sources are documented to enable traceability.

1.2 Beekeepers manage factors to reduce the bees' susceptibility to pests. A response is implemented when threshold levels are reached.

1.3 Beekeepers minimize direct and indirect contact with infected or infested bees.

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

1.5 Beekeepers have a standard response plan in place to address treatment thresholds, options and rotation plans, notification procedures, record keeping, and follow up actions.

1.6 Beekeepers have an elevated response plan 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 Beekeepers prevent the degradation and contamination of production inputs by safe and secure storage and disposal.

2.3 Beekeepers obtain bee equipment 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 Beekeepers regularly inspect bee equipment and, when necessary, action is taken to minimize negative impact to bee health.

2.5 Beekeepers take precautions to minimize the spread of pests through human contact with bees and equipment.

1 The wording of the target outcomes presented in this producer guide varies slightly from that in the National Bee Farm-Level Biosecurity Standard. The target outcomes in the Standard are worded to apply generically to honey beekeepers, alfalfa leafcutting bee producers, and producers and utilizers of bumblebees. The wording in this Producer Guide was modified to emphasize the honey beekeepers' role in attaining the target outcomes.

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 Beekeepers implement a sanitation and maintenance program for all premises, buildings, vehicles, and other equipment.

2.8 Beekeepers implement an integrated management program for weeds and nuisance pests.

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

Section 1

Bee Health Management

1.1 Bee Sources

Target Outcomes

Beekeepers minimize exposure to pests by introducing bee stocks of known health status. Sources are documented to enable traceability.

Description

Bees may be sourced in various forms from within the beekeeper's own operation, from other beekeepers in the province, from other provinces, or imported from other countries. Each form and source of bees and queens represent varying degrees of risk for introducing pests to colonies. Bees may be introduced at the apiary level (i.e. to several colonies simultaneously) or to individual colonies.

Known health status means the bees have been inspected and/or tested to determine their health status by a recognized agency.

Table 1 illustrates the bee sources and management practices that may introduce pests with bees to another colony or to hive equipment.

TABLE 1 Sources and management practices

Purchased or Self-Raised Sources	Management Practices
Queens, accompanied by five to six attendants are typically shipped in queen cages and plugged with "queen candy."	Equalizing is the practice of moving frames of brood and bees from one colony to another to make two or more colonies of equal strength (brood, bees, and honey).
Package bees are used to establish new colonies and replace winter losses. Packages usually weigh 1 or 1.5 kg and contain 8000 or 12,000 bees. Bees are shipped in either wooden or screened boxes with a sugar syrup feed source or in tubular containers with a gelled feeding source.	Splitting is the practice of dividing a strong well-populated colony into two or three smaller ones and adding a queen to the new colonies.
Nucleus colonies or "nucs" consist of a smaller number of bees than a full-sized colony and usually include a queen, brood, honey, and pollen. Bees are shipped on comb in "nucleus hives" smaller boxes with fewer frames than standard hives.	Swarms are a result of natural reproduction of a honey bee colony, leading to the creation of a new honey bee colony, in addition to the established colony. Hiving swarms may introduce pests and undesirable genetic traits through newly acquired drones that perpetuate swarming behaviour.
A full-sized colony is a "complete unit," comprising a standard-sized hive box, frames with combs containing honey, pollen and brood, the queen and worker honey bees.	Uniting is the practice of merging together two or more colonies into one colony to create a single stronger colony.

The Risks

Federal and provincial acts and regulations help to mitigate risks associated with bee introductions by requiring inspections and permits.

- Pests may be present in or on bees, in hives, on queen cages, in package boxes, in other packing material, or in hive equipment (if whole or nucleus colonies are purchased – also referred to as "on the comb"). The health status of the acquired bees should be compatible with the desired health status of the operation and meet government regulations.
- Importing bees from other regions, and particularly other countries, may present health risks, despite having import protocols in place to mitigate these risks (e.g. introducing new pests, along with populations of pests that are resistant to treatments registered for use in Canada).
- Introducing new pests, as well as populations that are resistant to treatments registered for use in Canada.

Tables 2 and 3 outline biosecurity risks associated with various bee sources.

TABLE 2 Biosecurity risks: purchased or self-raised

Purchased or Self-Raised Source	Source			
	Own Operation	Within Province	Other Provinces	Other Countries
Queens	Variable risk – dependent on health history and status of parent colony. Low-risk relative to purchasing bees on comb or bulk bees.	Reduced risk – if purchased from certified/inspected bee or breeders/queen producers	Permit required	Permit required
Package bees	Not applicable	Reduced risk – if purchased from a certified/inspected bee supplier	Permit required	Permit required
Full size and Nucleus colonies	Variable risk – Comb may harbour pests that can be transferred within the operation. Dependent on health history and status of originating colony/apiary	Variable risk - Comb may harbour pests. Dependent on health history and status of supplier Reduced risk – if purchased from a certified/inspected bee supplier with proper documentation	Permit required	Permit required

TABLE 3 Biosecurity risks: management practices

Management Practices	Source			
	Own Operation	Within Province	Other Provinces	Other Countries
Hive a swarm	Reduced risk if swarm is from same apiary with low chance of co-mixing	High risk if swarm is from or comingled with another local beekeeper's bees with unknown health status, practices or from an unknown source	Not applicable	Not applicable
Uniting, equalizing, or splitting	Reduced risk if bees are healthy and from same apiary with low chance of co-mixing	Not applicable	Not applicable	Not applicable

Producer Benefits

The benefits of implementing biosecurity-recommended practices when acquiring bee stock are that there is a reduced

- need for costly management and treatments at the time of, or subsequent to, introduction.
- chance of developing resistance to treatment products.
- risk of introducing pests if the beekeeper can trace the pest source back to its origin. Other colonies that might be affected can be quickly identified, with remedial action taken. The beekeeper can avoid that source or take preventative action before introduction if used in future.

Selecting bee stock with desirable genetic traits is an effective pest management strategy.

Recommended Practices

The management practices recommended in this section refer to raising bees, queens, and the purchase and introduction of bees from external sources.

1. **Supplier and Stock Selection**
   - **a.** Domestic
     - i. Where available, purchase locally produced queens and nucs of known health status from certified or inspected suppliers or cooperatives. Consult supplier lists that are issued annually by some provincial apiarists or other honey bee regulating authority.
     - ii. Purchase bees from suppliers that you know and trust and those with established disease/pest management programs.
     - iii. Investigate unfamiliar suppliers before purchasing.

iv. Produce, or purchase queens and nucs from bee breeders that offer bee stock with desirable genetic traits.

v. Re-queen on a regular basis, ideally every one to two years, with young queens to promote healthy bees.

vi. When bees are purchased from out of the province, obtain confirmation that the inspection by the designated originating authority was conducted as specified in the provincial and federal regulations before entry into the province.

b. Regulations and Compliance for Importing Bees (including queens, package bees, and nucleus colonies)

i. Federal

- Beekeepers must follow current federal import acts and regulations administered by the CFIA. Honey bees are defined as a "regulated animal" under the *Health of Animals Regulations*.
- Bees must be imported under permit from CFIA-approved countries of origin and with a CFIA-recognized health certificate from originating country.

ii. Provincial

Beekeepers must

- follow current provincial import and transport acts and regulations governing honey bees.
- follow the requirements for registration in their province.
- retain and make import records accessible.

2. Receiving and Placing Bees

a. Bees may be introduced to hives, or whole colonies may be placed immediately if

i. there is no provincial or regional directive in effect to quarantine new arrivals.

ii. the health status is known, and any additional requirements are met.

iii. introductions are segregated to separate apiaries.

b. If bees are not introduced immediately, they can be kept in a sanitary, segregated, temperature-controlled storage facility upon receipt.

i. Package bees and queens may safely be held in dark, temperature-controlled, properly ventilated storage for a short period before introduction.

ii. A segregated storage facility may be a separate building (e.g. a garage), room, or portion of a room that is separated from other areas with a room divider.

iii. The segregated space is bee tight.

c. Food stores are checked and supplemented with uncontaminated sugar syrup and irradiated pollen if necessary. (Refer to sections 1.2, 2.1, and 2.2 for more guidance on feeding.)

3. Inspection, Assessment, and Notification

a. Prior to introduction or hive placement, each bee or hive lot is inspected for the following: dead bees, bee activity, and visual inspection for presence of pests.

b. Beekeepers and staff are updated and trained to recognize pests that are both established and those that are not established in the operation. (Refer to section 2.9.)

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

Extra testing precautions are indicated when bees are derived from an unknown source.

d. The beekeeper administers tests and detection methods, and/or collects and sends samples of bees to a provincial bee lab or facility that is capable of conducting bee diagnostic testing. Bees are held in segregated storage or apiary until diagnosis is confirmed.

e. Suspicion of pests that present a biosecurity risk triggers a "response plan" that provides guidance to individuals on the appropriate procedures to follow.

4. Handling Introductions for Honey Bee Queens

a. Place imported queens in any high-risk shipments into new queens' cages prior to introducing to the hives.

b. Remove attendants before introducing queens.

c. If needed, plug hive entrances, or use entrance excluders after introductions to avoid robbing, and possibly introducing pests, while the new colony gets established.

5. Sanitation

a. Bees are introduced to new or disinfected hive equipment (e.g. combs may be treated by irradiation) prior to bee introduction. If your operation has a history of American foulbrood (AFB), use new foundation. Section 2.3 outlines the recommended methods for disinfecting contaminated hive equipment prior to reuse.

b. Take precautions to minimize the risk of spread of (potential) introduced pests through handling (e.g. gloves) and tools. (Refer to section 2.5.)

c. Hold packing material that will be reused in a segregated area until it is disinfected by

i. fumigation.

ii. bleach; follow recommendations for bleach concentration, length of time of treatment, and keep material out of direct sunlight while being treated.

iii. other methods, as deemed appropriate.

d. Destroy packing material that is not reusable by holding in a segregated area until transfer to an isolated burn site. Packing material should be disinfected before transporting if there is a risk of spread during transport.

e. Storage facilities and vehicles/equipment that held or handled bees that were confirmed or suspected of harbouring pests should be disinfected prior to reuse. (Refer to section 2.7.)

6. Treatments

a. Ensure that all treatments are in compliance with the *Pest Control Products Act* (Canada), the *Health of Animals Act* and *Regulations*, and with provincial regulations, if applicable.

b. Preventative treatments should be applied before or after introduction only where indicated, and follow annual provincial treatment recommendations and Integrated Pest Management guidelines to limit the development of treatment resistance.

c. Follow all product labels.

7. Monitoring

After introduction, check bee health status regularly, take the appropriate actions, update records, and to establish cause, cross-reference the health status of other colonies that received bees from the same source, if applicable.

If the cause is linked to bee source, notify the regulating authority and the supplier, so that investigation into the health of other beekeepers' colonies receiving bees from that source is initiated. (Also, refer to section 1.4.)

Record Keeping

A good method for tracking introductions (including splits) and recording treatments administered upon introduction is to use a colour-coding system or marking the hive lid.

Copies of records, including invoices, hive identification systems, and permits for imported bees should be kept for at least one year to enable traceback.

1. Purchases are clearly identified on receipt by lot number(s) and the following information is recorded for each lot:

a. date received;

b. name, address, and telephone number of supplier;

c. number of queens, nuclei, package bees, or colonies;

d. disease status if known (according to health-inspection certificate or supplier declaration/accompanying test results);

e. date of inspection by originating authority;

f. selling permit number (if applicable); and

g. treatments given prior to shipment and when, if known.

2. **If re-queening, hiving a swarm, or equalizing, splitting, or uniting colonies with own stock, record**
   - **a.** parent colony;
   - **b.** queen source;
   - **c.** date introduced, split, or united;
   - **d.** observed desirable traits;
   - **e.** disease history or status (test results); and
   - **f.** treatments given prior to introduction and when (if known).

3. **For all introductions, record**
   - **a.** the apiary and hive within which the bees are placed. Hives should have a unique identifier (e.g. a code);
   - **b.** treatments given post shipment; and
   - **c.** health assessments (observations and/or test results). (See section 1.4.)

1.2 Prevention: Minimizing Susceptibility to Pests

Target Outcomes

Beekeepers manage factors to reduce the bees' susceptibility to pests. A response is implemented when threshold levels are reached.

Description

Honey bee health may be compromised by a number of susceptibility factors that can effectively be managed within the beekeeping operation. If a colony is weakened, the bees will be more vulnerable to infection or infestation, and less able to recover in response to treatments.

Other than the direct effects of pests on bee health, six factors that can increase bee susceptibly to pests are as follows:

1. **Weather and Environment:** Bees should be protected from the impact of wind, temperature extremes, high humidity, and moisture build-up, both within and outside the hive. High temperatures, humidity, and poor ventilation within the hive contribute to the development of the swarming impulse, because the bees require more space to facilitate the evaporation of water from the nectar. Temperature and humidity also play a role in the effectiveness of mite removal by bees exhibiting hygienic traits. Poor conditions outside of the hive may inhibit flying, while lack of protection from extreme cold can lead to high winter losses.

2. **Nutritional:** Bees must have access to adequate sources of carbohydrates, protein, lipids, vitamins, minerals, and water. Feed sources include nectar flow, pollen, honey reserves, and feed/water supplements. Bees may be malnourished if exposed to only one source of pollen for an extended period of time (i.e. if placed for custom pollination of a single crop). Feeding also helps with the successful introduction of package bees or queens. Supplemental fall feeding ensures adequate resources for overwintering.

3. **Disturbance:** Bees are affected by movement (transportation to/from the field or relocation within the field) and handling through wrapping and unwrapping hives for winter protection, inspections, feed placement, and treatments. Bees must re-orient themselves to the new location once moved, and for long-distance east/west migratory beekeeping operations to a different time zone. Further distress may occur if robber bees are attracted during times of disturbance. Re-occurring nearby activities that are loud or create vibrations, such as the use of power mowing equipment, may also disturb bees. Non-human sources of disturbance include nuisance pests such as predatory wasps, mice (chewing), skunks, bears, and cattle.

4. **Pesticide Exposure:** Bees may be affected by direct exposure to pesticide applications, including insecticide, herbicide, or fungicide sprays or spray drift that is absorbed through the body or respiratory system, or by ingestion. Bees may be affected by the build-up of pesticides within the comb or food stores through the collection of nectar and pollen from the main crop, cover crop, or flowering weeds that have been exposed to pesticides. Exposure to pest control products with residual toxicity and the cumulative effects of multiple pesticides may present significant risk, as there could be a chemical interaction effect. The degree of toxicity to bees is impacted by such factors as the chemical "product group," formulation, application rate, and temperature conditions. Bees may be killed outright or show signs of bee poisoning that subsequently weaken the colony.

5. **Colony Strength:** A weak colony may be a sign of the above factors, as well as a source of continuing susceptibility of the colony to pests. Over-manipulation of the colony (e.g. excessive splitting or equalizing prior to placement for pollination) can further weaken the colony. A strong colony contains a healthy young queen, brood, workers, and drones in the correct balance for the time of year.

6. **A susceptibility threshold** is a measurable level of a factor at which intervention should be taken to limit negative impacts on bee health and economic loss. In this context, examples of susceptibility thresholds that could be established by the beekeeper include
   - **weather and environment:** temperature, humidity, or carbon dioxide levels that are measured within a hive, storage facility, or transport truck.
   - **nutrition:** a measure of food stores (e.g. hive weight, number of filled honey frames).
   - **pesticide exposure:** analysis of concentration of a pesticide in the comb.
   - **colony strength:** a measure of bee population, percentage of filled and capped brood frames.

The susceptibility threshold may vary under conditions when multiple factors are present.

The Risks

The risks associated with each factor varies from minor declines in honey production, suppressed egg laying/brood formation, to swarming, drifting, and robbing behaviour, to high winter losses and dwindling bee populations in early spring. These factors can shorten the life-span of the bees and therefore the size of the colony's population. Drifting and robbing behaviour may, in turn, lead to the introduction of pests to the colony.

The degree of risk is associated with the

- intensity, duration, and time of year of exposure to the susceptibility factor.
- ability of the bees to recover after the source is removed.
- combined effects of more than one susceptibility factor.
- compounding effect of exposure to pests which, in turn, causes greater susceptibility to other pests.

Bee ability to recover from most forms of mild, periodic, and short duration distress is relatively good, with the exception of some forms of pesticide exposure that can cause permanent damage or immediate death.

Producer Benefits

The benefits of implementing biosecurity-recommended practices to identify and reduce susceptibility factors affecting bees are

- reduced chance that an unnecessary treatment could be administered, due to an incorrect assumption that the signs were caused by pest.
- improved ability for bees to resist or recover from infections and infestations.
- reduced incidence of developing resistance to treatment products.
- reduced winter losses.

Recommended Practices

1. Weather and Environment Susceptibility Factors

The negative effects of wind, temperature, and moisture can be mitigated by apiary and storage facility set-up, shelter, hive design and management, and temperature and humidity control.

a. In the field

i. Locate apiaries with a southern sun exposure.

ii. Choose apiary locations that are not prone to flooding. Avoiding low areas will also protect colonies from night-time settling of colder air.

iii. Provide wind shelter for hive equipment at ground level.

iv. Orient entrances away from the prevailing winds.
v. Keep entrances clear of vegetation.
vi. Elevate bottom boards off the ground, using pallets or stands to improve air circulation and to prevent moisture build-up.
vii. Use tilted bottom boards to facilitate drainage.
viii. Use light-coloured paint on the outside of hives to reflect heat.
ix. Provide upper entrances for hives to allow water vapour escape and to prevent ice formation in winter.
x. If overwintering in the field, close screened bottoms, and wrap hives with clean well-insulated wraps. Remove when night temperatures are above 0°C. Modify overwintering protection accordingly for wet, mild conditions.
xi. Provide additional shelter from cold north winds if wintering outdoors.

b. Within the hive

i. Avoid crowding by providing enough space.
ii. Remove entrance reducers.
iii. Provide entrance mats and crack lids or supers; set ahead slightly to allow more air flow. Using upper entrances will reduce frost build-up.
iv. Use foundation and queen excluders judiciously to avoid forming a barrier to upward expansion.
v. Bottom super honey-bound colonies.
vi. Take remedial action if excess moisture, ice, or mould is observed on the inner cover, inner walls, frames or bottom boards, or if the interior of the hive is too dry during winter.

c. In the indoor wintering facility

i. Control temperature at 4°C–7°C.
ii. Provide air circulation and ventilation to maintain relative humidity at 50%–70%.
iii. Exclude as much light as possible, and use red bulbs.
iv. Stack hives in perpendicular rows to the air duct, with rows spaced about 1 meter apart to facilitate air movement.
v. Stack in a way that facilitates air circulation around each hive.
vi. Elevate bottom hive off the floor using pallets or stands.

2. Nutritional Susceptibility Factors

a. For healthy bees, ensure access to

i. a good quality carbohydrate source (nectar or supplement). Feeding honey or cappings back to bees presents a risk of disease transmission.
ii. pollen or pollen substitutes (protein, lipids, vitamins and minerals). Supplementary pollen feed should be free from disease.

iii. water.

iv. resins and gums from trees and other vegetation that are necessary for propolis production.

b. Feed bees, using unexposed feeders to control label dosages of registered honey bee medications and to prevent robbing and potential disease transmission. The same applies for supplemental water.

c. Monitor and provide supplemental feed and/or water, as required

i. to new queens, bees during shipment, and at time of introduction.

ii. in early spring before unwrapping.

iii. in late spring before nectar flow.

iv. when nectar/pollen flow is curtailed by crop conditions or of short duration (e.g. canola).

v. during inclement weather when bees may not forage.

vi. during drought or when/where natural sources of water are limited.

vii. after splitting.

viii. in fall before wintering.

3. Disturbance Susceptibility Factors

The effects of disturbance cannot be completely avoided but they can be minimized using common sense handling and management.

a. During handling and transport:

i. Handle bees and bee equipment with a gentle approach.

ii. Smoke the hives prior to handling to inhibit flying.

iii. Minimize the time that hive boxes are open or unwrapped during inspection, treatment, feeding, or removal of honey supers.

iv. Ideally, move to summer apiary sites in the spring when package bees are still in the brood chamber.

v. Avoid moving in winter.

vi. Manage temperature, humidity, and air circulation to prevent carbon dioxide buildup while in transit.

vii. Move at night, whenever possible.

viii. If daytime movement on warm days is necessary, use top screens to allow for ventilation and clustering space for the bees.

ix. Load hives with the frames parallel to the truck to minimize rocking.

x. Stabilize the hives and frames during movement and transit (e.g. through hive design to facilitate stable stacking, fasten frames using spacers or self-spacing frames to prevent slippage, use tie downs in the truck).

xi. Ensure adequate feed and water if transporting long distances.

xii. Avoid moving distances under 5 km in the field. Short distances can confuse the bees, causing them to return to the old site. Alternatively, small operators may move bees short distances each day over several days.

xiii. Lightly stuff the entrances to hives with grass once unloaded in the field to slow down foraging and to allow for orientation.

xiv. Minimize long hauls and the number of movements per year, if possible.

Minimize disturbance caused by noise, vibration, and jostling by carefully selecting the apiary site and by limiting the use of power equipment such as mowers around the hives. Protect the site from nearby exposure to sources of mechanical disruption, as well as animals, including cattle.

b. Monitor apiary locations in winter for

i. scratches or chew marks on the hive or winter wraps.

ii. tracks in the snow from humans, animals, or machinery.

iii. presence of mouse nests and chewed comb.

In addition, refer to section 2.8 for methods to manage nuisance pests of honey bees.

4. Pesticide Exposure Susceptibility Factors

a. Avoid pesticide exposure:

i. Have access to annual provincial crop management recommendations for common pests in the area of the apiary. Reference which products and formulations are harmful to honey bees and for how long after application.

ii. Keep current on other pesticides that may be approved for emergency use.

iii. Maintain regular communication with local farmers and landowners.

iv. Discuss pesticide application plans and hazards when making agreements to place bees on other farmers' crops.

v. Choose apiary sites away from intensely sprayed areas.

vi. Monitor spray programs in the areas where your hives are placed, including use on crops, public right of ways, industrial yards, ditches, parks, and golf courses.

vii. Identify apiary locations to applicators.

viii. Clearly post your name, address, telephone number, and beekeeper registration number (or identifying information required according to the Apiary or Bee Act) at each apiary location, enabling local farmers or pesticide applicators to easily contact you.

ix. Monitor weather conditions when pesticide spraying occurs, and take extra precautions to protect bees (e.g. from spray drift if windy conditions, or if cool weather is expected following application, because residues will remain toxic to bees for longer periods in cool weather).

x. Provide a safe alternate water source to discourage bees from drinking off plants (e.g. corn leaf axils) that may harbour contaminated droplets.

xi. Remove honey bee colonies as soon as pollination is complete and before any post-bloom insecticides are applied (e.g. in orchards).

xii. Follow the product label when using registered pest control products, and never use pesticide strips where combs are stored.

xiii. Avoid or use extreme caution when applying any pesticide around the apiary or at your storage or extraction facilities.

b. Consider addressing these critical aspects of pesticide application with the beekeeper, farmer, and/or applicator:

i. name of product applied, along with a copy of the current pesticide label;

ii. night-time, late evening, or (less desirable) early morning spraying;

iii. identification of buffer zones around your apiaries that are not to be sprayed;

iv. use of products, formulations, or cultural methods that are less harmful to bees for use if there is an option;

v. avoidance of application on crops or weeds when in bloom, which is regulated for some crops;

vi. use of ground versus aerial spraying; and

vii. prior to spraying with insecticides, mowing flowering cover crops, such as clover or weeds that are subject to bee foraging.

c. Mark the hives and monitor bees for the following if exposure is suspected:

i. large numbers of dead bees at the hive entrance

ii. dwindling adult population

iii. paralyzed, stupefied, unable to walk or fly properly

iv. nectar regurgitation/wet looking

v. swollen abdomen

vi. confused or aggressive behaviour

vii. disruption to laying/queen death

viii. dead brood

If pesticide poisoning is suspected, collect and freeze samples, record information, report to the provincial authorities and PMRA through the Pesticide Incident Reporting Program, and consider methods such as litigation to recover losses.

5. Weakened Colony Susceptibility Factors

a. Maintaining strong colonies is integral to successful beekeeping. Refer to beekeeping manuals for specific techniques.

i. A colony should consist of at least seven to eight frames of bees at the end of the season to ensure survival.

ii. Requeen with resistant stock at least every two years. More frequent requeening may be necessary for colonies that are wintered outdoors.

iii. Splitting strong healthy colonies addresses overcrowding and maintains an optimal balance of brood, workers, and drones for the time of year.

iv. In spring, add or remove empty frames as needed to provide adequate space in anticipation of a split or re-arrange brood frames (if double brood frames are used) to encourage even egg laying. In summer, add additional honey supers as needed.

v. Avoid providing more brood frames than are required for the population. This increases the hygienic "housekeeping" burden on the worker bees.

vi. Consider introductions to weak colonies via package bees, capped brood, or uniting with a captured swarm or another weak colony. It is imperative that the source of the weakness be understood and dealt with to avoid perpetuating the cause.

vii. Avoid harvesting pollen or propolis from weak or struggling colonies.

Colony strength monitoring, particularly in May and September, is necessary to initiate remedial action.

6. Preventative Chemical Treatments

Integrated Pest Management recommendations and annual provincial treatment recommendations should be followed to limit the development of treatment resistance. Preventative chemical treatments are not a substitute for minimizing susceptibility to pests, monitoring, culling brood frames, sanitation, or other methods to protect bees from exposure to pests.

7. Queen and Nuc Production

a. Care for queens and nucs by

i. using care when picking up to avoid damage.

ii. introducing or shipping as soon as possible. Ideally, storage and shipping time should be no more than two weeks (one week is recommended).

iii. keeping in a cool, well-ventilated dark place with no drafts when in storage.

iv. covering queen cages with a piece of paper and by avoiding mesh-to-mesh contact between two cages, because queens may damage each other through the mesh.

v. providing feed and water.

Record Keeping

Record-keeping recommendations focus on information that may flag the potential for negative impact on bee health, allowing for appropriate remedial action. This information can also rule out causes that would otherwise trigger ineffective and costly treatments.

Ideally record the following information:

1. **basic indicators of colony strength;**
2. **a colony strength rating (e.g. a number on a scale);**
3. **supplemental feed and water;**
4. **apiary placement and nectar source;**
5. **disturbance observations and cause;**
6. **indoor overwintering facility (temperature, humidity, and carbon dioxide monitoring);**
7. **queen (age, traits, and source); use the international colour code for thorax marking to identify queen age; and**
8. **details of suspected pesticide poisoning.**

1.3 Prevention: Minimizing Exposure

Target Outcomes

Beekeepers minimize direct and indirect contact with infected or infested bees.

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 either through planned bee introductions to healthy colonies or unplanned mixing, as well as indirect contact through contaminated equipment, feed, water, pollen, and handling. Mites passed from bee to bee may also carry over viruses.

Planned contact refers to direct bee-to-bee contact; an infected or infested bee passes the pest directly to a healthy bee or brood within the same colony. Planned contact can also occur through practices such as equalizing colonies before placing for custom pollination.

Unplanned mixing occurs when bees drift or transfer to colonies other than their own, often because they lack visual cues or are otherwise disoriented or displaced; for example by wind or movement. Disturbance through handling can also trigger drifting. Mixing is more likely to occur when bees need to expand their foraging range, because of lack of nectar and pollen or competition from other colonies. Food stores in the colony, open supplemental feeding, and honey spills attract bees from other colonies or places where other bees frequent. This is referred to as robbing behaviour. Mixing may occur during transport if bees cluster on the outside of the hive. Mixing may be with honey bees from other colonies or with another species such as bumblebees.

Indirect contact occurs when an infected or infested host bee leaves behind a pest on some surface or in some material such as feed, pollen, water, or feces, providing that the pest survives long enough to be transferred to another bee.

The Risks

Table 4 depicts the associated risks with the most common pests of honey bees in Canada. Beekeepers should also be aware of new biosecurity risks in their area.

TABLE 4 Honey bees in Canada: Common pests and risks

Pathogen, Parasite, or Insect Pest	Biology	Direct Contact	Indirect Contact	
			Feed and Water	Surfaces or Tools
AFB *Paenibacillus larvae*	Larvae ingest contaminated food from nurse bees and are susceptible three days after hatching. Housecleaning bees spread bacterial spores via their mouthparts when they exchange food.	High: when larvae are feeding, exchanging food between adult bees in the colony or exposure via robbing and drifting	High: brood food/ honey stores and contaminated pollen	Extremely high: Spores remain viable indefinitely (70+ years) on surfaces and contaminated comb. A living host is not needed.
EFB *Melissococcus plutonius*	Larvae under two days old are infected when they consume brood food. All three castes of the brood may be affected. Spread is the same as for AFB.	High: when larvae are feeding, exchanging food between adult bees in the colony or exposure via robbing and drifting	High: brood food/ honey stores and contaminated pollen	High: however, EFB does not survive long on surfaces
Chalkbrood *Ascosphaera apis*	Spores are spread in food, water, combs, or by drifting bees. Larvae-ingest contaminated pollen, water, and nectar or honey and are most susceptible 3–4 days after hatching.	Low	High	Low: however, spores can remain infectious for at least 15 years; fungus growth will occur in cool moist conditions

Pathogen, Parasite, or Insect Pest	Biology	Direct Contact	Indirect Contact	
			Feed and Water	Surfaces or Tools
Sacbrood virus	Nurse bees ingest virus-laden fluids when removing infected dead larvae from their cells. The virus is spread throughout the colony when the nurse bees feed one- to two-day-old larvae, when food is exchanged between adult bees, or when contaminated food stores are accessed.	High	High	Low
Other viruses DWV, KBV, APV, IAPV, BQCV, and others	Numerous other viruses can infect honey bees and can be associated with the presence of other pests	High: when associated with *Varroa* infestation and bees are more susceptible	Low	Low
Nosema Disease *Nosema apis* *Nosema ceranae*	A single celled protozoan that forms resistant spores that remains viable for long periods. Spores in feces from infected bees or contaminated water/pollen are ingested by adult bees, and germinate in the midgut.	Low	High: in water and pollen	High: through contact with contaminated feces or dead bee residue deposited on surfaces or water spills that have been contaminated by bee feces. Spores can be viable on these surfaces for long periods of time.
Varroa mite *Varroa destructor*	Females detach from their adult host inside the hive and lay eggs in brood cells, just before capping. Newly emerged bees carry the mites and transfer them to other bee colonies through drifting, robbing or bee to bee contact.	Extremely high: especially between queens/workers and drone brood within the colony Excessive drone comb presents a risk of infestation Moderately high when infected adults mix with other bees outside of the colony	Low	Low: *Varroa* only lives 7-10 days away from a host bee.

Pathogen, Parasite, or Insect Pest	Biology	Direct Contact	Indirect Contact	
			Feed and Water	Surfaces or Tools
Tracheal mite *Acarapis woodi*	Female mites are passed from the hair tips of one host bee to another, then enter the tracheal system where they feed and lay eggs	High: between older bees to young bees within a colony and via drifting bees between colonies	Low	Low
Small hive beetle *Aethina tumida*	Female beetles lay eggs on or near the combs. Eggs hatch in two to four days. Larvae (grubs) feed on pollen, bee brood and honey for 10-16 days then pupate in the soil for 15-30 days. Adult beetles fly back to the hive, can fly many kilometres, can live up to six months, are attracted to fruit, and can winter inside the cluster of a honey bee colony.	None	None	High: can be transferred through comb exchange, equipment or with imported bee packaging material. SHB can multiply rapidly in the extraction facility where they are attracted by honey spills.
Greater Wax Moth (western) *Galleria mellonella* Lesser Wax Moth *Achroia grisella*	Moth eggs are laid in cracks between frames, lids and boxes. Caterpillars (larvae) tunnel through wax combs and feed on pollen, honey and debris until they attach between supers or under the hive lid to pupate.	None	None	Extremely high

AFB = American foulbrood; APV = acute paralysis virus; BQCV = black queen cell virus; DWV = deformed wing virus; EFB = European foulbrood; IAPV = Israel acute paralysis virus; KBV = Kashmir bee virus; SHB = small hive beetle

Producer Benefits

The benefits of minimizing exposure to pests are

- saving time and money on treatments.
- reducing the chance of developing treatment resistance.

- requiring less need for equipment or bee destruction.
- increasing honey production by having stronger colonies.
- improving domestic and international marketability of honey bees, bee products, and pollination services.
- possibly continuing inter-provincial and international trade in the event of a serious outbreak.

Recommended Practices

1. Hive Equipment Design

a. Several equipment design considerations can reduce exposure to bee diseases and pests:

i. Install screened bottom boards. Incorporate the appropriate mesh screens into bottom boards. The mesh should be sufficiently above the bottom board to allow *Varroa* mites to fall through the screen and become stuck on installed "sticky" traps.

ii. Use queen excluders to confine the queen to the brood chamber. Failure to use a queen excluder that is tight fitting and maintained in good condition could result in eggs being deposited in honey combs, leading to the spread of disease through cross-contamination when supers are exchanged between hives.

iii. Replace at least 20 percent (ideally one-third) of brood frames every year with new frames, newly drawn comb, and foundation. This practice will help to reduce the level of spores and acaricide residues in the hive.

iv. Use unexposed feeders.

2. Apiary Placement

More intense management is required in areas of intensive custom pollination or where bees from more than one apiary (your own or another beekeepers) can mix in local foraging areas.

a. Be aware of local conditions (weather, soil type, susceptibility factors) and common pests in areas into which you are moving bees for pollination, especially if they differ from those in your home base. Take extra precautions when moving bees to and from these areas to avoid spreading pests into other areas.

b. Work with other beekeepers to create an awareness of the health status, and disease and pest management practices of adjacent apiaries.

c. Maximize the distance between apiaries.

d. Follow applicable pollination stocking rate recommendations.

e. If the health status of the neighbours' bees is suspect or conditions exist that encourage drifting, robbing, or swarming behaviour:

i. Decline to set up, or remove your hives.

ii. Increase apiary placement distances.

iii. Increase monitoring frequency and sampling (see Section 1.4).

iv. Provide unexposed, supplemental feed, as necessary, to prevent your own bees from drifting or robbing.

v. Call an inspector if necessary.

3. Prevent Robbing

These are examples of robbing prevention techniques to follow when possible:

a. Clean up honey/sugar syrup spills immediately.

b. Cover honey spills, exposed bee combs, and wax.

c. Use unexposed feeders.

d. Minimize leaks in feeders/pails.

e. Minimize the time that hives are open when inspected.

f. Minimize the opening of hives unless a problem is suspected, except if monitoring is needed.

g. Open hives and remove supers in early morning before flying.

h. Use bee escape boards.

i. Keep bee feed tightly sealed in bee-tight facility.

j. Remove old hive equipment/discarded frames that could attract other bees.

k. Avoid placing apiaries near landfills or garbage dumps.

l. Remove abandoned vehicles/farm equipment etc. that could provide a nesting area for other bees.

m. If wintering outdoors, reduce bottom hive entrance before feeding begins.

n. Limit the number of colonies placed in a single bee yard.

o. Separate the apiary or overwintering facility from honey extraction, wax rendering, or storage areas that contain feed or honey (your own and your neighbours)

p. Have bee-tight honey extraction, wax rendering, or storage areas (e.g. use bee-escape devices).

q. Remove weak, queenless, or unsustainable hives.

4. Prevent Drifting

a. Examples of drifting prevention techniques are as follows:

i. Maximize distance between apiaries, and between hives and hive rows within an apiary.

ii. Limit the number of colonies in an apiary.

iii. Provide visual cues.

iv. Change the angle of the entrances:

- irregularly shaped hive layout (e.g. avoid lining up in long rows along a straight fence line)
- opposite facing entrances
- colours/patterns
- strategic placement near landmarks

v. Regulate hive movement (e.g. avoid repositioning short distances).

vi. Take precautions to prevent shaken or stray bees from entering other colonies when shaking bees in front of new hives or removing bees from honey supers.

vii. Orientate hive rows, such that prevailing winds do not concentrate bees at the end of the row.

5. Swarm Prevention

a. Actively manage colonies to prevent swarming frequently in the spring and periodically throughout the summer and fall.

i. Inspect and remove swarm cells every 9–10 days.

ii. Place populous colonies in areas with early main nectar flow and add sufficient supers.

iii. Requeen colonies with a queen strain that has a genetically low propensity to swarm.

iv. Requeen with a younger queen.

v. Ensure the queen has a broad space to lay.

vi. Reverse brood boxes in the spring.

6. Exercise Caution when Splitting, Uniting or Equalizing Colonies

a. Monitor and treat, if necessary, before performing these manipulations.

b. Avoid mixing bees from different apiaries or those with differing health status.

c. Avoid introducing healthy bees to contaminated equipment or vice versa.

7. Minimize bees flying away during transport, and reduce exposure to other bees

a. Respect active quarantine, breeding, or research districts in the province.

b. Transport at night.

c. Use nets or top screens at all times during transport (day and night), if transporting by open truck. Clean nets to remove dead bees and debris between use.

d. Turn entrances in toward the middle of the truck, but be cautious regarding restricted air flow.

e. Use entrance screens, but do so with caution; bees can panic if overheated.

f. Plug or tape all cracks between supers.

g. Use alternative methods such as refrigerated trucks.

8. **Collecting Supers and Extraction**
   - **a.** Avoid extracting honey from brood combs that are contaminated with American foulbrood disease or European foulbrood disease.
   - **b.** Avoid accepting honey supers for extraction from other beekeepers, unless you know the health status of their bees.
   - **c.** Have smaller beekeepers do their own extraction.
   - **d.** Collect honey supers for extraction at the appropriate time.
   - **e.** Minimize bringing brood into the honey house with honey supers, particularly when managing colonies without queen excluders.
   - **f.** Extract honey supers promptly.
   - **g.** Clean extracting facilities on a regular basis.
   - **h.** Ensure good top and entrance ventilation, or maintain the humidity of hot rooms at < 50% relative humidity.
   - **i.** Store wax cappings in sealed containers.

Record Keeping

The purpose of record keeping in minimizing exposure to pests is to facilitate traceback to the source of the exposure and to identify the paths that exposures occur, allowing for quick action in order to avoid further spread.

1. **Mark some or all equipment with unique identifiers (e.g. numbers or colours).**
2. **Track which colonies are in which apiaries.**
3. **Map the location of colonies in each apiary.**
4. **Work with other beekeepers, PAs and producer associations to coordinate hive movement (for pollination) to reduce the risk of exposure.**
5. **Record the name and address of other beekeepers' bees that are transported with or placed in proximity to your own bees if known.**
6. **Maintain and keep records of pest presence for individual colonies, by apiary and the entire operation.**
7. **Record management actions and dates that could represent potential sources of exposure:**
   - **a.** feed source.
   - **b.** Introduction of used hive equipment and supplies.
   - **c.** honey super placement, exchange, and removal dates.

d. brood chambers received into the storage facility.

e. bee source.

In addition, suspected and confirmed reports or official alerts of outbreaks of pests uncommon to the local area should be recorded at the apiary level. These records would be used to trigger more intensive monitoring in high-risk areas.

1.4 Diagnoses and Monitoring

Target Outcome

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

Description

Beekeepers and their staff should be trained on diagnoses and monitoring procedures to identify pests in their bee operation. If laboratory analysis is needed, beekeepers should be trained and have appropriate equipment available. If further identification and verification are required, beekeepers should know how to collect and where to send samples to diagnostic laboratory services. Beekeepers may participate in voluntary inspection programs for some biosecurity threats, where available. Beekeepers do not rely solely on regulated inspections for monitoring. Monitoring has three key purposes:

1. **Monitoring to detect abnormal conditions in the bee colony and to trigger an investigation into the cause, and to rule out non-infectious/infestation causes before treatment:**
   - **a.** unexpected declines in honey productivity or food reserves that may signal a bee health issue
   - **b.** rates of winterkill
   - **c.** visual observations of bee populations, including
     - i. bee cluster size (number of frames covered with bees)
     - ii. queen presence
     - iii. eggs
     - iv. brood pattern
     - v. queen cells
   - **d.** visual observations of presence of dead bees and larvae:
     - i. inside the hive (e.g. brood comb, on bottom board)
     - ii. outside the hive (e.g. at hive entrances)
   - **e.** visual observations of abnormal bee behaviour:

i. unusual aggressive behaviour
ii. robbing behaviour
iii. bees not flying, lethargic, disoriented, crawling, twitching, or trembling

2. Monitoring to diagnose pests, determine infestation or infection levels if applicable, and to trigger treatment and notification, if required:

a. observations of abnormal adult bee appearance or ill health:

i. dysentery or Nosema-like symptoms:
- greasy or wet looking, hairless, light coloured or opaque, reddish eye;
- presence of fecal matter on frames or near hive entrances;
- odour; and
- counts of spores to assess whether recommended treatment thresholds for the monitoring period have been met.

ii. visual signs of mites:
- adult *Varroa* mites on brood and adult bees
- bees with deformed wings
- presence of adult male mites and developing stages at the bottom of newly emerged brood cells
- presence of fecal materials near caps of newly emerged brood cells
- counts of mites to assess whether recommended treatment thresholds for the monitoring period have been met

b. visual signs of brood diseases:

i. atypical or dead larvae
ii. AFB scale
iii. chalkbrood mummy
iv. sacbrood

c. visual signs of small hive beetle or wax moth, or associated damage

d. visual signs of disturbance by nuisance pests such as ants, bears, skunks, raccoons, and rodents

e. sampling for diagnostic laboratory or inspection services to confirm infection or infestation

3. Monitoring to assess treatment thresholds, triggering re-treatment, if necessary, and evaluating treatment effectiveness:

a. Assess whether recommended treatment thresholds for the monitoring period have been met (i.e. count mites, count Nosema spores, etc.).

b. Evaluate treatment efficacy (i.e. if in doubt due to suspected resistance, if treatment conditions were not optimal, if experimenting with a new treatment).

c. Test to confirm that treatment resistance did not occur.

*A **treatment threshold*** is a measurable level of an infection or infestation at which intervention should be taken to limit negative impact on bee health and to minimize economic loss. Treatment thresholds for some pests are specific to the sampling method, timing of sample collection, life stage of the pest, and geography. Treatment threshold levels may vary if multiple parasites are present (e.g. *Varroa* and tracheal mites), or if bees are more susceptible. Consult the provincial apiarist or specialist for treatment thresholds that are recommended in the local area.

The Risks

The risks of NOT monitoring for honey bee pests are

- rapid spread throughout an apiary or an entire operation.
- spread to neighbouring beekeeping operations through co-mixing (i.e. robbing) of infected or infested bees.
- missing the proper window of the bees or the pest for administering effective treatments.
- misdiagnosis leading to the wrong treatment being administered.
- unnecessary treatment applications if the pest is only suspected and not confirmed, or if the recommended treatment thresholds have not been reached.
- the incorrect assumption that a treatment has been effective when not the case due to resistance or environmental factors.
- increased risks of contaminating honey and speeding up the development of resistance due to prophylactic use of medications.

Monitoring visual signs does not guarantee that the colony or hive equipment is pest free. For example, AFB spores may be present, and early signs of the manifestation of the disease are often hard to detect.

Producer Benefits

- The key producer benefit of regular monitoring is knowing that proper procedures have been followed which either avoid the unnecessary use of controls or allow the proper use of controls in a timely manner.
- A monitoring program enables early intervention to contain or eliminate the spread of the pest and to limit the impact on honey and colony production.
- Late summer or fall monitoring may reduce winter losses by triggering management responses that improve wintering bee health and colony strength.

Recommended Practices

Principles of monitoring include:

1. **Pay regular attention to area outbreaks and alerts.**
2. **If applicable, have regular monitoring precede the recommended treatment period. It should be timed to match the lifecycle of the bees (when they are most vulnerable), the lifecycle of the pest (when they are most likely to infect or infest the bee), and seasonality.**
3. **Establish an ongoing monitoring plan that is harmonized with the bee operation's seasonal activities to assess colonies for pests during the following periods:**
   - **a.** spring, summer, and fall, according to the pest
   - **b.** after treatments (to evaluate efficacy)
   - **c.** in winter when weather permits if wintering outdoors (if applicable)
   - **d.** while in the wintering facility if wintering indoors (if applicable)
   - **e.** before uniting, splitting, equalizing, or requeening (if applicable)
   - **f.** before equalizing colonies prior to sending for pollination
   - **g.** before pulling honey supers (to identify weak colonies with low production)
   - **h.** before queen rearing begins (if applicable)
   - **i.** during queen rearing period (if applicable)
   - **j.** before moving or transporting bees or queens (if applicable)
4. **Use an easy-to-interpret rating or scoring of colony strength, recording to track changes (e.g. a rating of 1–3).**
5. **Recognize early visual signs that may indicate a problem. Further investigation into the cause is triggered to avoid unnecessary treatments.**
6. **Monitor environmental or other factors (i.e. drought, pesticide kill, etc.) that may mimic the signs of infection or infestation.**
7. **Use sampling methods that are thorough enough to represent your entire operation.**
8. **Handle samples with care to avoid spread or degradation of the sample before it is analyzed.**
9. **Confirm using microscopic tests, diagnostic labs, or inspection services where indicated.**
10. **Identify samples by colony, apiary, date, and beekeeping operation.**

11. **Be aware of, and participate in, voluntary inspection and surveillance programs, where offered, in addition to inspecting one's own colonies.**

12. **Keep records of collected observations and data by dates.**

13. **Train and update beekeepers and staff to recognize common and exotic pests and their signs.**

14. **Administer tests for suspected treatment resistance.**

15. **Assess treatment efficacy in order to repeat re-treatment, if necessary, or use an alternative treatment if ineffective treatments are determined.**

Refer to Appendix D for identification and monitoring methods for the main pests affecting honey bees.

Record Keeping

Record keeping is essential to monitoring for pests and diseases. Retain a record of the following information:

1. **apiary and colony identifier**
2. **date of inspection**
3. **person who inspected/monitored**
4. **colony strength rating**
5. **honey production**
6. **visual observations of bee health and behaviour**
7. **visual observations of signs of pests**
8. **visual observations of disruption, comb, or hive box damage**
9. **spore or parasite counts, and sampling method used**
10. **notes on new biosecurity risks in the area**

Recording for monitoring may be done on a hive-by-hive basis or for the whole apiary if a sample of hives is regularly monitored.

1.5 Standard Response Plan

Target Outcomes

Beekeepers have a standard response plan in place to address treatment thresholds, options and rotation plans, notification procedures, record keeping, and follow up actions.

Description

*A **response*** is an intervention to prevent, eliminate, or reduce levels of infections and infestations of honey bees. Examples of responses include procedures for segregation; proper disposal; cultural, physical, and mechanical methods; or treatments with registered chemical or biological control products.

*A **standard response*** refers to interventions that address pests commonly encountered in the operation or the general area. Such biosecurity risks may be associated with provincial requirements or alert advisories.

Elevated response is addressed in section 1.6. An elevated response is triggered when a high risk, exotic, or unfamiliar pest is suspected or where its presence is confirmed. Such biosecurity risks are likely associated with provincial requirements.

*A **standard response trigger*** means that the pest has been confirmed or that the level of infection or infestation has been determined where seasonal treatment thresholds have been established by provincial recommendation.

*A **response plan*** is in place that includes procedures for segregation, destruction, cultural and chemical treatments, and communication and notification.

Types of treatments:

Acaricides: Substances used for killing mites (also called "miticides")

Antibiotics: Substances used for killing or inhibiting bacteria

Fumigants: Controls that works in the vapour (gas) stage

Organic Acids: Organic compounds with acidic properties

Pheromone traps: Traps that use a pheromone – a chemical produced by insects to communicate with members of the same species – to attract an insect pest

Synthetic acaricides: Acaricides that are made synthetically

Non-Chemical Management is a method of managing a pest using a cultural, mechanical, or physical technique, rather than a biological or chemical-based control product.

Standard response planning entails

- keeping up to date with recommended management recommendations.
- understanding influences that could reduce treatment effectiveness.
- understanding and following product labels.

- managing the timing and scope of treatments.
- rotating and alternating treatments, when recommended, to reduce the development of resistance.
- coordinating treatments with sanitation and disinfection procedures to avoid re-exposure.
- evaluating results.
- keeping records of treatments and results.

Response planning requires that beekeepers and their employees be trained on procedures in order to implement the plan and know when and how to contact the provincial apiarist, apiculture specialist, or other regulating authority.

The Risks

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

- economic loss; increased winter losses, shortened lifespan of bees, slow spring buildup, and interference with brood rearing, resulting in reduced honey yields;
- reduced treatment efficacy or outright treatment failure, resulting in weakened colonies or death;
- risk of toxicity due to chemical interactions;
- the more rapid spread of the pest, both within the operation and to other beekeepers' colonies;
- greater likeliness of reinfection or reinfestation;
- increased incidence of treatment resistance; and
- colonies weakened by pests have less capability to withstand susceptibility factors and secondary infections.

Producer Benefits

Treating according to threshold levels provides the benefits of

- reduced time and cost of administering treatments.
- resistance management.
- a decreased risk of chemical residue buildup.

Following all recommended treatment procedures, timing and ideal application conditions will help to

- improve efficacy.
- slow declines in honey production and bee losses.

Recommended Practices

The primary recommended Standard Response practice is to obtain and follow provincial treatment recommendations. This includes being aware of new product registrations, changes to product use

procedures, or seasonal treatment thresholds, as well as non-chemical practices. Some provinces publish recommendations in the form of an annual update, whereas others issue a series of fact sheets or bulletins that are updated as required. If your province does not publish recommendations, contact your provincial apiarist or apiculture specialist for advice.

1. Principles of Treating with Chemical Controls

Use registered chemical treatments, rather than, or in conjunction with, cultural and sanitation/disinfection methods, whenever feasible. Chemical treatments are not a substitute for using non-chemical management techniques or minimizing bee susceptibility factors.

a. Avoid developing resistance by

i. rotating and alternating treatments, if applicable, at each treatment period (e.g. spring and fall).

ii. alternating or rotating different types of treatments between chemicals in different groups, whenever feasible. Avoid using multiple treatments for the same pest in the same treatment period.

b. Minimize the use of synthetic acaricides. Be aware of potential chemical interactions and buildup in the wax that can be highly toxic to bees.

c. If there is more than one treatment option available, choose treatments with more specificity to the organism and reduced toxicity to bees.

d. Be aware of and follow seasonal treatment thresholds for spore or mite counts:

i. One treatment may control multiple pests or diseases if both are present.

ii. Prophylactic or preventative treatments of antibiotics may or may not be recommended in certain circumstances. Contact your provincial apiarist or apiculture specialist for advice.

iii. Avoid treating, if treatment thresholds have not been reached.

e. Read all labels before applying any pest control products to your colonies:

i. Use medications, acaricides, and other treatments at the recommended rate or dose.

ii. Use products only if registered for that use, or if prescribed by a veterinarian.

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

iv. For all treatments, respect withdrawal times and the maximum time the pesticide is permitted to be inside the colony. Avoid the use of treatments when honey supers are on, unless stated as safe on the product label.

v. Dispose of treatments (e.g. acaricide strips) according to label directions.

vi. Avoid reusing acaricide strips.

vii. Avoid the use of products after their expiry date.

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

f. Be thorough and consistent when applying treatments. Where practical, treat all colonies that require treatment in the same yard at the same time. Alternatively, move some colonies out of the apiary that do not require treatment, and treat the rest.

g. Apply at the right time, especially if treatment is administered with feed. Treatments need to be applied when infestations/infections reach treatment threshold levels and before honey production. Medicated feeding should occur before temperatures are too low and when the bees can no longer break cluster to access feed.

2. Non-Chemical Techniques to help Manage Pests in Live Bee Colonies

Note: Cultural and mechanical techniques may not eliminate the need for chemical treatments altogether. These techniques may reduce the spore or mite count below the treatment threshold.

The techniques described in this section refer to management of pests within live bee populations.

a. Managing Levels of Disease Caused by Pathogens

i. The best cultural defence against disease is to maintain strong colonies with access to clean food and water, and to minimize susceptibility factors.

ii. Regularly monitor to identify pests, and segregate to prevent further spread.

iii. Routinely replacing brood frames and substituting contaminated combs with new comb are effective in reducing diseases such as Nosema and other brood diseases.

iv. If disease levels have built up to unacceptable levels in the comb, healthy bees may be introduced to uncontaminated equipment by shaking bees in front of the new hive.

v. Regular requeening with resistant stock, or stock that exhibits hygienic traits, is an important preventative cultural practice discussed in Section 1.1.

b. Managing *Varroa* Mite Levels

Varroa mites may be managed with these non-chemical techniques:

i. Maintain strong bee populations.

ii. Use screened bottom boards.

iii. Requeen with mite resistant stock.

iv. Practise drone brood trapping and drone comb removal for Varroa mite load management and monitoring.

v. Use frames with drone foundation or drone brood.

vi. Split and requeen with queen cells, or use other techniques to interrupt the brood-rearing cycle.

c. Managing Tracheal Mites

Tracheal mites may be managed with a non-chemical technique by

i. maintaining strong bee populations.

ii. placing sugar/vegetable shortening mixes (3:1 ratio) on the top bars of the hives. Shortening traces on bees prevent mites from recognizing the young bee as a potential host.

iii. requeening with tracheal mite resistant (TMR) stock.

iv. minimizing interchange of combs between colonies if health status is unknown.

d. Managing Small Hive Beetle

Small hive beetles may be managed with these non-chemical techniques:

i. Maintain strong bee populations.

ii. Avoid situating apiaries on sandy soil where larvae can easily burrow and pupate.

iii. Use traps in the colony.

iv. Avoid making contact with equipment, stacking infested supers on strong colony hive boxes, inserting splits or exchanging combs with infested colonies.

v. Remove dead outs promptly – beetles will multiply rapidly if not kept in check by worker bees.

vi. Use queen excluders.

e. Managing Wax Moth

Wax moths may be managed with these non-chemical techniques:

i. Maintain strong bee populations.

ii. Remove wax and debris from the bottom boards of hives regularly – at least once a year.

Record Keeping

The following records of treatments and non-chemical management techniques should be kept on a per colony basis, unless all colonies in the apiary or operation are treated identically:

1. **name of treatment**
2. **lot number of treatment, if applicable**
3. **individual who applies the treatment or who performs the procedure**
4. **date of verification by, and signature of, a person, other than applicator**
5. **supplier**
6. **expiry date of product**
7. **date of application**
8. **dose applied, especially if different than label rate**

9. **notes about environmental conditions that could impact efficacy (e.g. temperature)**
10. **Nosema spore or Varroa mite counts before and after treatment to measure effectiveness of treatment**
11. **cultural or mechanical techniques employed**
12. **observations**

Retaining and filing copies of invoices will assist in record management for honey bee pest treatments.

1.6 Elevated Response Plan

Target Outcomes

Beekeepers have an elevated response plan 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 pest is suspected or where its presence is confirmed. Such biosecurity risks are likely associated with provincial requirements and in some cases, federally (CFIA) notifiable diseases.

An elevated response plan is triggered when

- there is a quarantine in place. The declared quarantine area and individual quarantine order specifies the applicable boundaries, the reason for issuance, and the actions required, both permitted and prohibited. They remain in effect until lifted by the issuing authority.
- alerts are issued by the federal or provincial governments, or producer associations that an exotic pest has entered the country or has been found in a province or a local area.
- there is informal communication about unusual or elevated area outbreaks. These reports could originate from neighbouring beekeepers, associations or clubs, beekeepers that place bees for custom pollination near where other bees are placed, from farmers where bees are placed, or companies that contract custom pollination services.
- the presence of high-risk pests in an operation is confirmed by the provincial apiarist or the honey bee regulating authority.
- some change in bee populations, activity, or honey production is observed that is impossible for the beekeeper to readily explain or has never seen before.
- signs of disease or the presence of mites or pests are observed that the beekeeper had not encountered before.

- a beekeeper has treated for a pest but found the efficacy to have been less than expected. This could signal that treatment resistance is developing, the pest has been misdiagnosed, or that the application technique or the conditions under which the treatment was applied were not optimal.

The Risks

The following risks are associated with NOT having an elevated response plan:

- potentially significant economic loss if inappropriate action is taken, appropriate action is not taken on short notice, or if there is no treatment available;
- possible quarantine order placed on a bee yard, which remains in effect for an extended period;
- possible disruptions to colony and equipment movement, or bee and supplies purchase or sale, associated with mandatory quarantine areas;
- more rapid spread of the pests, both within the operation and to other beekeepers' colonies;
- colonies weakened by pests have less ability to withstand the effects of inclement weather, malnutrition, disturbance, and pesticide exposure; and
- reduced treatment efficacy or outright treatment failure if the pest is misdiagnosed and the wrong treatment is given, possibly resulting in weakened or dead colonies.

Producer Benefits

These are the benefits to producers with an elevated response plan:

- A potential problem can be effectively dealt with before spreading and becoming a significant threat to bee operations.
- Economic loss can be mitigated, and the cost and time associated with aggressive or large scale monitoring, treatment, and even quarantine can be avoided or reduced.
- Beekeeper reputations can be preserved or restored more quickly if the problem is addressed effectively and in a timely manner – an advantage if marketing bees, bee products, or providing pollination services.
- Treatments and application techniques can be adjusted to improve future efficacy.

Recommended Practices

An elevated response plan includes the following:

1. **Communication and notification. The plan includes communication with each of the following:**
   - **a.** staff;
   - **b.** bee inspector, provincial apiarist, or the honey bee regulating authority;
   - **c.** associations and clubs;

d. suppliers or customers of bees, or bee products that could transmit the biosecurity risk;

e. to other beekeepers where there is a possibility of spreading the pest; and

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

A directory of contact names, email addresses, and telephone numbers is kept up to date and is accessible to staff.

The primary trigger to communicating with government is regulatory for notifiable biosecurity risks.

The trigger to communicating with others outside the operation may be a function of

a. whether the biosecurity risk is suspected or confirmed.

b. the potential for rapid spread.

c. the presence of the biosecurity risk elsewhere in the area.

d. the identified source of the hazard.

2. Bee management protocol

a. If a biosecurity risk is suspected but not yet confirmed, follow the instructions provided by your provincial apiarist or the honey bee regulating authority.

Immediate actions may include the following:

i. Temporarily suspend colony and equipment movements outside of a contained area (or quarantine area if applicable), if any are scheduled; for example movement to a new bee yard for custom pollination.

ii. Close, mark, and restrict access to suspect colonies.

iii. If feasible, segregate suspected or dead colonies in a bee-tight facility. If applicable to the biosecurity risk, store in a cold room with low relative humidity.

iv. Suspend bee and supply sales (if applicable).

v. Suspend further introductions from the suspected source of the biosecurity risk to your operation.

vi. Increase monitoring and inspection frequency and sampling.

vii. Set traps, if applicable (e.g. for small hive beetle).

viii. Require beekeepers and staff who enter or leave your areas where the biosecurity risk has been contained to inspect or remove protective clothing and footwear, replacing with a spare set of clothing and footwear.

ix. Reduce the carry-over of dust and debris into buildings by sealing passageways and loading bays, and by restricting the use of dollies and carts to either the field or the building.

x. Take extra precautions to disinfect vehicles, forklifts, nets, facilities, hive equipment, tools, and personal protective equipment after handling infested or infected colonies, or contaminated hive equipment.

b. If a biosecurity risk is confirmed, these additional procedures may be recommended:

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

ii. Extend treatments to all colonies in the apiary, depending on the biosecurity risk.

iii. Increase cultural, mechanical, and physical management techniques, as needed to minimize bees' susceptibility to pests.

iv. If a new virus infection is confirmed, concentrate on *Varroa* mite management, because the combination of these biosecurity risks may be devastating.

3. Additional protocols after confirmation and, if applicable, to the biosecurity risk

a. Quarantine Protocols

i. Follow all requirements of the quarantine order or declared area. These may include restrictions on movement, obtaining official approval before moving colonies and equipment, specific destruction and disposal protocols, as well as record keeping.

b. Visitor protocol

i. Maintain a visitor log, including name, organization, contact information, location, where the visitor is coming from and going to, the purpose of their visit, and the date and time of their visit.

ii. Require visitors entering or leaving your premises (as applicable) to inspect or remove protective clothing and clean footwear, and provide a spare set of clothing and footwear.

c. Signage

i. Meet any signage requirements to identify quarantine boundaries.

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

iii. Ensure suspect or confirmed hives are marked as such.

Record Keeping

1. Record keeping is similar to that of the standard response plan, but includes date and source of notifications and reports on quarantine orders (with contact information) to and from premises:

a. staff

b. provincial apiarist or the honey-bee regulating authority

c. bee associations and clubs

d. relevant suppliers or customers

e. other beekeepers

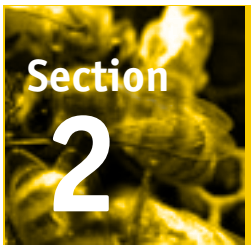
f. farmers and custom pollination contractors

2. **Strict record keeping of incidence management may be required by the provincial apiarist or honey bee regulating authority after confirmation.**

3. **Keep copies of all records and documentation relating to notifications and quarantine orders.**

4. **Ensure that standard record-keeping procedures are implemented for receiving bees, supplies, or for shipments from the operation.**

5. **Maintain visitor log records.**



Operations Management

2.1 Obtaining Production Inputs

Target Outcomes

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

Description

Production inputs include "consumable" products such as feed (carbohydrate supplements and pollen or pollen substitutes), water, treatment products (pest control products, including pharmaceuticals, acid treatments and essential oils) and cleaning and disinfection supplies. Refer to Appendix F for information on selecting disinfectants.

Production inputs exclude bees (Refer to section 1.1), and reusable hive equipment, foundation, tools, hive wraps, clothing, and gloves.(Refer to sections 2.3 and 2.5.)

Production inputs may be purchased, acquired at no cost (e.g. from other beekeepers), or derived from the beekeepers' own operation (e.g. honey or pollen used for feed).

Reliable sources are known to be providers of products that are suitable for honey bees, free from contamination, not expired (applicable to some treatment products), and accurately labelled. Supplier lists for safe sources of production inputs may be identified by local beekeeping associations or provincial apiculture programs.

The beekeeper obtains documentation (a supplier declaration that the input is suitable for feeding to honey bees or that the wax is free of pesticide residues). The beekeeper maintains records of the product, date acquired, quantity acquired, lot number, and supplier name and contact information to enable traceback if a problem should occur that is related to using that input.

The Risks

There are three types of risks associated with using production inputs that are not recommended or not obtained from documented safe sources:

1. Introduction of pests to healthy bees: Water, honey, or non-irradiated pollen fed to bees may contain pests.

2. Bee susceptibility: Feeding carbohydrate supplements, other than white sugar (sucrose) syrup or high fructose corn syrup (HFCS) suitable for bees, may result in toxicity to bees or cause malnourishment.

3. Potential for reduced treatment efficacy; purchasing and/or using expired treatment products: Using treatment products that are not obtained through veterinary prescription or are not registered for use for honey bees may result in the following: be less effective than recommended treatments, result in the development of treatment resistance, pose a health risk to the consumer, and present a legal risk to the beekeeper.

Producer Benefits

The benefits of implementing recommended biosecurity practices when obtaining production inputs are

- reduced chance of introducing pests to healthy bees and therefore reduced need for increased management and treatments of exposed bees.
- if a pest is introduced through production inputs, the beekeeper can trace the source back to its origin, quickly identify other colonies that might be affected and take remedial action, as well as avoid that source or take preventative action before exposure to bees if supplies from that source are used in future.
- optimal treatment efficacy.
- reduced chance of developing resistance to treatment products.

Recommended Practices

1. **Domestic Sources for Production Inputs**
   - **a.** Where available, purchase from certified/inspected suppliers, or through recognized bee supply companies and cooperatives, as identified annually by the provincial apiarist or other authority.
   - **b.** Purchase production inputs from suppliers that you know and trust and those with established disease/pest management programs.
   - **c.** If feasible, investigate unfamiliar suppliers before purchasing.
   - **d.** Confirm that the supplier has a provincial permit or licence to sell applicable production inputs.
   - **e.** Confirm that feed supplements are suitable for honey bees.

2. **Water**
   - **a.** Use clean potable water, which meets municipal regulations for drinking water, for mixing sugar syrup or as a water source for bees.

3. **Supplemental Carbohydrate Feed**
   - **a.** Be aware that the recommended supplemental carbohydrate feed is sugar syrup made from pure white sugar (sucrose) or food grade HFCS.

b. Avoid feeding honey to bees, including allowing them to feed off wet combs (i.e. clean off frames or feed off cappings).

c. Ensure feeders and containers are new or have been disinfected prior to refilling.

4. Supplemental Protein Feed

It is recommended that only irradiated pollen or protein supplements (containing no pollen) be fed to bees:

a. Ensure that beekeepers are familiar with and follow current federal acts and regulations concerning the importation of "bee products," which are defined under the *Health of Animals Regulations* (Section 2 and 57) as including pollen for feeding. Pollen may be imported legally for bee feed if it has been irradiated. Beekeepers need to be aware that the pollen of several plant species is prohibited or regulated under the *Plant Protection Act* (D-08-04 Section 3.4.7).

b. Request proof of irradiation of the production input, if applicable.

c. Ask for certificate of origin for pollen feed.

d. Request content, including floral source (which may indicate pesticide contamination) for pollen feed.

5. Treatment Products

Only obtain treatment products registered for use with honey bees or hive equipment, as stated on the product label, or as prescribed by a veterinarian.

a. Beekeepers should be familiar with the *Health of Animals Act* and *Regulations* that govern antibiotic use for honey bees.

b. All chemicals used for the treatment of honey bee pests must be registered with Health Canada: Veterinary Drugs Directorate or the Pest Management Regulatory Agency. Consult with your provincial apiarist or the provincial environment department regarding licensing requirements for pesticide application.

i. Ensure products are not expired.

ii. Obtain treatment products from reliable sources if the product requires special storage conditions (e.g. temperature, light, humidity).

Record Keeping

1. Production inputs are clearly identified on receipt by lot number(s) and the following information is recorded for each lot:

a. product details (name, quantity, lot number, date received, expiry date).

b. name, address and telephone number of supplier.

2. **Inventories of treatment products should be updated as products are used or new shipments are received.**

3. **Records should be kept for at least one year to enable traceback.**

2.2 Handling and Disposal of Production Inputs

Target Outcomes

Beekeepers prevent the degradation and contamination of production inputs by safe and secure storage and disposal.

Description

Production inputs include "consumable" products such as

- feed (carbohydrate and protein supplements and substitutes);
- water;
- treatment products (pest control products, including pharmaceuticals, acid treatments, and essential oils);
- cleaning and disinfection supplies. (Refer to Appendix F for information on using and handling disinfectants.)

The Risks

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

Spread of pests within the operation or to other beekeepers' operations through exposure of healthy bees to contaminated feed and/or water or beeswax foundation derived from contaminated hives: Contaminated pollen and honey stores contained within the hive can be of particular risk for spreading disease from area to area when moving colonies for pollination. (Refer to section 1.3).

Reduced efficacy of treatments: Treatment products may be degraded or become toxic to bees if they are not stored according to label instructions (e.g. light-, temperature-, or humidity-controlled storage), are reused, or are used after the expiry date.

Potential for treatment-resistance development may occur if, for example, acaricide strips are not removed promptly at the conclusion of the treatment period or are reused.

Producer Benefits

The benefits of implementing biosecurity-recommended practices when handling and disposing of production inputs are

- reduced chance of introducing pathogens to healthy bees and therefore reduced need for increased monitoring, management, and treatments of exposed bees.
- optimal treatment efficacy.
- reduced chance of developing resistance to treatment products.
- less need for destruction of supplies by minimizing exposure to contaminants.
- improved reputation as a reliable supplier of bee productions inputs – a benefit if selling beekeeping supplies.
- less need for buying new feed to replace spoiled feed.
- less need for buying new treatments to replace spoiled treatments.

Recommended Practices

Personal sanitation practices are followed after handling confirmed or suspected production inputs that have been contaminated with bee pests.

1. **Handling and Disposing of Feed and Water**
   - **a.** Use unexposed (e.g. hive-top) feeders and clean up honey spills and syrup as soon as possible.
   - **b.** Provide an alternate water source if necessary, limit bees from seeking water where they may co-mix with others, or be a nuisance to the neighbours.
   - **c.** Feeders and water containers should be sealable and of a smooth material (e.g. food-grade containers) that can be thoroughly cleaned to remove wax, propolis and honey residue and disinfected before reuse. Rinse with clean, potable water before refilling. Use floats on the water so the bees won't drown and change water weekly.
   - **d.** Store liquid feed in sealed containers. Pollen patties should be stored in a cool, dry area or frozen. Store all feed in areas segregated from bees, honey processing and other storage facilities.
   - **e.** If a food or water source is found to have been accessed by infected or infested bees, or if the health status of bees accessing the food or water source is unknown, the feed and water should be removed (if feasible), sealed and disposed of safely.
   - **f.** If moving hives ensure that the feed and pollen stores are not carrying diseases that are new or uncommon in the area being moved to.
   - **g.** Avoid disposing of excess, uncontaminated sugar syrup by dumping on the ground as it can attract robber bees and pests.

h. Excess pollen patties should be removed before placing honey supers on the colony and used patties should be buried or burned and not exposed to bees.

i. Avoid the buildup of dead bees and other insects in or around feeders.

j. Clean dead bees or other insects from feeders.

2. **Handling and Disposing of Treatment Products**

a. If applicable, store pharmaceuticals and chemical treatments according to label instructions (temperature, humidity, and light controlled).

b. Keep products in their original unopened package until ready for use.

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

d. Promptly dispose of used, expired, or excess products that will not be used, according to the label instructions or further recommendations. Contact your provincial apiarist or apiculture specialist for current disposal recommendations.

e. Mark hives with the number of acaricide strips applied to control mites and the date they should be removed. Count and record the number of strips to ensure that all strips are removed at the conclusion of the treatment period.

f. Avoid re-using acaricide strips.

g. Follow label instructions when applying treatments, especially if exposed to direct sunlight or high heat to prevent degradation of the treatment.

Record Keeping

Records should be kept on

1. **feeding dates, feed type, lot number, quantity, and supplier.**
2. **treatments applied, product lot numbers, and dates for application and removal (if applicable).**
3. **apiary and or hive placement identifier (i.e. where the product was used).**

2.3 Obtaining Bee Equipment

Target Outcomes

Beekeepers obtain bee equipment 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

Bee Equipment includes all reusable hive equipment:

- hive boxes
- brood and honey frames
- bottom boards
- inner and outer covers
- queen excluders
- foundation
- feeders
- bee escape boards
- queen cages
- mouse guards
- entrance reducers
- hive stands
- winter wraps
- propolis and pollen traps

Bee equipment excludes production inputs and tools. Tools are considered an extension of the beekeepers' person and are addressed in section 2.5.

Reliable sources are known to provide equipment that is free from pest contamination. Supplier lists for safe sources of bee equipment may be identified by local beekeeping associations or provincial apiarists.

The beekeeper obtains documentation such as a supplier declaration (if applicable) and maintains records of the equipment, date acquired, quantity acquired, supplier name, and contact information to enable traceback if a problem should occur that is related to the use of that equipment. This may be through the beekeepers own records or through provincial inspection records.

Used equipment may be disinfected by chemical, irradiation, heating, freezing, and scorching or other methods to kill any living organism that could infect or infest healthy bees. Requirements for method of treatment may differ for the various pests.

The Risks

- The primary risk associated with introducing used bee equipment to the operation without ensuring its disease-free status or treating it first is the exposure of healthy bees to pests and their spread throughout the operation.
- Using poorly constructed wooden ware (e.g. poorly fitting hive boxes and frames, non-galvanized metal parts and nails that can rust) that has not been properly protected with bee- and honey-safe wood preservative and fresh paint to protect from rot can cause the colony considerable distress from pests and predators that enter the hive.

- Reusing comb without properly irradiating or disinfecting first may also introduce pathogen spores.
- Wax foundations may contain high concentrations of residues from treatment products, such as acaricides, that could be toxic to bees.
- Wax foundations that contain treatment residues may lead to the development of treatment resistance and honey contamination.

Producer Benefits

These are the benefits to obtaining high-quality, disease-free hive equipment:

- reduced chance of introducing pests to healthy bees and thus a reduced need for increased management and treatments of exposed bees
- ease of inspection and monitoring
- less need for destruction of contaminated equipment
- longer equipment life and less need for ongoing maintenance and equipment repair
- healthier bees through better moisture control within the hive
- reduced impact on the bees from robbing or damage from predators and pests such as mice
- improved reputation as a reliable supplier – beneficial if selling beekeeping equipment

Recommended Practices

1. Purchasing Used Hive Equipment

a. Domestic

i. Where available, purchase used equipment from local certified/inspected suppliers, or through reputable bee supply companies and cooperatives.

ii. Obtain a health certificate or inspection certificate.

iii. Avoid purchasing from third parties outside of the beekeeping industry or suppliers whose status cannot be verified (e.g. over the Internet, at an auction).

iv. Investigate unfamiliar suppliers before purchasing.

b. Regulations and Compliance for Importing Used Bee Equipment

Obtain confirmation that the inspection by the designated originating authority was conducted within 30 days (or as specified in the provincial/federal regulations) before entry into the province:

i. Federal:

- Beekeepers are familiar with and follow current acts and regulations concerning the importation of used beehives, used beehive equipment, or beeswax under the *Health of Animals Regulations* (Section 57a). It is prohibited to import used bee equipment.

ii. Provincial:

- Beekeepers are familiar with and follow current provincial import and transport regulations as defined by the applicable Bee, Livestock Health, Animal Health, or Apiary (Inspection) Act and Regulations.
- Permits are required in advance of importing used equipment from another province or transporting used equipment through other provinces.
- Beekeepers follow the requirements for registration in their province; for example, each year, beekeepers register with the provincial apiarist or bee authority by the annual registration date or within the specified number of days after acquiring bees and/or equipment.
- Records are retained and accessible for the required time period.
- Provincial import permits are applied for in advance of importation.
- Shipments are accompanied by a copy of the original inspection report from the originating provincial government authority.
- Segregation/quarantine, treatments, and destruction and/or disposal, if ordered by the inspector, are followed by the method and within the time frame specified.

2. Selection or Construction of Hive Equipment

Inspect and select new and used hive equipment, based on the following criteria:

a. clean tight joints and well-fitting parts with no cracks or holes in the hive bodies;

b. hive boxes that stack tightly with no gaps in between where pests or predators could enter;

c. box joints that fit snugly: neither too tight (can cause splitting) or too loose (can cause rot);

d. use of galvanized metal parts and nails to prevent rust;

e. clean, smooth wood cuts and wood with no or only small tight knots;

f. wood that is not susceptible to moisture and not pressure-treated for construction of hives; and

g. new plastic foundation, if possible, or have proof of irradiation if reusing plastic foundation.

3. Introducing Used Hive Equipment

One of the best defences against introducing pests is to avoid acquiring used equipment, or only accept if the disease history is known.

It is recommended that all used hive equipment be segregated in a bee-tight storage facility or dedicated bee yard upon receipt, especially if the equipment contains live honey bees. These colonies should be closely monitored for at least one year to prevent possible transference of disease to healthy colonies. Honey from these colonies should be extracted last. If AFB is detected, then the equipment should be rendered or disposed of appropriately (see section 2.4). If no disease is detected after three years, the colonies and equipment may be integrated into the rest of your operation.

If the used equipment does not include a colony of bees, and proof of disease-free status or a certificate of irradiation is not provided, the equipment should be received into a segregated area and inspected by the province. Equipment should be scraped and pressure washed, and one of the following disinfection methods should be used before introducing the equipment to your operation; however, not all disinfection methods are effective against all diseases.

- **a.** Irradiation is effective for controlling AFB, EFB, *Nosema ceranae*, and chalkbrood. To send equipment for irradiation, follow all preparation, handling, packing, and shipping instructions, as indicated by the irradiation service provider:
  - i. Before shipping for irradiation, kill, remove, and burn bees, and extract honey using a specially designated extractor to avoid cross-contamination.
  - ii. Request and retain a copy of the irradiation certificate upon return of the equipment.
  - iii. Ensure that the equipment is marked as irradiated before putting it back into use.
- **b.** Be aware that heat treatment is effective for *Nosema apis* management (i.e. 49°C for 24 hours); however, caution must be exercised in that effective temperatures will melt wax.
- **c.** Scorch bee boxes with fire.
- **d.** Dip wooden ware (bee boxes, wooden feeders) in hot paraffin wax at a sufficient temperature and duration to achieve disinfection.
- **e.** Chemical disinfection (e.g. with bleach).

Registration for acetic acid fumigation for controlling Nosema is currently under review by PMRA.

4. **Foundation**
   - **a.** Obtain new plastic foundation and avoid reusing.
   - **b.** Use wax from an ISO-accredited rendering facility. Avoid acquiring wax foundation or plastic foundation with wax from unproven sources.

Record Keeping

Record keeping is particularly important when acquiring used equipment that may present a risk of exposure to pests.

The following information should be recorded:

1. **date of receipt;**
2. **name, address, and telephone number of supplier;**
3. **apiary location with apiary number and/or hive placement identifier i.e. where the equipment was placed;.**

4. **health status or other documentation provided by supplier;**

5. **treatments administered upon receipt of the equipment.**

Records should be kept for at least one year to enable traceback.

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

Target Outcomes

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

Description

Managing, cleaning, disinfecting, destroying by burning, disposing properly, and maintaining bee equipment in a manner that prevents or removes pests, and unwanted bees, will reduce this biosecurity risk.

Bee Equipment includes all re-usable hive equipment (see section 2.3).

Bee products include honey, beeswax, pollen, and propolis.

Management includes removing and replacing (exchanging) frames or other pieces of hive equipment, scraping, brushing, disinfecting, and disposing. Management also includes bee-tight storage.

Maintenance includes routine repair, inspection, culling, and repainting.

The Risks

Pathogen spores can survive on wood and metal surfaces of hive equipment, on or in dead bees, or in bee products, including honey, wax, pollen, and propolis. Other insect pests and parasites can survive on or in the bee equipment, feed inputs, or other material for short periods of time (see section 1.3).

Unused equipment can provide shelter to unwanted bees, and poorly maintained equipment can provide entry points for robber bees and other insect predators. These bees and insects can spread pests within the beekeeping operation or to other beekeepers' operations. Robbing activity may be triggered, causing interaction between colonies and increasing the chance of pest transmission.

Some bee treatments are effective against the vegetative stage of the disease within the bee, but do not kill spores on surfaces.

Bee products present a risk of pest transmission to healthy bees if

- bee product residue remains in beekeeping equipment that is reused without cleaning (e.g. scraping or brushing) and disinfecting.
- the bee products are harvested and used as production inputs to the beekeeping operation (e.g. supplemental feed, foundation).
- the bee products are accessed by robber bees.

Worker bees can pick up pathogen spores and parasites from dead bees and debris during cleaning activities, and spread the infection or infestation to healthy brood or bees within the colony.

Producer Benefits

These are some of the benefits of enhanced biosecurity in managing and maintaining bee equipment:

- reduced risk of exposure, introduction, and spread of pests;
- saving time and money on treatments;
- less need for destruction of infested or infected honey bee colonies and contaminated equipment;
- longer equipment life;
- reduced robbing;
- reduced damage from predators and pests;
- a marketing advantage if selling beekeeping equipment; and
- enhanced trade opportunities.

Recommended Practices

1. Implement an Equipment Identification System

a. To enable hive equipment management and monitoring of colony health (section 1.4), employ a system of identifying apiaries and hives. Identification is necessary for keeping accurate records that in turn can help identify weaker colonies or whole apiaries, so that timely action can be taken. Identification also facilitates traceback to the source of an infection or infestation so that action can be taken to prevent further spread.

b. Possibly use a geographical identifier for apiaries that correspond with provincial registration requirements for reporting apiary locations.

c. Create unique identifiers for large operations, and especially those where colonies are moved for pollination, as follows:

i. apiaries
ii. equipment storage facilities (if multiple)
iii. pallets (for movement, winter storage)
iv. hive boxes
v. brood chambers

Examples of identification systems:

- a numbering or colour-coding system;
- equipment identified by the date when it was brought into service. This method is particularly effective for identifying when a piece of equipment is due for scheduled repair or culling;
- tools such as mapping the location of colonies within the apiary for management and traceability;
- date-stamped digital photographs used as a visual tool for monitoring colony health, queen activity, and brood comb, hive maintenance requirements, as well as identification of pests. A photo of the unique hive identifier should precede the sequence of photographs for each colony; and
- more sophisticated systems, involving GPS systems and bar codes or quick response (QR) codes printed on hive labels that are used with hand-held readers, cell phone, or tablet applications.

d. Label feed pails "for feed only" or for "medicated feed only."

2. Routine Inspection

a. Thoroughly inspect all hive equipment for structural integrity at least once per year.

b. Look for signs of poorly fitting equipment, cracks, damage from handling and tools, damage from predators such as bears or mice, signs of vandalism, water-logged material, rot, rust, exposed wood in need of paint, leaky feeders.

c. Thoroughly inspect colonies for signs of pests at least twice per year (spring and fall), and ideally whenever handling the equipment.

d. Increase the frequency of inspection of brood frames if pests are present in the apiary or become a biosecurity risk in your area.

e. When visiting an apiary, inspect colonies suspected with pests last.

f. Close and mark hives, and segregate equipment that is suspected of being contaminated, reporting to your provincial apiarist or bee authority.

3. Equipment Exchange and Replacement

a. Carry extra hive boxes with you when you visit the apiary, and swap out damaged or deteriorated boxes as you find them or if you split wood when opening the hive.

b. Set aside equipment for repair in a segregated storage area.

c. Minimize the exchange of equipment between apiaries and between individual hives within an apiary unless splitting colonies or creating nucs. Only exchange frames that are visually free of infection.

d. Use a colour-coding or numbering system to match frames and supers to a bee yard.

e. Adopt a "Brood Frame Replacement strategy." Replace a minimum 20 percent of all brood frames, and ideally replace one-third each year (i.e. replace 2–3 older combs per brood chamber with newly drawn combs or foundation). Ideally, frames should be date-marked or coded to facilitate identification for replacement.

f. Use brood comb only in the lower hive boxes, and avoid moving into honey supers. Frames from the brood box must not be extracted.

g. Ideally, queen excluders are used. If used, examine regularly, ensure it is in good condition with no gaps. Replace if necessary.

h. Remove discarded burr com, place in a sealable container, and remove from the apiary to prevent robbing and attracting pests and predators.

4. Maintenance and Repairs

a. Keep the apiary clean, manage vegetation, and remove unused and obsolete equipment.

b. Under normal use, clean boxes, lids, and bottom boards yearly.

c. Thoroughly clean the equipment before attempting equipment repairs. Winter is an ideal time to repair equipment. Apply wooden or galvanized metal patches, ensure tight-fitting repairs, use waterproof glue, putty or caulking, and repaint.

d. Repairs and paint should be applied to supers before long-term storage. Regularly inspect comb for signs of pests.

5. Disinfecting Equipment

a. Routine disinfection of hive equipment is recommended before reintroducing bees to prevent the spread of pathogens. (Refer to Appendix F for disinfection methods.) Follow provincial protocols for handling and storing contaminated equipment that is to be disinfected.

b. Follow procedures for sanitizing and disinfecting transportation equipment (section 2.7), personal protective equipment (e.g. gloves) and tools after handling infected bees, bee products, and bee equipment (section 2.5).

c. Collect and store discarded wax combs in a sealed bucket or drum. Wax combs can be melted in a solar wax melter, and reused or sent to a rendering facility.

6. Storage

a. Provide bee-tight, segregated storage for equipment, discarded comb, and other used material awaiting disposal, repair, disinfection, or wax rendering.

b. Inspect winter wraps, and clean and disinfect if contaminated with fecal matter before storing.

c. Store unpopulated hive equipment and winter wraps that are ready for use in a clean, dry, bee-tight area or in the apiary in closed drums to protect from foraging bees.

d. Remove honey, stored pollen, and propolis before storing equipment.

e. Store bee products in sealed containers in bee-tight facilities to prevent robbing.

f. Keep garbage storage areas clean and maintained.

g. Position long-term garbage storage well away from the apiary and facilities, and avoid exposure to foraging bees.

h. Manage wax moths in stored equipment, using these non-chemical techniques:

i. Expose loosely stacked equipment to cold or heat treatments at the appropriate temperature and duration. Ensure good air flow.
ii. Avoid mixing brood comb with honey comb in storage.
iii. Dry supers before storage.
iv. Close off/cover empty supers.
v. Wrap frames in plastic or store in sealed bins.
vi. Layer stacks with cedar boards, shavings, cardboard, or newspapers (with lavender).

i. If small hive beetle has been detected,

i. store comb in a temperature-controlled facility with low relative humidity (less than 50 percent) and with good air circulation to inhibit the hatching of small hive beetle eggs.
ii. freeze honey supers to minimize the risk of infestation.

7. Disposal

a. Dispose of dead bees, bee products, debris, empty honey supers and other equipment that cannot be repaired by burning, burying, or sending to the municipal landfill sites. Place these materials in sealed garbage bags or tight containers.

b. If sending to the municipal landfill, ensure proper handling of garbage to avoid robbing by foraging bees, attracting other predators, insects, or rodents.

c. Use garbage cans or bins with tight-fitting lids and that are lined inside with plastic bags to reduce odours and to help keep the cans or bins clean.

d. Provide garbage bins for disposing waste, used gloves, and other material at the first entry point from the apiary, as well as access points to segregated areas.

e. Dispose of garbage regularly, in accordance with provincial and municipal regulations.

8. Destruction of Colonies

a. Be aware of and follow provincial protocols for reporting an occurrence of AFB or other high-risk pest, handling, storing and destruction of contaminated equipment, products, and bees. Contact your provincial apiarist or bee authority for more information.

9. **Extraction**
   - **a.** Avoid extracting honey, harvesting pollen, or using beeswax from contaminated equipment that is to be burned. Infected bees and bee products should be burned with the equipment.
   - **b.** Never extract honey from brood combs. Never extract honey from AFB-infected colonies. Extract honey from combs with less serious diseases such as EFB and chalkbrood last.
   - **c.** If small hive beetle has been detected,
     - i. extract filled honey supers within one to two days, and render cappings promptly to avoid rapid buildup of beetles in the honey and wax.
     - ii. practise sanitation, surveillance, and management in the honey house.

Record Keeping

Records should be kept on bee equipment for each of the following at a level appropriate to the operation (i.e. beekeeper operation, apiary, hive, or equipment component):

1. **inspection**
2. **equipment disinfection treatments**
3. **equipment repair**
4. **equipment disposal**
5. **schedule of brood frame replacement**

An annually updated inventory of hive equipment that is in storage or in use, identified by status, is useful for planning for equipment repairs, culling, and acquisition. A three- to five-year timeline is suggested.

Records should be kept to enable traceback.

2.5 Personal Sanitation

Target Outcomes

Beekeepers take precautions to minimize the spread of pests through human contact with bees and equipment.

Description

Beekeeper personal contact with bees may be directly via bare hands, with personal protective equipment such as coveralls, gloves, veils and head gear, footwear, or by tools that the beekeeper uses to manipulate and maintain the hive.

Tools include the smoker, hive tool (to open the hive, pry frames apart, and scrape off wax, propolis, and debris), frame grips, blowers, brushes, and grafting tools for queen rearing.

Forklifts, dollies, and hand trucks used to move hives are considered part of transportation equipment, not personal equipment.

The Risks

As the beekeeper moves from hive to hive, apiary to apiary, and between the storage facilities, the bee yard and the extraction facility, there is the potential of spreading live *Varroa* mites and pathogen spores by hands, gloves, or via tools. Pests such as small hive beetle are highly mobile and can "hitch-hike" on the beekeeper's personal protective equipment.

Producer Benefits

- The primary benefit of practising rigorous personal sanitation procedures when handling bees and hive equipment is to reduce the chance of spreading pests to healthy bees within the operation and therefore reduce the need for increased management and treatment of exposed bees.
- Personal sanitation prevents or limits the spread of pests among colonies in the same apiary or storage facility, as well as protects entire apiaries or storage facilities from exposure to pests found elsewhere in the operation. This may also reduce the limitation of trade between different beekeeping operations and regions, based on disease status.

Recommended Practices

1. **Handwashing (If Gloves Are Not Worn)**
   - **a.** Carry water, soap, and paper towels for washing hands, or use hand sanitizer.

b. Wash hands after handling contaminated equipment or bee products. Place cloth towels or paper towel used for hand drying in a sealable bag for later disinfection or disposal.

c. Wash hands when moving from apiary to apiary, even if infection or infestation is not confirmed.

2. Gloves and Clothing

a. Carry a supply of several pairs of disposable gloves or clean reusable gloves.

b. Wash and disinfect soiled reusable gloves before reuse. Wash canvas gloves in a bleach solution. Scrub down rubber gloves with hand cleaner and a scouring pad or powder while still being worn. Avoid cowhide gloves that are difficult to clean and disinfect.

c. Change gloves after handling contaminated equipment or bee products. Insert the contaminated gloves in a sealable bag for disposal or later disinfection.

d. Change gloves when moving from apiary to apiary, even if an infection or infestation is not confirmed.

e. Carry soap, water, and a mild bleach solution or hand sanitizer, washing hands before putting on the clean gloves.

f. Prevent stray bees or pests (such as small hive beetle) from "hitchhiking" on protective clothing, footwear, or head gear when moving from apiary to apiary.

g. Wash coveralls and head gear regularly to sanitize.

h. Clean and disinfect footwear if leaving an AFB- or small hive beetle (SHB)-contaminated, or other high-risk apiary.

3. Tool Disinfection

a. Carry extra sets of clean and disinfected hive tools.

b. Disinfect tools after handling contaminated equipment or bee products. Insert the contaminated tools in a sealable bag for later disinfection if there is no method of disinfection readily available on-site.

c. Disinfect or change tools when moving from apiary to apiary, even if infection or infestation is not confirmed.

d. Disinfect or change tools when moving between hives if disease is present.

e. Clean hive tools by scraping two tools together to remove wax, honey, propolis, and debris. Follow proper handling and disposal methods for this material, especially if known to be contaminated with pathogen spores. Remove any excess material with scouring pads or steel wool.

f. Scorch tools with the smoker's heat or propane torch.

g. Disinfect smoker surfaces that have come in contact with honey or propolis by scorching the wooden surface of the bellows, where handled. For smokers with plastic or wooden bellows, wrap duct tape, where handled. Peel back the duct tape to remove the contaminated surface, but seal in a plastic bag for disposal.

4. Disposal

a. Burn or dispose of used personal protective gear and broken tools in a municipal landfill. Broken metal tools may also be recycled but should be disinfected first.

Record Keeping

Record keeping for personal sanitation may be used to demonstrate recommended management practices to staff.

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

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

Well-designed facilities with adequate climate control will protect bee health in storage, and prevent degradation of production inputs such as treatment products. Storage with sufficiently controlled cold or heat may also be used to effectively treat equipment.

Facilities include

- indoor wintering and other facilities where bees are stored when received into the operation.
- buildings used for honey extraction or wax rendering.
- storage facilities for bee production inputs, including feed and treatment products.
- storage facilities for products such as nuisance pest repellents or poisons and other pesticides (not used for bee treatment), cleaning agents, petroleum products, and lubricants.

- storage for unused bee equipment, tools, hive wraps.
- storage of bee products and packaging material.
- hive-equipment repair shop.
- garages for housing transportation equipment.

Facilities management extends to building exteriors and loading areas.

The Risks

Refer to section 2.7 for 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 low relative to direct contact with hive equipment, other risks, such as the following, may be mitigated by carefully considered facility design:

- Bees in storage may experience considerable distress from storage pests, rodents, movement disturbance, lack of ventilation, and overheating, making them more vulnerable to biosecurity risks.
- Stored treatment products may be degraded by high temperatures and light exposure, reducing efficacy and possibly leading to treatment resistance.
- Inadequate ability to physically segregate infected or infested bees, contaminated hive equipment, tools or other materials, present a risk of more rapid spread throughout the operation.

Producer Benefits

Facilities designed with biosecurity in mind benefit the beekeeper by

- preventing entry of storage and nuisance pests that can cause damage to hive equipment and rob or degrade bee products, resulting in economic loss.
- protecting bee health when wintered indoors, due to unfavourable temperature and humid conditions, storage pests (e.g. robber insects, wax moths) and nuisance pests such as mice.
- reducing the chance of exposure to bee pests being brought in by storage and nuisance pests.
- containing and controlling pests if brought in on purchased bees, with infested or infected colonies from the field, or with honey supers (e.g. wax moth control with cold storage).
- preventing the degradation of treatment products.
- improving treatment efficacy and reduced chance of resistance development.
- easing the cleaning and disinfecting of facilities.
- easing the performing of inspections and in administering treatments.

Recommended Practices

1. Building Design

a. Pave loading areas.

b. Grade and drain roadways and pathways.

c. Install spring-loaded, self-closing doors.

d. 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 (i.e. scrapings or dead bees) that cannot be easily removed.

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

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

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

h. Ensure that the indoor wintering facility is large enough to prevent crowding, promote air circulation, and minimize the requirement for moving hives in storage. Hives may be off-set or staggered when stacked to allow for indoor winter feeding, if necessary.

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

2. Surface Materials

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

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.

Install sealed concrete floors, as honey is acidic and can break down concrete.

i. Provide grade floors that prevent water from pooling, and slope to facilitate drainage.
ii. Avoid packed dirt floors.
iii. Avoid unfinished wooden surfaces.
iv. Use a perimeter moulding where the floor and walls meet, and seal all gaps. Finish corners to prevent buildup of debris.
v. Use plastic or vapour barrier to cover floors and walls during storage of live bees in winter.

3. Ensure facilities are bee tight, and to the extent possible, insect and rodent proof

a. Provide a one-way exit or method to remove bees in the unloading area and to allow bees that are trapped in recently removed supers a means of escape.

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

c. Screen windows and provide bee-escapes.

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

e. Set out collection hives near entry points to discourage field bees from clustering in the buildings.

4. Provide Appropriate Temperature-Controlled Storage

a. Follow storage requirements for products, if indicated on the label. In some cases, a refrigerator, ventilation and air conditioning (e.g. honey bee medication), or a freezer (e.g. pollen patties) are necessary.

b. Maintain indoor bee wintering facilities at 4°C–7°C.

c. Avoid exposing bee feed to excessive heat.

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

5. Ensure Adequate Ventilation and Air Circulation in Indoor Wintering Facilities

a. Stack hives in rows perpendicular to the air duct, with rows spaced about 1 m apart to facilitate air movement.

b. Use a perforated polypropylene air duct or fan to ensure that the air in the room mixes evenly.

c. Require an efficient air exchange system to remove heat, water vapour, and carbon dioxide generated by bees in winter storage.

d. Ensure that screens and filters can be easily removed for cleaning.

e. Ensure that areas where bees are stored receive clean air that is not recycled from areas where pesticides or other toxic materials are stored or where fumigants are applied.

f. Have a constant flow of air, in addition to an intermittent air flow at higher rates.

g. Install back-up power systems.

6. Lighting

a. Exclude as much light as possible in the indoor wintering facility to suppress bee activity. Use red light bulbs and light traps around air intake fans.

b. Provide adequate lighting to enable inspections and other maintenance tasks in all facilities. When bees are stored indoors, minimize disturbance. Use flashlights.

c. Use dark surfaces in areas where bees are stored overwinter.

d. Ensure that there are no cracks where light may enter the facility. Close the door in the dark with enough time for vision to adjust and to detect any light entering the building.

7. **Segregation**
   - **a.** Provide segregated storage by using separate buildings, separate rooms with doors that are sealed when shut, or by using plastic curtains.
   - **b.** Ideally… provide segregated storage areas
     - i. to receive purchased bees.
     - ii. for indoor wintering; have segregated storage for infected, infested, or suspect colonies.
     - iii. for honey supers from healthy colonies separated from those brought in from diseased hives or those from other beekeepers if doing custom extraction.
     - iv. for products that could be potently toxic to bees or could contaminate bee feed.
     - v. for tools and equipment brought into the facility that requires disinfection.
     - vi. for storing and repairing used hive equipment.
8. **Cleaning and Waste Disposal**
   - **a.** Have an adequate water supply for pressure washing and a liquid disposal system.
   - **b.** Provide leak-, insect-, and rodent-proof garbage containers with plastic liners.
   - **c.** Regularly dispose of any buildup of dead bees or insect pests. Use a squeegee on a smooth floor to minimize distributing allergens into the air. Use a respirator. Store all dead bees in garbage bags or sealed containers.

Record Keeping

Record keeping for facilities design should describe the types of material used in the construction of the building.

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

Target Outcome

Beekeepers implement a sanitation and maintenance program for all premises, buildings, vehicles, and other equipment.

Description

Pests that survive on premises, buildings, vehicles, and other equipment can directly spread to bees. Buildings and equipment can also provide shelter to unwanted bees, and these bees can spread pests within the beekeeping operation (section 1.3).

Managing, cleaning, disinfecting, and maintaining premises, buildings, vehicles, and other equipment (i.e. equipment used for moving hives, extraction and wax rendering) in a manner that prevents or removes pests, and unwanted bees will reduce this biosecurity risk. Cleaning areas are designated for moveable equipment and vehicles.

Maintaining building systems (e.g. ventilation, temperature, humidity control, and lighting) will help to protect bee health in storage.

The Risks

Pathogens can survive on wood and metal surfaces, and in carrier substances such as feed or water. If diseased bees are handled by vehicles and equipment, and then subsequently used to handle healthy bees, there is a risk that pathogen can spread. Other pests and parasites can survive on equipment, buildings, and unused bee equipment, though some for only short periods of time.

Table 5 presents examples of the interaction of disease parasites and pests with buildings and equipment.

TABLE 5 Parasite and pest risk to buildings and equipment

Site or surface	Risks
Apiaries and Yards	Variable: A significant risk is presented by abandoned bee equipment contaminated with AFB. This risk is low to moderate for other pests; however, unwanted infected bees and pests may nest in this equipment and spread the biosecurity risk to healthy bees where co-mixing opportunities exist.
Wintering and other storage facilities	Moderate. Healthy bees may be exposed to infection from dead bees, or spores present on the surfaces of equipment or facilities. Buildings can provide nesting areas for pests and infected bees.
Honey extraction/wax rendering buildings	Moderate. Honey spills can attract infected bees and other pests. Healthy bees may be exposed to infection from dead bees, or spores present on the surfaces of processing equipment or facilities. Buildings can provide nesting areas for pests and infected bees.
Honey extraction/wax rendering equipment	Variable: Risk is high for AFB or if rental/shared equipment has not been disinfected between uses.
General storage and other buildings	Moderate: Buildings can provide nesting areas for pests and infected bees.
Transport vehicles and forklifts	Moderate: Pests can survive for varying lengths of time on transportation equipment surfaces, in netting, on pallets, in bee feces, and on honey spills.

AFB = American foulbrood

Producer Benefits

There are benefits of enhanced biosecurity management in maintaining premises, buildings, vehicles, and other equipment:

- reduced risk of exposure, introduction, and spread of pests;
- reduction in time and money on treatments;
- possible compliance with some CFIA regulatory requirements for honey extraction facilities. For additional information, refer to the CFIA website
- compliance that may also meet some provincial requirements for field entry.

Recommended Practices

1. **Premises and apiary maintenance**
   - **a.** Remove unused bee equipment and other equipment that could make homes for pests and bees from those areas where bees are kept. This includes old vehicles, shelters, and farm equipment:
     - i. Inspect new apiary sites and bee yards before placing bees, and remove any unused equipment, and, where possible, any structures that could be used as pest or bee housing.
     - ii. Alternatively, set out bait hives and test those bees before (re)introducing to your operation.
     - iii. Keep premises and areas around honey house, wax-rendering facilities, and bee wintering facilities free of unused bee equipment.
     - iv. Refer to AFB management for handling and removing used or abandoned AFB-contaminated equipment.

2. **Sanitation of buildings and equipment**
   - **a.** Clean and disinfect building and equipment to remove pests:
     - i. After and before transporting bees, ensure that the deck of the vehicle is free of debris and dead bees. Remove netting by hand and sweep off the deck. Ensure that the debris is discarded in the trash and either burned or brought to a municipal landfill.
     - ii. After and before transporting bees, ensure that all honey spills are cleaned up. Scrape off spilled honey discard, and clean the surface area of the spill with water.
     - iii. Inspect all equipment (forklifts) that is used to handle bees and bee equipment to ensure that it is free of honey and debris.
     - iv. When handling bees and bee equipment that are known to have been in contact with pests, take extra precaution to clean and disinfect the surfaces of the vehicles and equipment before handling other bees or bee equipment.
     - v. Keep premises and areas around honey house, wax-rendering facilities, and bee-wintering facilities free of unused bee equipment.
     - vi. Know the disease history, if purchasing or renting used extraction or wax-rendering equipment. Clean and disinfect before use.

vii. Be aware that, ideally, all beekeepers have their own extraction equipment.

viii. Refer to AFB management for handling and removing AFB-contaminated equipment.

ix. Thoroughly clean indoor wintering facilities after bees are removed from the building in the spring. Remove dead bees, sweep floors where possible, and power wash the floors, walls, and ceilings that can be cleaned.

x. Clean honey spills daily in the honey extraction building. Scrape off honey, and use hot water and vinegar to aid in cleaning. Be aware that the use of other chemicals inside the extraction building represents a food safety concern, and thus follow CFIA regulations when considering detergents or chemicals.

3. **Clean and Disinfect building and equipment**

   a. If vehicles, equipment, or buildings have been used to handle, or house bees or bee equipment contaminated with persistent diseases such as AFB, clean and disinfect surfaces using recommended methods. Refer to Appendix F for more information.

4. **Maintenance of buildings**

   a. Ensure that buildings are kept in optimal condition:

      i. Once a year, check that any buildings are bee tight, and that openings to rodents and other pests are sealed.

      ii. Provide daily monitoring of any indoor wintering facilities to ensure that ventilation systems are functioning properly, maintaining adequate air quality including temperature, carbon dioxide, and moisture.

5. **Maintenance of a designated cleaning area for vehicles and equipment**

   a. Clean vehicles and portable equipment at designated cleaning areas, and handle waste water appropriately:

      i. Carry out cleaning of vehicles and equipment in locations away from where bees are kept.

      ii. Contain or divert drainage of waste water away from where bees are kept.

      iii. Ensure that there is no standing water accessible by foraging bees.

      iv. Power wash, if possible, the designated cleaning area after cleaning contaminated equipment and vehicles.

Record Keeping

A record of cleaning and maintenance includes the following logs:

1. **repairs made to buildings (electronic or hand-written);**

2. **building, equipment, and vehicle cleaning and disinfection (electronic or hand-written); and**

3. **the monitoring of indoor wintering facilities (electronic or hand-written), including notes and/or readings (temperature, moisture, carbon dioxide).**

2.8 Control of Weeds and Nuisance Pests

Target Outcomes

Beekeepers implement an integrated management program for weeds and nuisance pests.

Description

An **integrated management program** utilizes monitoring techniques, as well as weed and nuisance pest-appropriate cultural, mechanical, physical, biological, and chemical controls. Weed and nuisance pest management protects the colonies from attack and the hive equipment from damage, and facilitates beekeeper access to the colonies for inspection and management.

The Risks

Weeds growing in and around the apiary or around facilities can

- provide nesting sites for nuisance pests and robber bees.
- serve as a way in to the hive for insect pests.
- obstruct entrances to hives and inhibit bee foraging.
- hold moisture that can deteriorate the base of the hive equipment or promote colony diseases such as chalkbrood that thrive in high humidity conditions.
- short-circuit electric fences meant to keep out predators.
- obstruct the beekeeper from performing routine inspections and managing the colonies.

Nuisance pests may

- disturb the colony.
- damage the hive, comb, or winter wraps.
- nest in or near the hive.
- deplete the bee populous by consuming adult bees and brood.
- rob food stores.
- cause the bees to behave aggressively.
- generally result in a weakened colony that is more vulnerable to bee pests.
- spread pathogens or other pests and may be a threat to colonies in both the bee yard and indoor overwintering facilities.

Bears pose a great threat to honey bee colonies and can destroy an entire bee yard in their quest for food.

Rodents, including mice, shrews, and voles present a risk especially during the fall and winter months, whether in the field or in an indoor wintering facility. Rodent urine is partially repellent and will not be cleaned out by the bees in the spring. Rodent problems are more likely to occur in apiaries located near woodlots or in fields.

Skunks and raccoons scratch at hive entrances at night (when bees are less likely to sting) and feed on the bees when they come out to defend the colony. This feeding activity is more common in spring.

Insectivorous birds, such as blue jays, can be a severe problem in queen-rearing operations. Woodpeckers can damage hive equipment.

Amphibians and reptiles will also eat honey bees, but they are not considered serious pests.

Insect pests include predatory wasps and ants. Ants may nest inside or beneath the hive and are a more serious nuisance in heavily wooded or sandy soil areas. Carpenter ants may cause structural damage to hive parts, especially bottom boards.

Farm livestock (e.g. cattle) and pets generally present a minor risk, unless the apiary is in a highly populated area. Livestock may aid in weed suppression in the apiary.

Humans, although perhaps not technically, are a biosecurity risk in that they may vandalize the apiary or steal honey or equipment.

Producer Benefits

Deterring and controlling nuisance pests benefits beekeepers by

- reduced financial losses from hive damage, and bee and honey losses.
- reduced time spent on equipment repair and replacement.
- less aggressive, and easier to manage bees.
- easier access to hive equipment in the apiary.
- bees that can better cope with serious pest biosecurity risks.
- reduced chance of introducing and spreading pests.

Recommended Practices

1. Monitoring

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

a. toppled hives and obvious disturbance, damage to, or theft of, hive equipment.

b. disturbance to surrounding vegetation.

c. holes dug in front of hive entrances.

d. scratches at hive entrances.

e. dirt on entrance boards.

f. entrance reducers removed.

g. chewed comb.

h. bee parts and animal scat visible on the ground near the entrance.

i. bear or cattle hair caught on barbed-wire fencing.

j. damage to winter wrapping material.

k. evidence of nesting in wrapping material.

l. agitated, aggressive, and weakened colonies.

2. General Management

a. Keep facilities, apiaries, and their surrounding areas free of broken frames, comb, garbage, and other attractants.

b. Feed bees in leak-proof unexposed feeders, and avoid feed spills.

c. Avoid honey spills and avoid placing honey supers on the ground when removing from the hive.

d. 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.

e. Move bees to a new location.

3. Weed Management

a. Mowing around the apiary is effective but may cause some disturbance to bees. If herbicides are used, apply products that are safe for use around bee yards; avoid application when bees are flying or when weeds are in bloom, and follow product labels. Check with the landowner before applying herbicides.

b. Relocate the hives every few years. Colony debris is a good source of fertilizer for weeds and can promote weed growth.

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

4. Bear (and Cattle) Management

a. Carefully select the apiary site to avoid the home ranges of bears and wildlife corridors, such as bush along forest edges, ravines, and stream beds.

b. Know that the best defence against both bears and cattle is to install a permanent, baited, electric fence around the bee yard before bears have discovered the site:

i. Be aware that temporary electric fences may be set up in some circumstances.

ii. Consider a solar-powered energy source for the fence.

iii. Establish the apiary away from trees, which will prevent bears from climbing and dropping inside the fence.

iv. Keep vegetation controlled under, around, and above the fence to prevent it from shorting out.

v. Obtain detailed information about bear fences from the provincial apiculturist's office or wildlife management office.

c. Trapping and shooting bears is another alternative if deterrent methods are unsuccessful. Contact the provincial wildlife office for information and regulations.

5. Rodent Management

a. For outdoor overwintered colonies,

i. chase away mice already in the hive, and destroy nests.

ii. replace chewed frames, because bees will replace destroyed worker cells with drone cells.

iii. install an entrance reducer at the lower hive entrance in early fall. Provide ventilation if the entrances get blocked by debris that the bees are unable to easily remove.

iv. place poisoned grain or commercial rodent bait on inner covers, with the feeder holes blocked, below the insulation, and underneath hives. Ensure that excess bait is removed when hives are unwrapped in the spring and before bees start flying.

b. For colonies in winter storage,

i. ensure the storage facility is rodent-proof.

ii. use rodent management measures such as traps, commercial poison bait stations, and cats.

iii. close off stacks of supers, above and below, with a queen excluder, wire screen, or tight-fitting telescoping lid.

iv. place rodent bait on the floor or on the bottom pallet. Avoid placing bait between hive stacks, as chewed bits can fall into the frames.

c. Wash rodent urine from the interior surfaces of wooden ware with water.

d. Identify the placement of bait stations on a facilities' map, and inspect regularly.

6. Skunk and Raccoon Management

a. Staple a piece of chicken wire or screening to the bottom board, and stretching in front of the hive and around the winter wrap to discourage skunks and other animals from scratching at entrances. A board with many sharp nails pointing upwards or toothed grips used by carpet layers may also be installed at hive entrances.

b. For small apiaries, install a wire mesh or short garden fence, extended into the ground to prevent skunks from burrowing under.

c. Add an upper entrance to the hive, and keep colonies on stands.

d. Be aware that trapping and shooting skunks is another alternative, if deterrent methods are unsuccessful. Contact the provincial wildlife office for information and regulations.

7. Wasp Management

a. Remove material from around the apiary that could act as wasp-nesting sites.

b. Locate wasps by following their flight and remove wasp nests.

c. Consider screens, traps, or entrance reducers.

d. Apply insecticides to wasp nests with extreme caution to avoid exposure to bees.

e. Use flyswatters.

f. Ensure bee- (and wasp) tight facilities with escapes in windows.

g. Avoid using insecticide strips in facilities.

8. Ant Management

a. Keep the area around colonies free of the accumulation of grass, brush, and dead wood that could act as nesting sites or "bridges" into the hive.

b. Systematically search for the ant nests around the apiary and destroy (e.g. by burning).

c. Pour boiling water into the nest on a warm, sunny day.

d. Protect colonies from ants and products applied to the ground to manage ants by placing hives on stands with the legs set in water or cans filled with vegetable oil.

e. Ensure bottom boards are sound. Bees and comb must not come into contact with treatments.

9. Vandalism and Theft

a. Locate the apiary so that it is not easily visible from a secluded road.

b. If possible, locate apiary where it can be easily observed by the beekeeper or neighbours.

c. Notify the police.

d. Use a guard dog.

e. Consider installing a surveillance camera.

f. Brand or mark equipment, or install microchips in hives.

Record Keeping

1. **Maintain a list or map of facilities that require regular attention.**
2. **Maintain an inventory of nuisance pest control products.**
3. **Record observances of nuisance pest damage by date and apiary.**
4. **Record any chemical treatments or cultural controls by date, who administered, and why.**
5. **Record locations and the monitoring schedule of bait traps.**

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

Staff includes all those who work in the beekeeping operation, consisting of 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 honey bee biosecurity.

Standard operating procedures (SOPs) are developed for the beekeeping operation. These are written (and illustrated) step-by-step explanations of how to perform a specific task from beginning to end. A beekeeper may develop SOPs for some specific tasks that have a high biosecurity benefit.

The Risks

The risks associated with not developing SOPs or providing training are as follows:

- exposure and/or spread of pests to healthy bees;
- missed or delayed diagnosis of a pest, resulting in economic loss;
- wrong diagnosis of a pest, resulting in unnecessary treatment;
- errors in administering treatments that could reduce efficacy or be toxic to bees; and
- risks to staff health and safety when administering treatments to address biosecurity risks.

Producer Benefits

Someone who is properly trained will adopt biosecurity procedures as routine and provide suggestions for improvement.

Consulting with and involving staff in its development and revision results in a more effective biosecurity plan – one that has biosecurity more easily integrated into daily tasks.

Having documented SOPs and trained staff can benefit the beekeeping operation through

- improved prevention (exposure, spread, and bee susceptibility reduction);
- earlier detection of biosecurity risks;
- reduced need (and cost) for increased monitoring, management, and treatments;
- reduced risk of errors when administering treatments;
- worker health and safety; and
- improved traceback ability.

Recommended Practices

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

- joining their local beekeeping association.
- accessing resources that are available through
  - — their provincial government (Refer to Appendix A for provincial contact list.);
  - — federal government (Refer to Appendix B additional resources);
  - — the Canadian Honey Council (CHC); and
  - — the Canadian Association of Professional Apiculturists (CAPA).

1. Standard Operating Procedures

SOPs may be developed and should be reviewed at least annually for the following processes:

a. monitoring and sampling procedures (standard and elevated frequency, and sampling percentage)

b. action to take if a new or high risk pest is observed during regular beekeeping activities

c. reporting

d. immediate action to prevent spread (e.g. sanitation)

e. quarantine protocol

f. AFB disposal and disinfection (bees, equipment, tools, etc.)

g. prevention methods

h. treatment administration

i. record keeping

j. 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 those working within the operation should have a general understanding of the purpose, principles, and processes of biosecurity.

Biosecurity training should include

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

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. signs of exposure to pest susceptibility factors that may mimic disease caused by a pest.
v. environmental or other conditions that promote or impede spread of the biosecurity risk.
vi. compounding effects of multiple biosecurity risks and bee susceptibility factors.
vii. potential impact on bees and honey production.
viii. recognition of brood comb.

c. monitoring procedures and signs to look for while performing regular duties, and the triggers to report. The senior beekeeper should be trained in advanced monitoring and sampling procedures (e.g. determining parasite counts, sampling for laboratory analysis) and know when to trigger implementation of standard and elevated response plans.

d. recommended practices to prevent the spread of pests while performing regular duties:

i. personal sanitation;
ii. routine handling, maintenance, sanitation, and disposal of production inputs, equipment, facilities, and dead bees;
iii. procedures for introducing, handling, situating, and moving live bees; and
iv. cultural controls.

e. treatment application methods:

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

f. current regulations governing registration, bee purchase, sale and movement permits, notification, and treatments.

g. key contacts such as bee authorities, experts, diagnostic laboratories, and irradiation services. Training should include knowledge of when and how to contact these resources.

h. record-keeping requirements within the operation.

i. a system of identifying and marking hive boxes or other equipment.

3. Timing and Frequency of Training

Staff are

a. trained when first employed.

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

A hands-on, competency-based supervised training program is generally considered more effective than a theoretical program or self-study delivery. 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. attending demonstrations, seminars, or workshops offered by the provincial government, beekeeping associations, private organizations, etc.;

d. formal qualifications, for example completion of a master beekeeper course, veterinary training, pesticide applicator certification course, attending college or university programs, and correspondence courses; and

e. self-study.

5. Support Materials

To improve comprehension, training and support materials are illustrated, well-organized, and written in simple (non-scientific) language. Also, training and support materials are translated, as applicable; for example, French to English, English to French, and English to Spanish. Examples of support materials for use in training may include:

a. the 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, report forms);

h. memo postings and emails;

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

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

Record Keeping

A record of training should be kept for each worker.

Examples of records:

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

Provincial Contact Information

Visit your provincial government website, or call your provincial apiarist or bee-regulating authority

- for current pest management and treatment recommendations, factsheets and advice.
- for current registration and regulation information (e.g. provincial apiary or Bee Act).
- to report a biosecurity risk or suspected pesticide poisoning of bees.
- for information on diagnostic and inspection services, and voluntary monitoring programs.

Province	Department	Website	Phone #
British Columbia	Ministry of Agriculture	www.gov.bc.ca BCA Apiculture Home Page: www.agf.gov.bc.ca/apiculture/	(604) 556-3129 or 1-888-221-7141
Alberta	Agriculture and Rural Development	www.gov.ab.ca ARD Apiculture home page	(780) 415-2314 or 310-0000
Saskatchewan	Agriculture	www.gov.sk.ca	(306) 953-2304
Manitoba	Agriculture, Food and Rural Initiatives	www.gov.mb.ca	(204) 945-4825 or (204) 945-3861
Ontario	Ministry of Agriculture, Food and Rural Affairs	www.omafra.gov.on.ca OMAFRA Apiculture home page	(519) 826-3595
Quebec	Le ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec	www.mapaq.gouv.qc.ca MAPAQ Apiculture home page	(418)380-2100
New Brunswick	Agriculture, Aquaculture and Fisheries	http://www.gnb.ca/	(506)453-2666
Nova Scotia	Agriculture	http://novascotia.ca/	(902) 679-8998
Prince Edward Island	Agriculture and Forestry	http://www.gov.pe.ca/	(902) 314-0816
Newfoundland and Labrador	Natural Resources	http://www.gov.nl.ca/	(709) 637-2046

Additional Resources

1. Canadian Honey Council (CHC) – National Office

36 High Vale Crescent, Sherwood Park, AB T8A 5J7

Telephone: 1-877-356-8935 or 1-780-570-5930

The Canadian Honey Council is the national association of beekeepers, representing 7000 apiculturists across Canada. The CHC provides a forum where producers, packers, professionals, provincial associations, and officials from different levels of government can discuss and recommend action in the best interests of Canada's honey bee industry.

Contact or Visit the CHC website for information and links to the following:

a. newsletters

b. provincial Beekeeping Associations

c. federal and provincial government contacts

d. education and beekeeping courses

e. suppliers

f. the Canadian Bee Industry Safety Quality and Traceability (C-BISQT) on-farm food safety program, developed by the CHC with information on production practices, on-farm food safety, and honey house design.

g. integrated pest management (IPM) monitoring and treatment calendar with listing of diagnostic laboratories and testing facilities

h. Canadian Association of Professional Apiculturists (CAPA)

L'Association Canadienne des Professionels de l'Apiculture

PO Box 373, Aylesford, NS B0P 1C0

CAPA members study, educate, and administrate in the fields of apiculture and pollination. They engage in diverse pursuits, including

- regulatory aspects associated with management of honey bees
- research into the secrets of bee and pollination biology
- inspection of commercial bee colonies for diseases and pests
- collection of statistics on provincial and federal honey and wax production

- inspection of commercial honey and wax for purity
- conservation initiatives to encourage wild species of bees
- development of cost-effective methods for the sustainable management of commercial bees

CAPA publications:

a. Scott-Dupree C. (Editorial Chair) Honey Bee Diseases and Pests, 2nd English Edition and 3rd French Edition, Revised, Canadian Association of Professional Apiculturists.

b. Scott-Dupree C. A Guide to Managing Bees for Crop Pollination. Available: www.capabees.com/main/files/pdf/CAPAcroppollination.pdf.

c. CAPA Apicultural Reading List.

2. NSERC-Canpolin, Canadian Pollination Initiative, University of Guelph

NSERC-CANPOLIN is a five-year NSERC strategic network that is addressing the growing problem of pollinator decline in agricultural and natural ecosystems in Canada. NSERC-CANPOLIN offers an exciting and unique approach to pollination research. For the first time, leading experts in entomology, ecology, plant-reproductive biology, genomics, prediction, and economics have joined forces to explore the full scope of the pollination problem – from pollinator health and conservation to the gene flow in plants, the impact of climate change, and the economics of pollination.

3. Canadian Beekeeping Manuals

a. Gruszka John (editor). Beekeeping in Western Canada. Alberta Agriculture and Rural Development, 1998, Edmonton, Alberta. Available: www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex38.

b. Skinner Alison J, Tam Janet J, Bannister Rachel M. Ontario Beekeeping Manual. 2011 Edition. Ontario Beekeepers Association Technology Transfer Program. Available: http://www.ontariobee.com/index.php?action=display&cat=61&v=177.

c. Skinner, Alison J., Tam, Janet J., Bannister, Rachel M. "Ontario Queen Rearing Manual" 2011 Edition, Ontario Beekeepers Association Technology Transfer Program. Available: http://www.ontariobee.com/index.php?action=display&cat=61&v=177.

d. Gestion optimale du rucher. 2e edition, Centre de référence en agriculture et agroalimentaire du Québec (CRAAQ). Available: www.craaq.qc.ca/Publications-du-CRAAQ/gestion-optimale-du-rucher-2e-edition/p/PAPI0103.

4. Training and Extension

a. Ontario Beekeepers Association, Technology Transfer Program

Orchard Park Centre, Suite B47, 5420 Highway 6 North, Guelph, Ontario, Canada N1H 6J2

b. Commercial Beekeeping – Certificate Program

A new certificate program at Grande Prairie Regional College (GPRC) Fairview will be the first beekeeping vocational program in Canada for the education and training of commercial beekeepers.

c. See also CHC website for links to local beekeeping courses.

5. Federal Government

a. Canadian Food Inspection Agency

i. For bee industry information follow paths from Animals>Terrestrial Animal Health to:

- Biosecurity – select Bees
- Diseases – select Reportable Diseases, Immediately Notifiable, and Annually Notifiable Diseases
- Imports > Policies > Animal Products and By-Products >Bee Products

ii. Links to the *Health of Animals Act and Regulations* are found on the CFIA website.

b. Health Canada

Pest Management Regulatory Agency (PMRA)

Report a Pesticide Incident

c. Public Works and Government Services Canada

Organic Production Systems: General Principles and Management Standards

CAN/CGSB-32.310-2006. Amended October 2008, December 2009 and June 2011.

Honey Bee Operating Steps

Figure 1: Spring Management

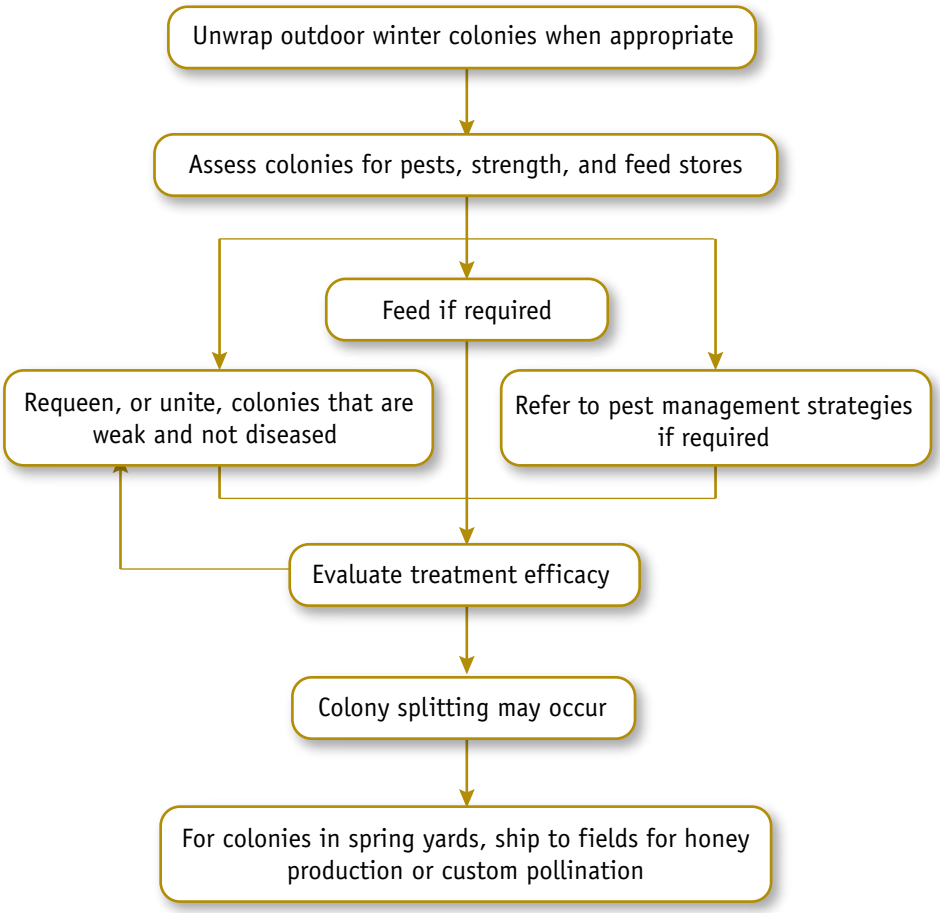


Figure 2: Summer Management for Honey Production

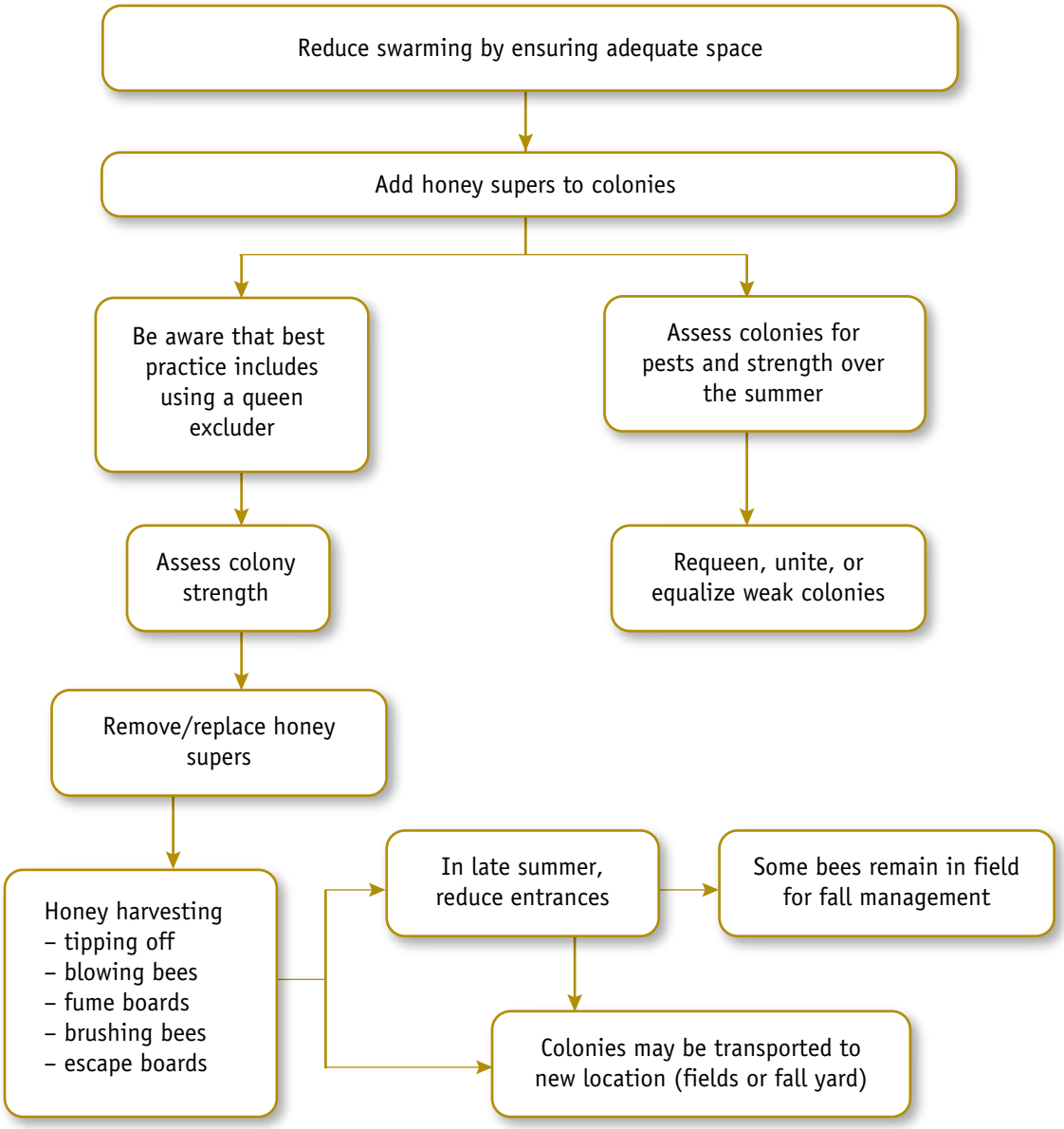


Figure 3: Fall Management

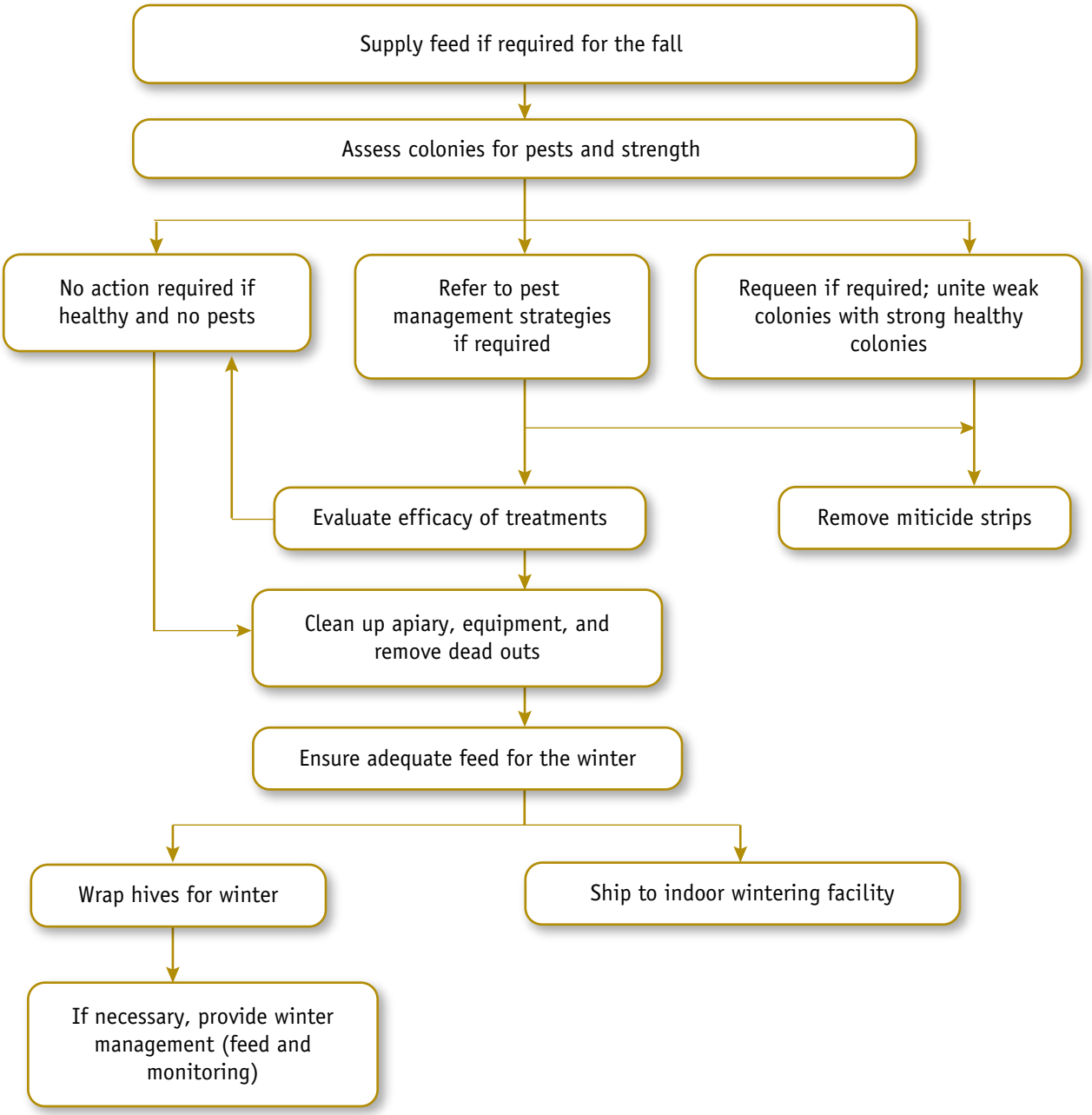


Figure 4: Wintering Indoors

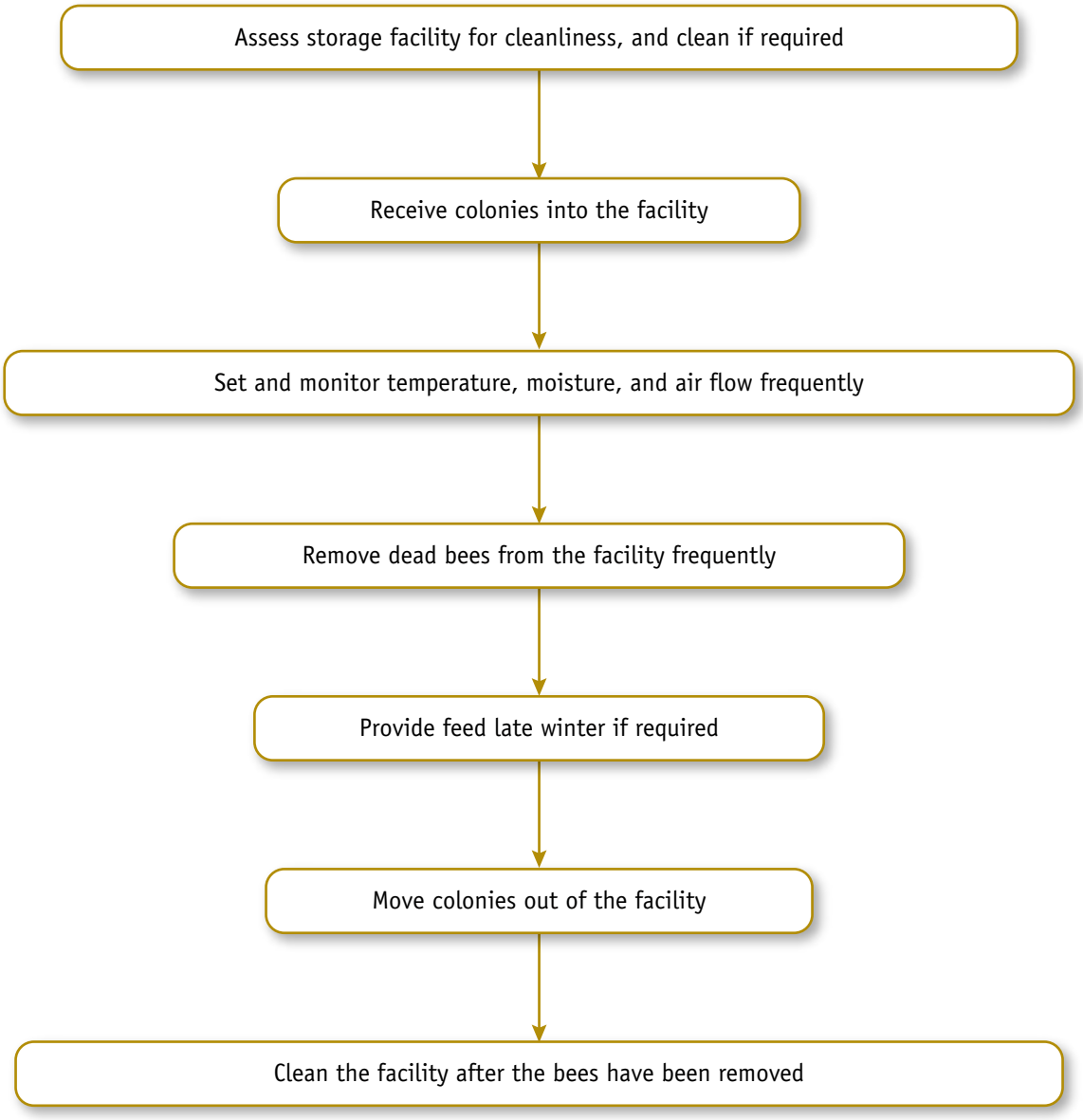


Figure 5: Requeening

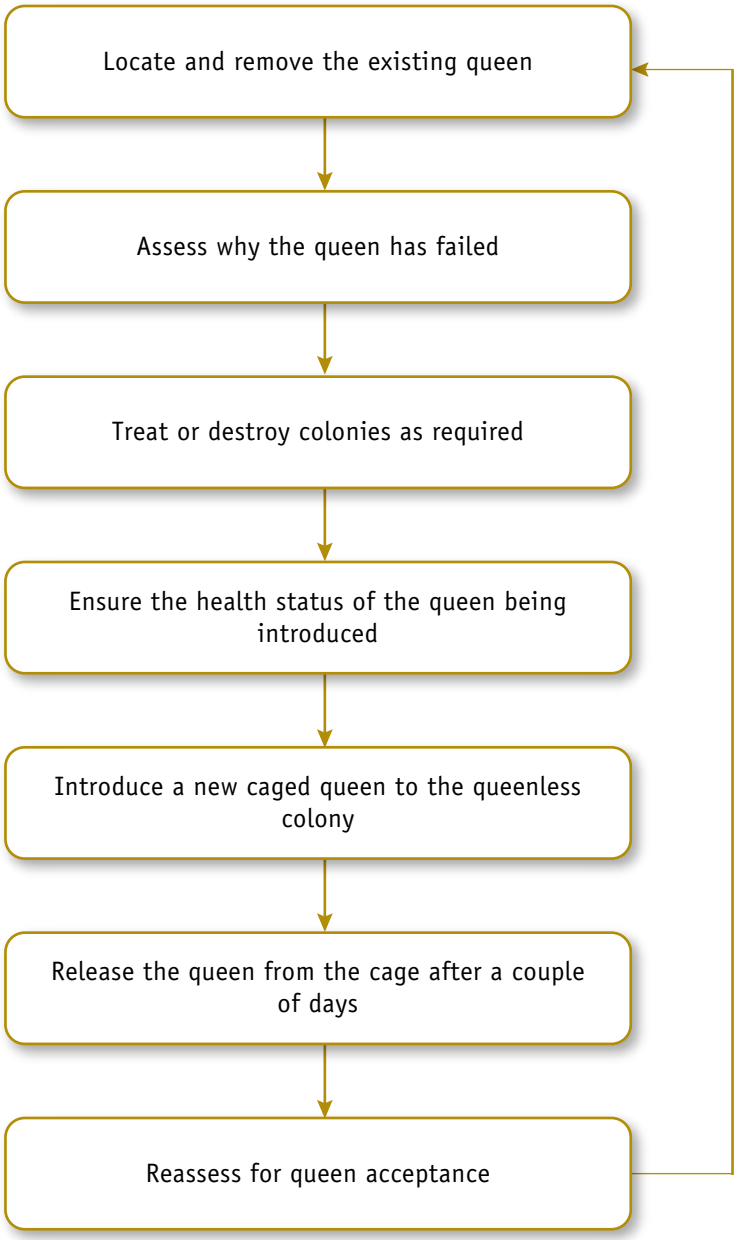


Figure 6: Uniting or Equalizing a Colony

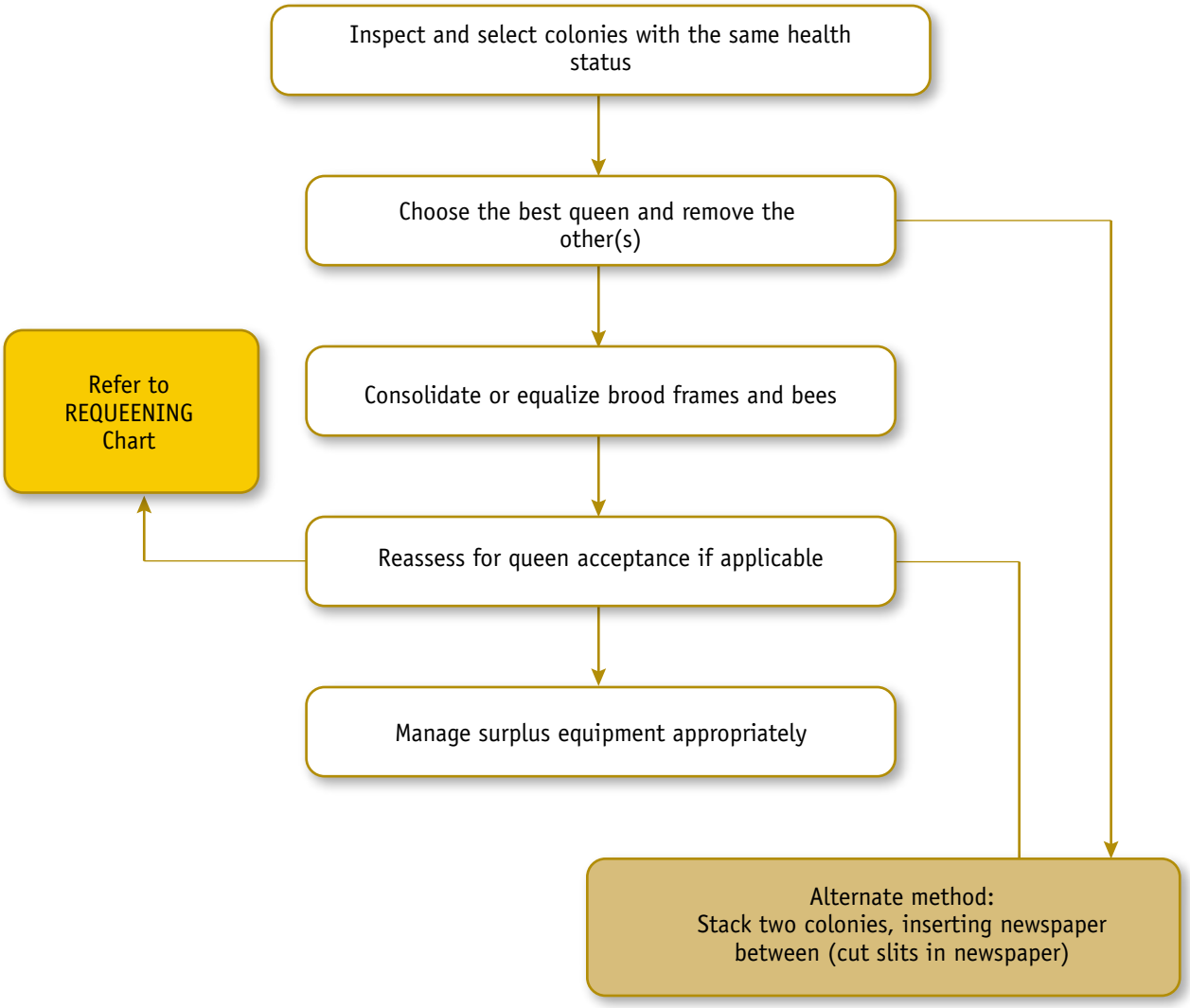


Figure 7: Splitting a Colony

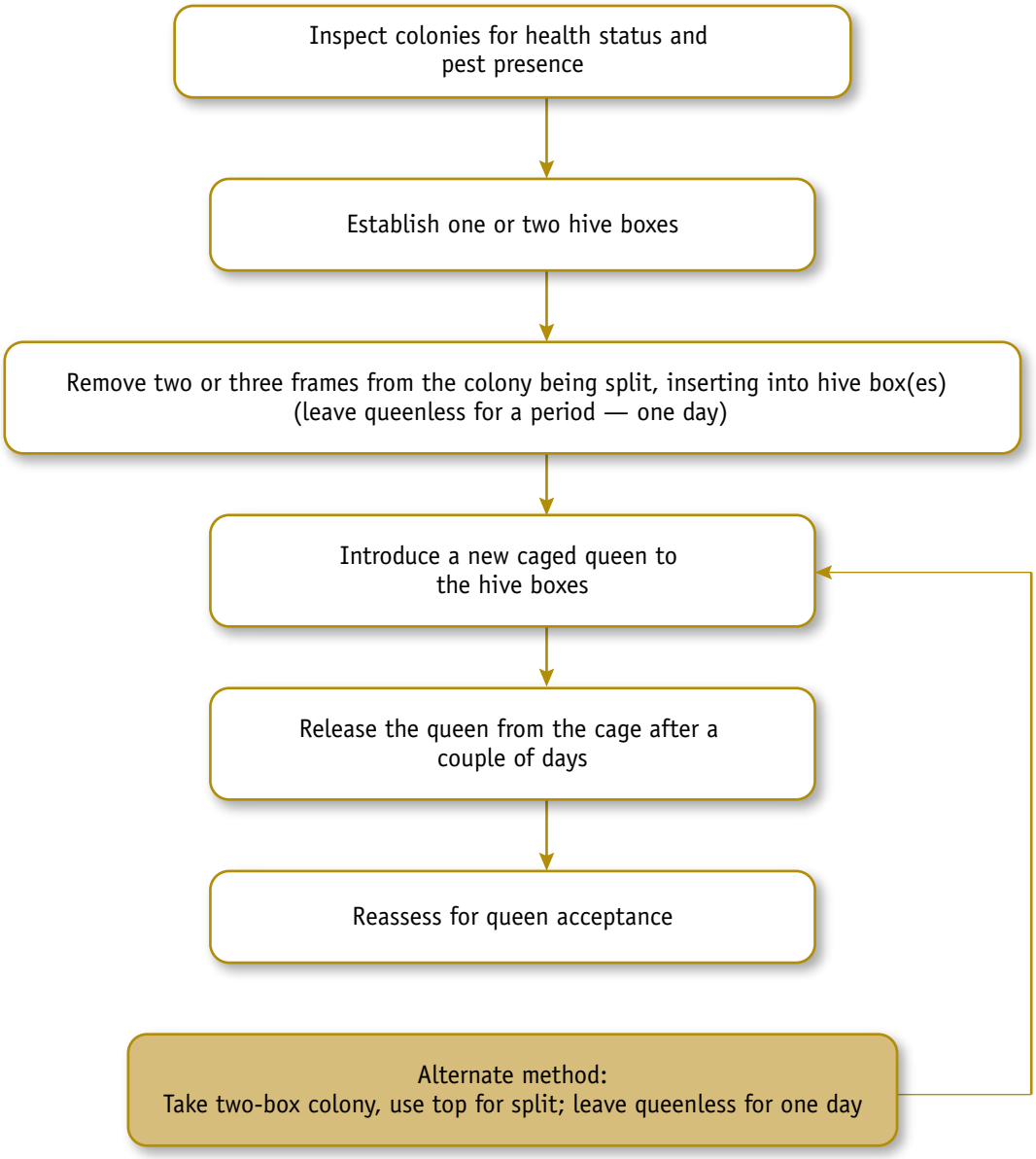


Figure 8: Honey Extraction

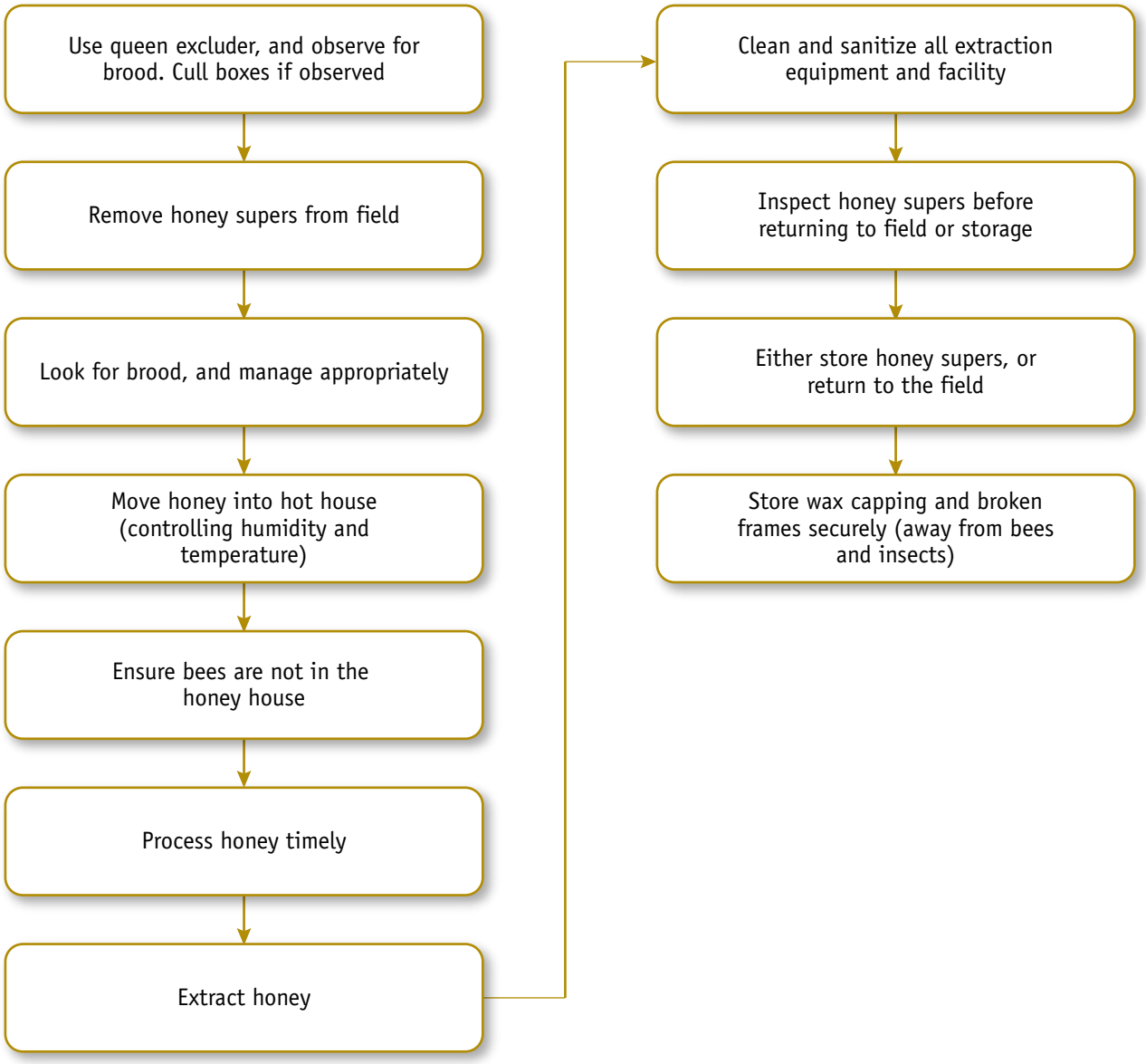


Figure 9: Transporting Bees and Equipment (Forked)

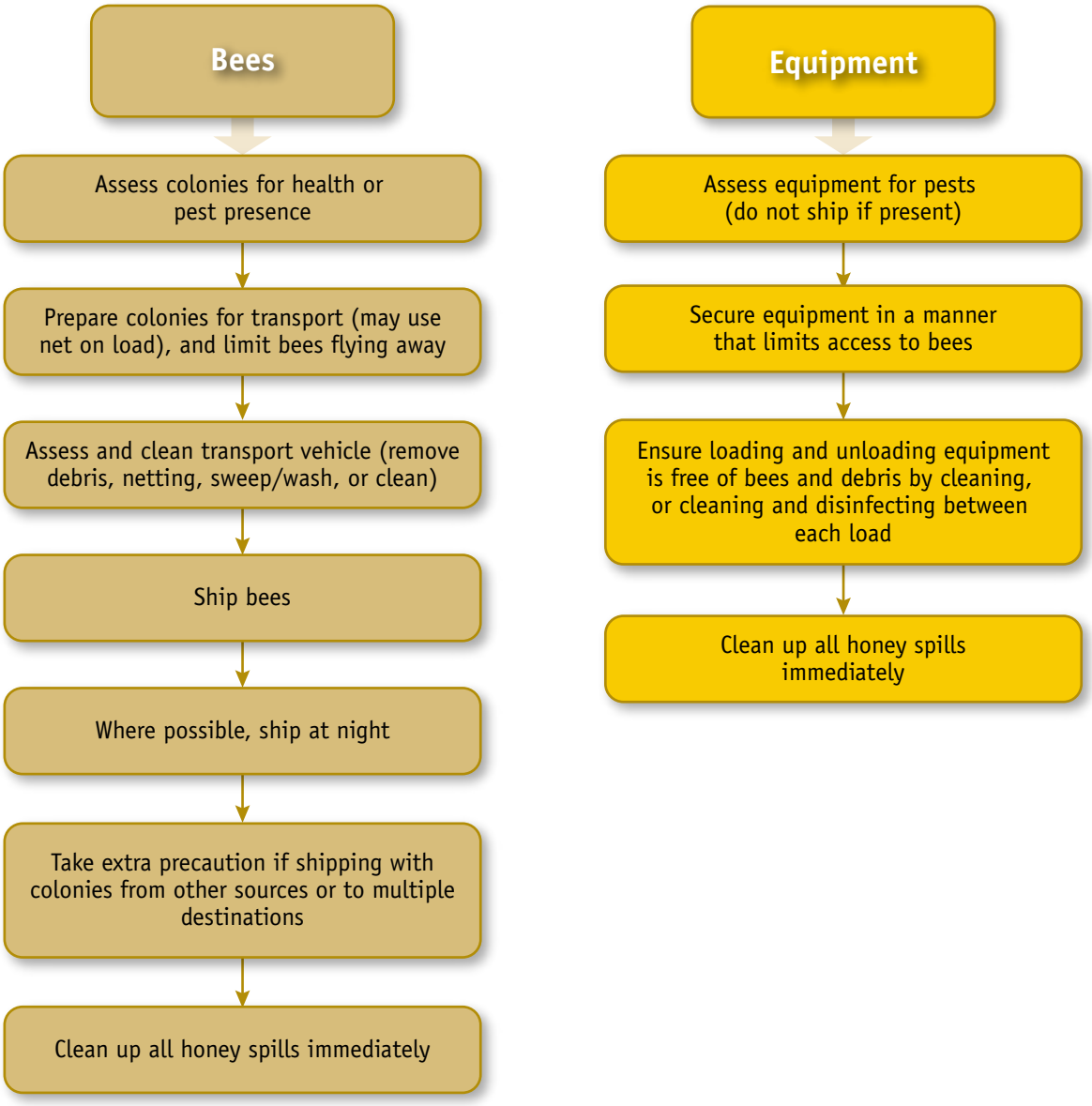


Figure 10: Receiving Bees

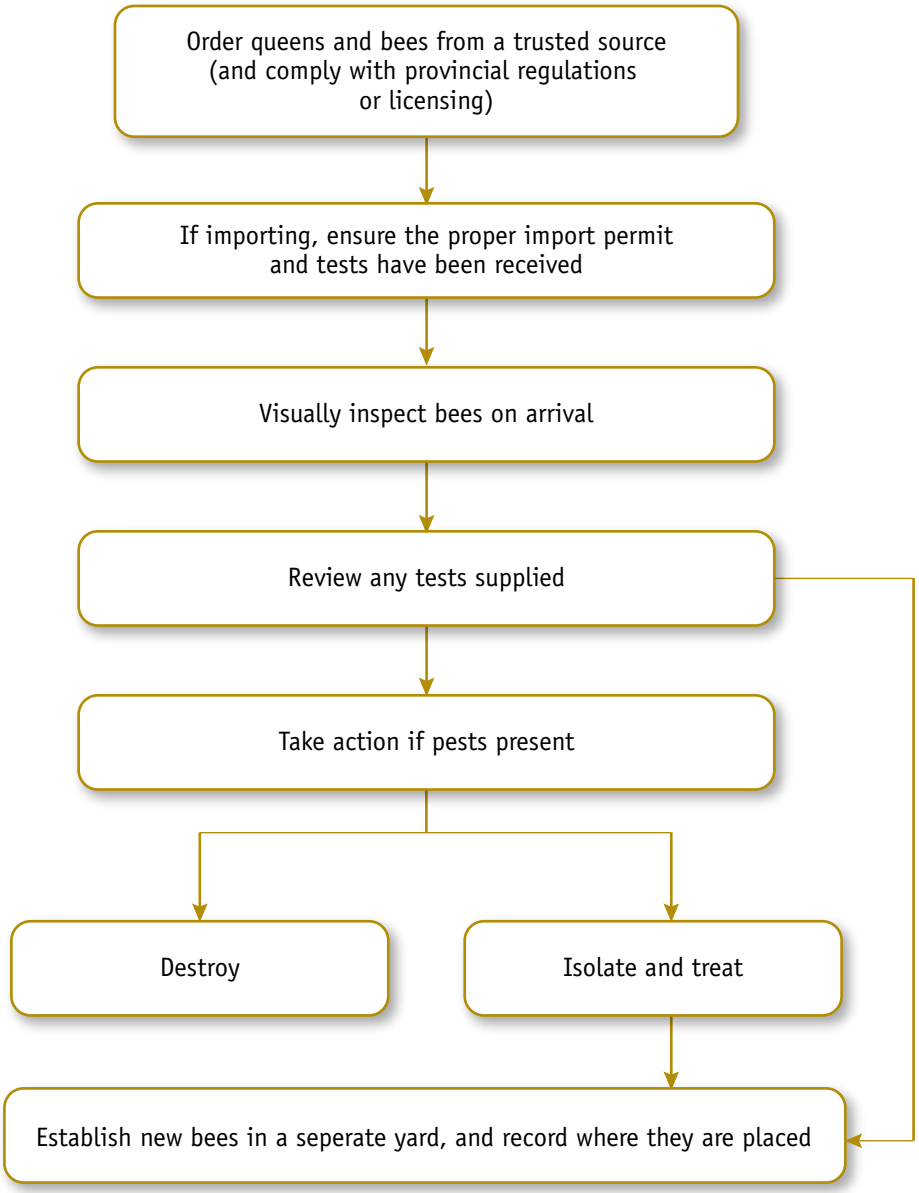


Figure 11: Receiving Feed

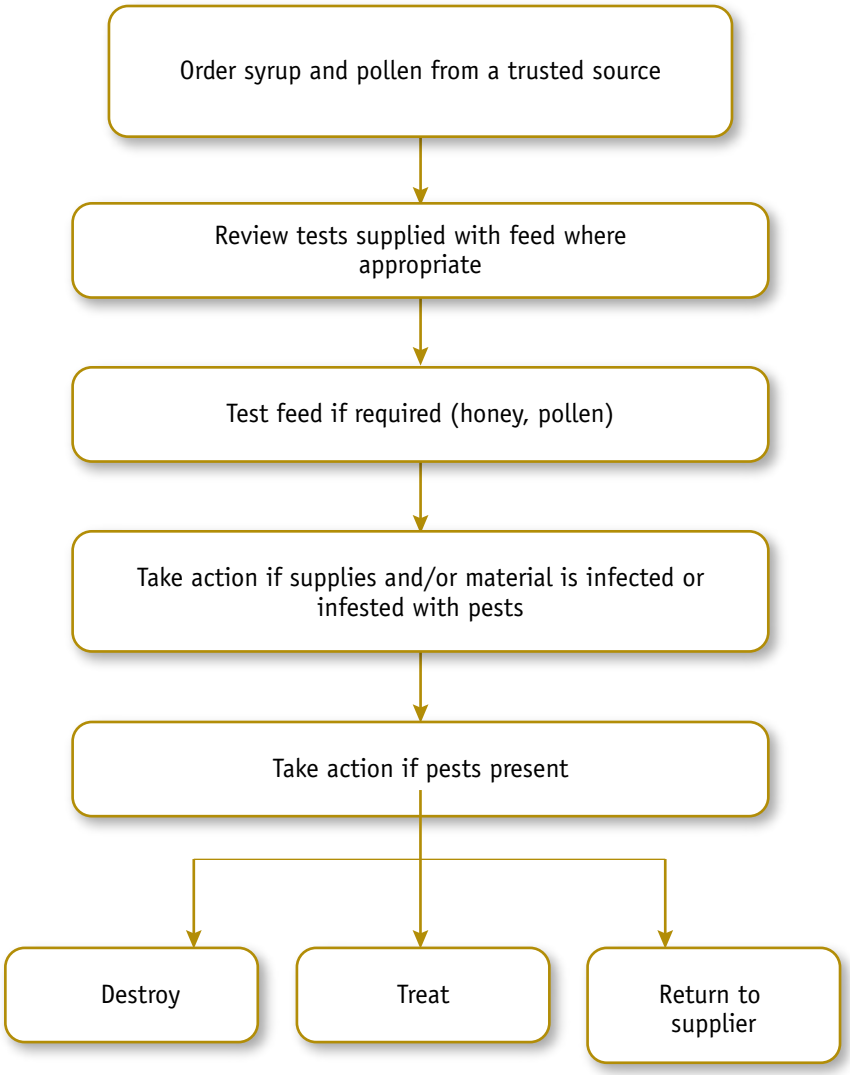


Figure 12: Receiving Supplies

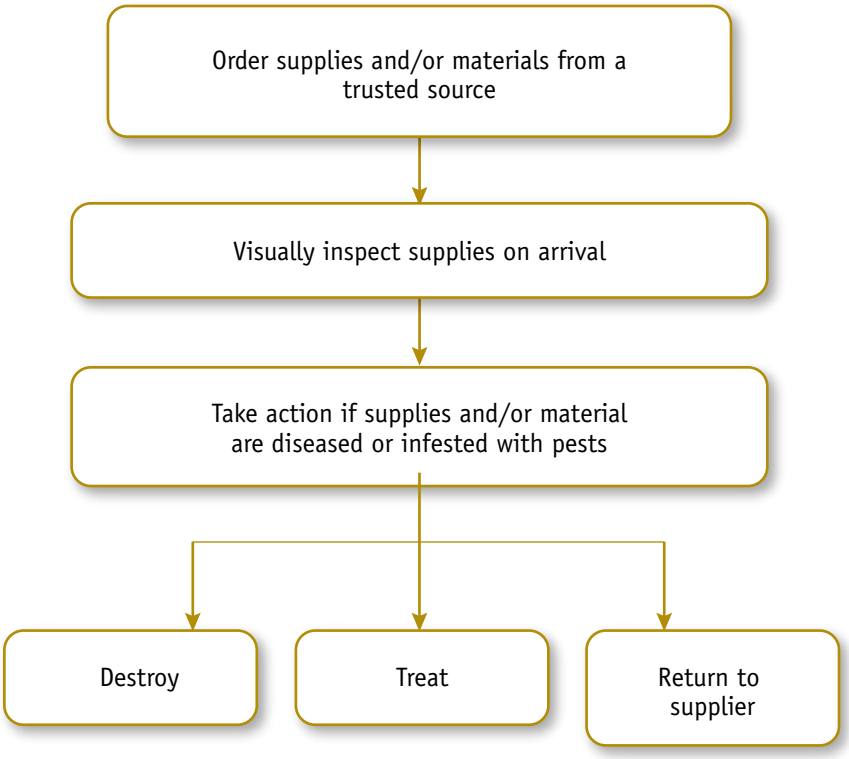


Figure 13: Shipping Bees

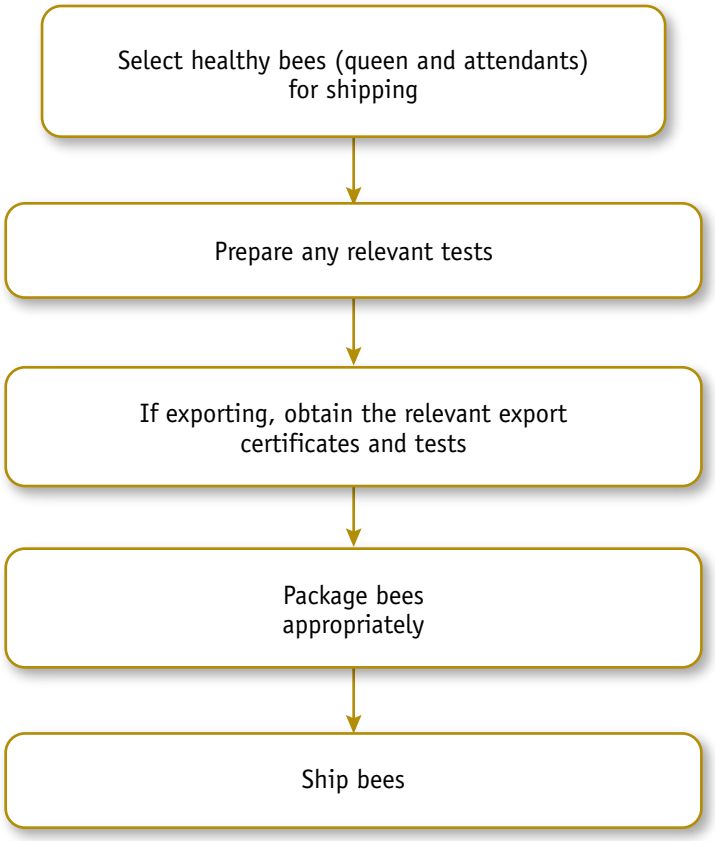


Figure 14: Queen Rearing

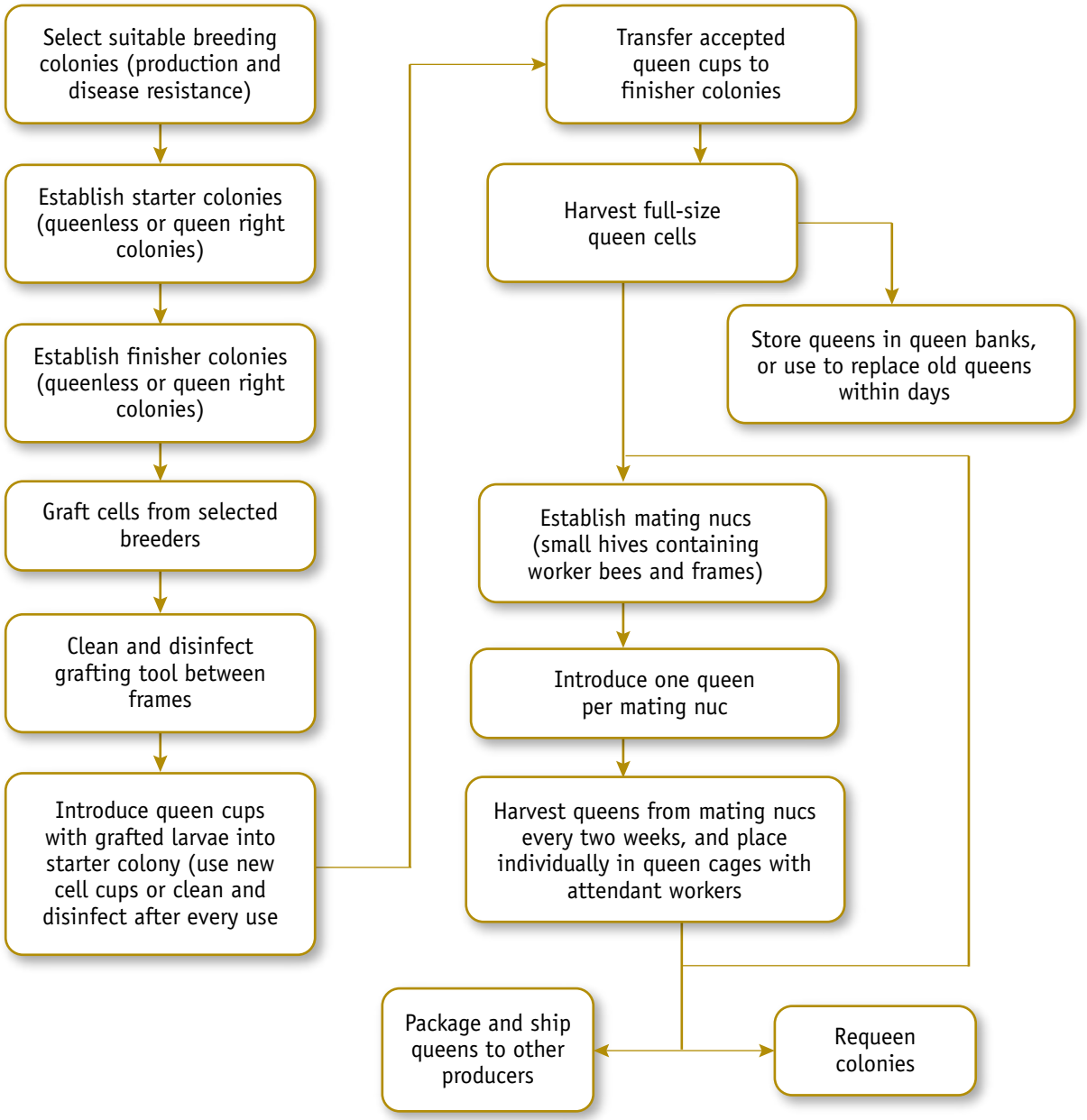


Figure 15: Recording

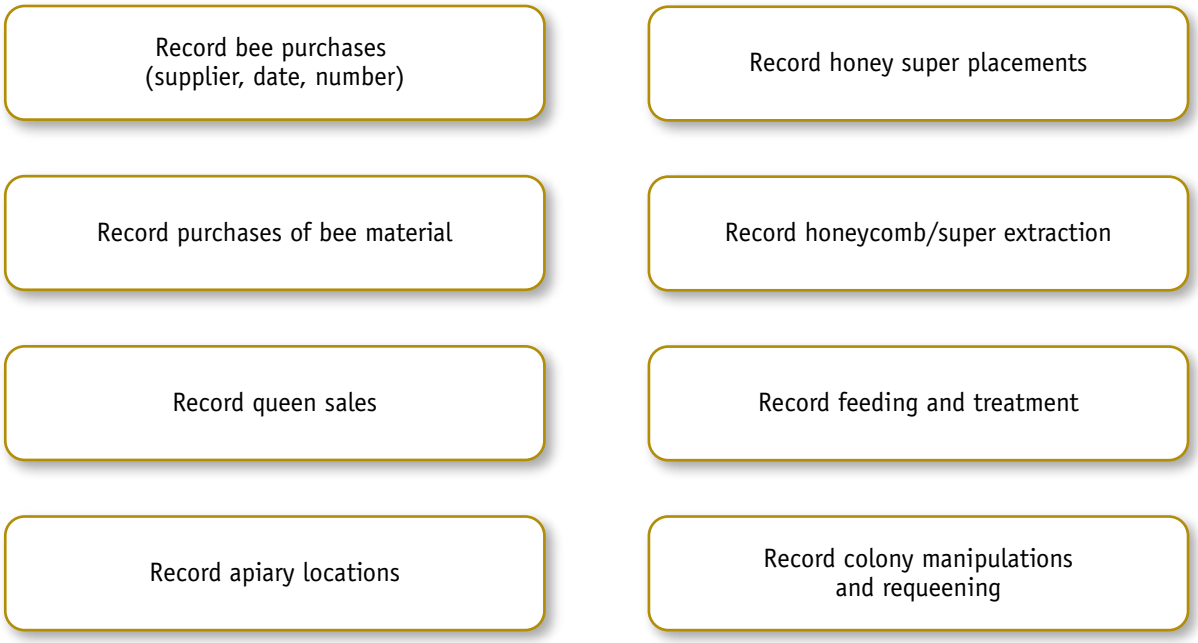


Figure 16: Custom or Contract Pollination

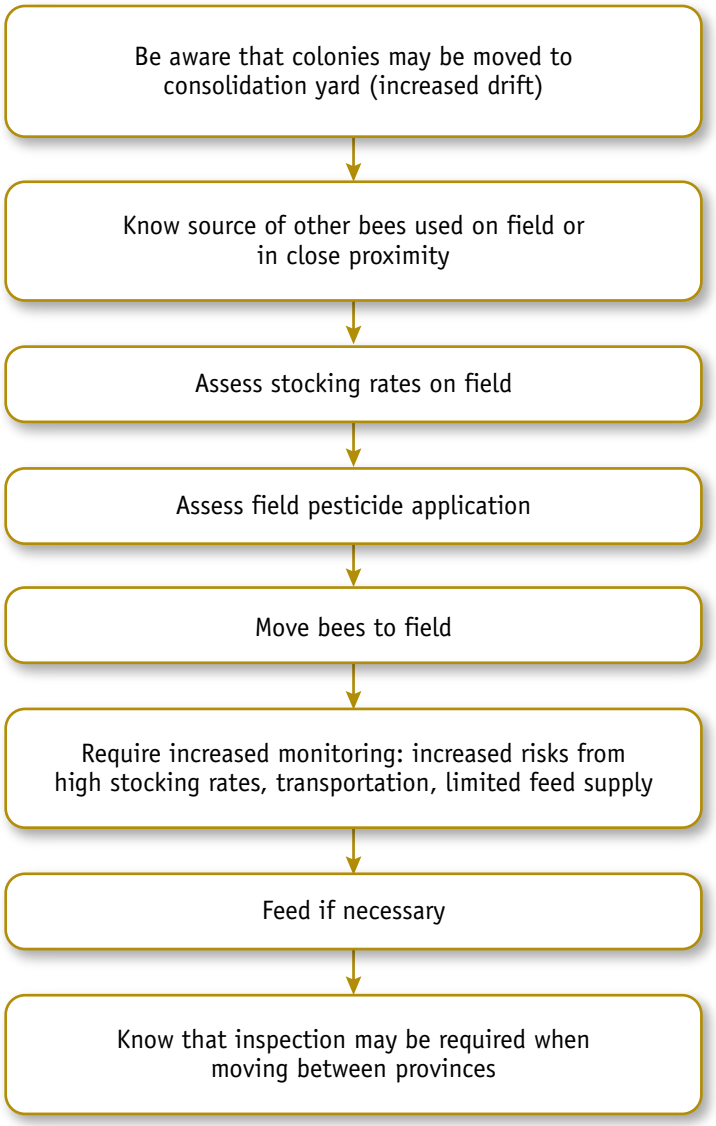


Figure 17: Facilities

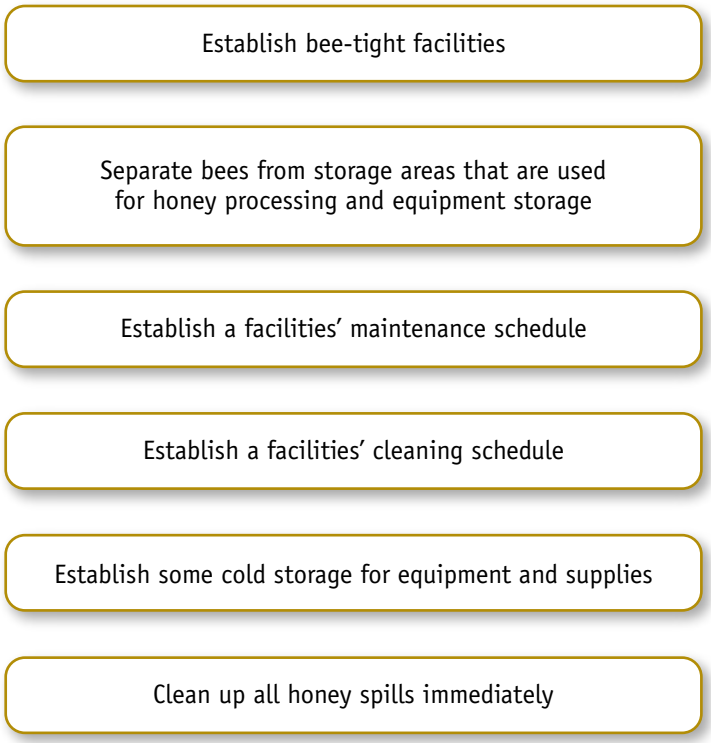
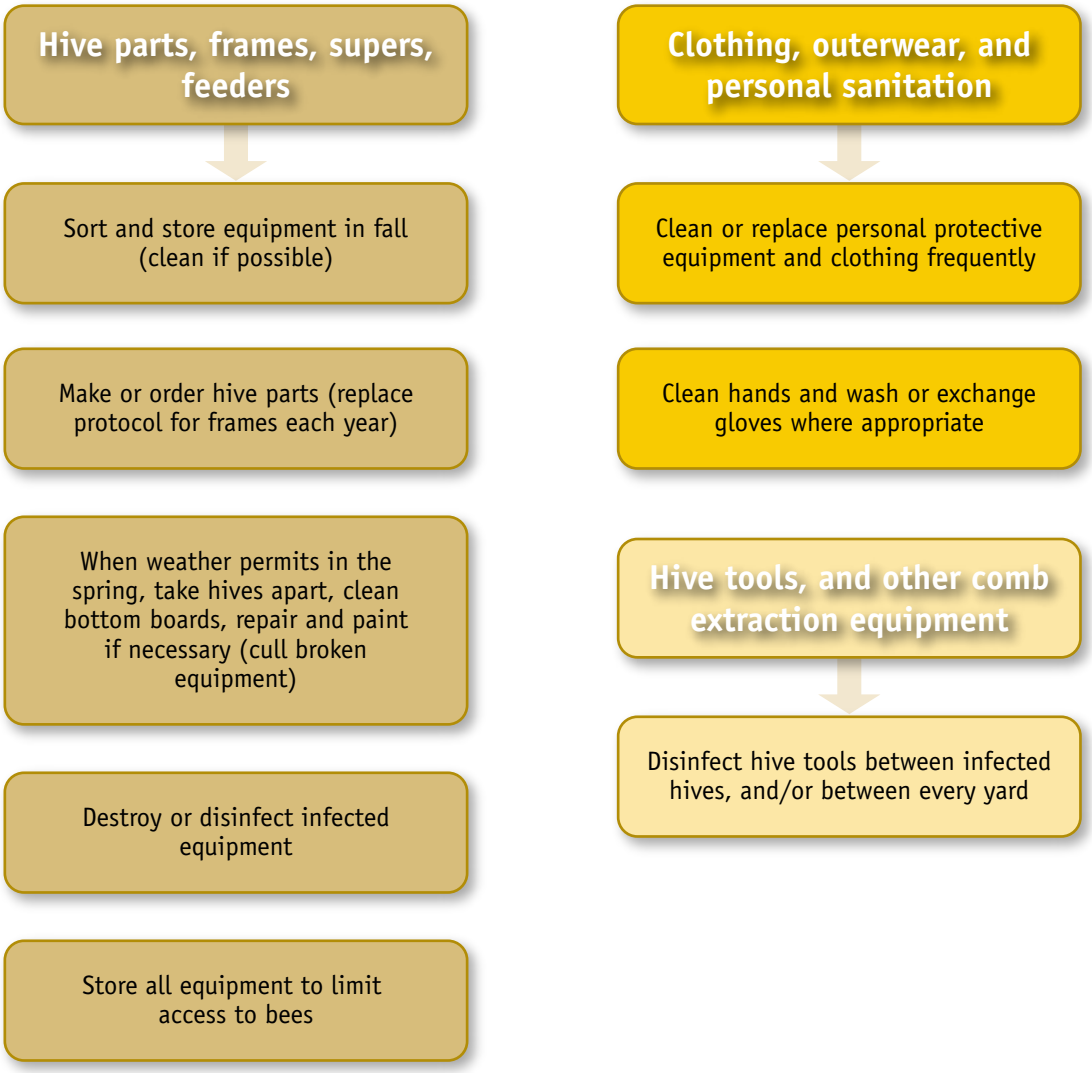


Figure 18: Equipment Cleaning, Personal Sanitation, and Storage



Diagnosis and Monitoring Methods: Main Pests Affecting Honey Bees

American Foulbrood

Regular inspections of the brood area of honey bee colonies are advised, especially during the active spring, summer, and fall. Visually examine brood frames for signs of American Foulbrood (AFB). Signs include an unhealthy, scattered brood pattern with sunken/punctured cappings that appear dark or greasy. Diseased brood combs also have a characteristic fish-like odour. Any discoloured brood should be examined closely, under good lighting, and at a slight angle so that the lower sides of the cell can be seen clearly. Infected larvae settle to the bottom or the side of the cell wall in a sunken gooey mass, which is beige to dark brown in colour. Occasionally, the tongue of a dead pupa is found extending and attaching to the cell wall. Brood frames should be carefully examined for scale (hardened dark black masses of old dead larvae) that adhere directly to the cell wall.

Detect AFB using the ropiness test – insert a twig, matchstick, or toothpick into the cell to "stir" larva, and draw out the contents. A 2 cm "rope" with the consistency of mucous will be stretched from the stick if it is AFB. AFB can also be confirmed through microscopic examination or molecular testing. The spores resemble slender rods in chains. Contact your bee regulating authority if you are unsure of your AFB diagnosis or if you find AFB.

European Foulbrood

Regular inspections of the brood area are advised, especially in spring and early summer. European Foulbrood (EFB) is often associated with susceptibility factors. Signs include an unhealthy brood pattern with capped and uncapped cells being found scattered irregularly over the frame, and twisted pearly white coloured larvae in a "c" shape in the cells. Larvae infected with EFB typically die before cell capping and give off an offensive, sour smell. In some cases, infected larvae may generate little or no odour.

EFB-infected larva turn yellow at first and then brown, at which time the tracheal system becomes visible as a glistening vein-like network throughout the larval body. The larvae eventually decay to a point where they form a dry, rubbery scale in the cell; the scale can be removed quite easily by the bees.

Prior to forming a dry scale, the larvae become somewhat softened and granular. Test for ropiness, using a twig, matchstick, or toothpick that is inserted into the larvae, and stir. Then, draw out the content, but it will not reveal the typical gluey long string or ropy signs of AFB, but rather a dry appearance.

Advanced microbiological culture and molecular tests are also available. Contact your provincial apiarist or bee authority for more information.

Chalkbrood

Regular inspections of the brood area are advised. Signs of infection can include patchy irregular brood, and white and/or black "mummies" in cells. An early sign of chalkbrood infection is small pinhole-sized holes chewed into the cappings by the worker bees. Eventually, worker bees will uncap the cells and remove the mummies, discarding them at the hive entrance and/or on the bottom board. Pollen traps (under the hive) should also be checked for chalkbrood mummies. Monitoring for chalkbrood should be increased during cold spring and high moisture climates.

Sacbrood

Regular inspections of the brood area are advised, especially in spring and early summer, when forage is limited. Signs include patchy brood, punctured cell cappings, and larvae that look like a watery sac. Some cells may remain capped after the surrounding brood has emerged. Diseased brood usually die in the pre-pupal stage. They tend to darken prematurely from white to yellow, and finally change to a dark brown colour once they die. Dead larvae will be found lying along the length of a cell with a slightly raised darkened head. If left long enough, the larval remains will dry out and settle into a brittle scale that can easily be removed from the cell.

Nosema Disease

Nosema is caused by two microsporidian (fungal) parasites: *Nosema apis*; more recently, *Nosema ceranae*. It is the most widespread disease of adult honey bees in Canada. *Nosema apis* typically has the highest levels in the spring, whereas *Nosema ceranae* may also be detected throughout the season. Signs of generalized Nosema disease include gradual depopulation, slow population buildup in spring and summer, and higher winter losses. *Nosema apis* infection can include dysentery, crawling behaviour in front if the hive, disjointed wings, distended abdomens, and the loss of the sting reflex. Dysentery and crawling bees are not commonly seen with *Nosema ceranae* infections.

Signs of Nosema may not be visually evident, especially if infestations are light. Behavioural signs are similar to those of pesticide poisoning, and poor quality food stores may cause dysentery. Therefore, confirming Nosema spore presence and determining spore counts are necessary to determine whether recommended treatment thresholds have been reached.

Ideally, microscopic and molecular tests should be performed by a diagnostic laboratory with beekeepers who have been properly trained in the sampling, slide preparation, and identification procedures.

Alternatively, follow provincial apiarist, bee authority, or laboratory-recommended procedures when collecting and preparing samples to be sent for analysis and confirmation of diagnosis. Typically 30–60 adult bees are collected from the front entrance or inner cover of a suspected colony. Selecting older foraging bees provides a more reliable result, as younger housekeeping bees are less likely to be infected with Nosema. For an apiary composite sample, collect approximately 10 bees from each colony (up to 10 colonies per apiary). Place sample in a 50%–70% alcohol solution to preserve the bees. Bee samples may also be frozen or dried for later analysis. Label sample by colony number and apiary with the beekeepers name and contact information.

Honey Bee Tracheal mites

Honey bee tracheal mite (HBTM), *Acarapis woodi*, is an internal parasite. It lives and reproduces in the tracheal system of honey bees. They feed on bee hemolymph. The mites infect adult worker, drone, and queen honey bees, and can be serious if not treated. Tracheal mites affect the overwintering capability of bee colonies, cause disjointed wings (called 'K-wing') and result in infested bees crawling near the hives. A heavy HBTM load diminishes brood area, reduces bee populations, results in low honey yields and, ultimately, in colony loss.

Collect samples in early spring or early fall for monitoring tracheal mites. To determine the efficacy of your treatment: collect samples in the fall, if you treat in the spring, or vice versa.

There are two sampling methods:

1. **Individual bee colony samples: Collect 50–75 bees per hive from honey combs or the inner cover. Place collected bees in a jar containing 70% alcohol. From each apiary, collect samples from 6 hives. In each operation, collect samples from 5 to 10 apiaries. Then, dissect 30 to 50 bees per colony. Check the infestation levels under the microscope to determine the average mite prevalence.**
2. **Composite bee sample representing an apiary: Collect 5 to 10 bees from honey combs or the inner cover from each hive in an apiary of 25 to 40 colonies. Place collected bees in a jar containing 70% alcohol. Collect composite samples from 5 to 10 apiaries. Dissect only 150 bees for each apiary, and examine the tracheae for the presence of tracheal mites under a microscope.**

Varroa Mite

The *Varroa* mite (*Varroa destructor*) is an external parasite that feeds on adults, larvae, and pupae, and is visible to the unaided eye; visual signs include shrivelled wings on emerging bees, patchy brood pattern, and reddish mites on bees or comb. Because *Varroa* is relatively common, monitoring is used to determine mite count thresholds that may trigger treatment or to evaluate treatment efficacy (resistance), and not only confirm presence in the colony.

Several monitoring methods are available:

1. **Quantitative Determination of Treatment Threshold Levels**
   a. (24-Hour) Sticky Board: Quick Natural Mite Drop on a Sticky Trap

      Pros: The natural mite drop is a reliable method to determine treatment threshold counts if *Varroa* presence is confirmed. A sticky board also prevents mites from climbing and reinfesting bees.

      Con: The natural mite drop requires a repeat visit to the apiary. In addition, leaving the sticky boards for more than 72 hours makes it difficult to count the mites, due too much debris.

      i. Coat a thick piece of paper (filing folders [38 x 30 cm] work well), using 50% Vaseline/50% Crisco, Tangle Trap paste, or Sticky Stuff.
      ii. Place the coated paper under a screen, and on the bottom board for three days.

iii. Count the *Varroa* adult mites on the sticky board, and divide by three to obtain an average mite fall per day.

Natural *Varroa* mite drop is affected by a number of factors, including weather and genetics. For this reason, monitor over three days, calculating the average per day to use in reference to treatment thresholds.

b. Varroa Hand Shaker

Pros: Simple, reliable, and fast method to carry out in the field and does not require a second trip.

Con: Bees in the samples are killed during the process:

i. Collect approximately 300 worker bees (1/3 cup) from brood frames into a sample jar that contains (up to half of the jar) winter windshield washing fluid, or 70% alcohol. A total of 300 dead bees will fill about 1 inch (25 mm) in the bottom of the jar.

ii. Screw the sample jar onto the hand shaker, and then shake the *Varroa* hand shaker vigorously up, down, and sideways for 40 to 60 seconds.

iii. Turn the jar with the bees upside down to keep the bees on the top of the screen, allowing the mites in liquid to pass through into the bottom jar.

iv. Check and count the number of mites collected in the fluid in the bottom jar.

v. To determine the percent infestation, use the following equation: multiply the number of counted mites by 1.3. This will give you the corrected number of mites. Then, divide the corrected number of mites by 3. For example, assuming that you collected 300 bees, and counted 7 mites in the bottom jar, the total number of mites is equal to 7 x 1.3 = 9. The percentage infestation is equal to 9 divided by 3 = 3%.

Handheld, easy to use, commercially made mite shaker devices that give effective and fast results are also available. Follow the directions given with the shaking apparatus. Contact your local bee supply outlet for availability.

c. Honey Bee Diagnostic Lab

Collect the recommended number of bees, as indicated by the provincial apiarist, bee authority, or laboratory, and place in a jar of alcohol, and ship to a honey bee diagnostic lab.

2. Qualitative Indicators of Varroa Presence

Pros: This method can be carried out in one visit to the field. Confirmation of *Varroa* presence may flag the need for sticky board method.

Con: It is not as accurate as quantitative methods for determining whether treatment thresholds have been reached.

a. Ether Roll

Ether roll is a quick field test. Place 125 mL (½ cup) of bees (approximately 300 bees) from the brood chamber in a glass jar. Spray with three or four squirts of ether (engine starter fluid). Replace lid and shake for one full minute. Roll the jar, and then count the *Varroa* stuck

to the glass and under the lid. Do this in a well-ventilated area, wearing gloves to minimize contact with the ether.

b. Sugar Roll (dusting)

Sugar Roll is a quick field test. Use a double jar, with perforated lids bonded together. Scoop 125 mL (½ cup) of bees (approximately 300 bees) from the brood chamber, and place in one jar. Add 30 mL (2 tablespoons) of powdered (icing) sugar to the other jar, shaking gently back and forth to coat the bees. Empty the coated bees onto a flat surface, away from the wind, and count the *Varroa* mites remaining in the sugar as the bees walk away.

c. Uncapping Drone Brood

This method can be done off-site with frozen samples at the beekeepers' convenience. First, record the amount of drone brood per colony. Uncap and remove larvae/pupae from 100 drone cells, recording the number that are infested with *Varroa* mites. Count both immature and (adult) mature mites. Compare the level of infestation to the total amount of drone brood in the colony.

3. Threshold Guidelines for Varroa

Once results are obtained, consult the treatment thresholds that are indicated in the annually updated provincial recommendations for mite control. If your province does not publish annual recommendations, contact your provincial department. Treatment methods are established for each monitoring method and for two periods: early May and late August. Treatment threshold levels may be lower if more than one pest is present (e.g. *Varroa* and tracheal mites).

If treatments were applied and *Varroa* infestation is at the threshold level or higher the next spring and there were abnormally high losses over the winter, it is advised to test for acaricide resistance.

In June, monitor all bee yards (at least five hives in each), using the monitoring method of choice to determine whether *Varroa* mites were controlled by the spring treatment.

Monitor a number of bee yards to represent your operation. In each bee yard, examine at least five hives in early August, using the monitoring method of your choice to ensure that *Varroa* infestations are not at, or above, treatment threshold levels. If they are highly infested, they will have sustained enough damage that the colony will not winter properly and will more likely die. Treat early fall or as early as possible after removing honey supers to protect winter bees. If honey supers are still on and mite levels are high, remove honey supers and treat immediately. Treatments that are applied late in September and October have reduced efficacy, compared with treatments applied earlier.

Due to potential efficacy constraints caused by environmental conditions with treatments that are temperature dependent and have potential for resistance in chemical treatments, it is highly recommended that monitoring occur after treatments to determine whether the treatment was effective or whether there is a need for a follow-up fall treatment (after brood production stops). Late nectar flows and inclement weather can delay the treatment of colonies in the fall, resulting in reduced efficacy of mite control products and high winter kill.

The monitoring process should therefore include monitoring and recording of environmental conditions.

Varroa can have several generations per year and thus can develop resistance to some treatments within a short time. For this reason, beekeepers should frequently monitor for suspected resistance.

Small Hive Beetle

Egg, larval, and adult stages of the small hive beetle (SHB) and damage caused by the larvae of SHB can be observed in the honey bee colony, on exposed hive equipment, or in packaged material of imported bees.

Inspect hives for the presence of the small hive beetle. Examine the tops of brood frames (particularly towards the ends of the frames) for the presence of SHB adults immediately after the lid is removed, because adult beetles will run away from light. Adult and larval beetles may also be encountered on the bottom board or on the surface of brood frames among worker bees. Inspect for SHB adults on the bottom board by quickly looking for the adult beetles as soon as the brood chamber is tipped to expose the bottom board.

Extraction facilities should also be monitored for the presence of SHB.

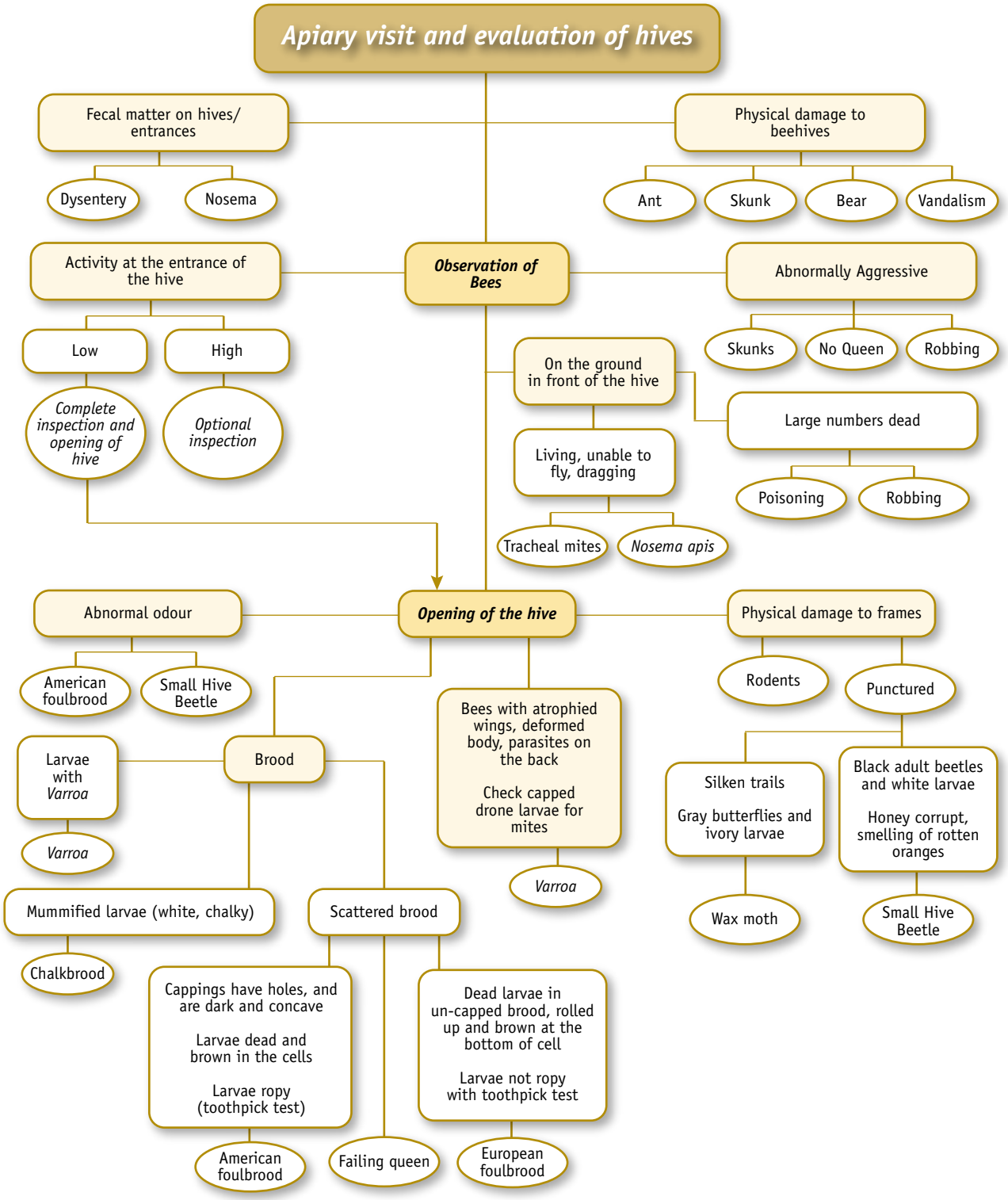
A variety of mechanical traps may be used to monitor for SHB. Consult bee-supply outlets for a range of options, or contact your provincial apiarist or bee authority for recommendations.

The adult beetle is about 3/16" (5.5 mm) long, 1/8" (3.2 mm) wide, and dark brown in colour. It has clubbed antennae. The larva looks similar to a wax moth larva, but the SHB larva has spines along the length of its body. The SHB larva has three pairs of true legs, while the wax moth caterpillar has three pairs of true legs plus prolegs (false legs). SHB larva does not spin a cocoon in the hive. Adult and larval SHB can also be found in dead colonies and exposed colony equipment.

If SHB is suspected in your hives, immediately contact your provincial apiarist or honey bee regulating authority. Follow all notification procedures, and permit and quarantine regulations.

Monitoring for SHB includes ongoing awareness of confirmed presence in your local area.

FIGURE 1 Honey Bee Pest Diagnosis and Monitoring



Honey Bee Biosecurity: Self-Evaluation Checklist

This checklist is designed to assist beekeepers in evaluating their biosecurity programs. Though it does not list all the components or measures detailed in the Producer Guide, it does provide a general overview of the main recommendations in the sections. If, while using this evaluation tool, questions arise or specifics are required, please refer to the Producer Guide. Some items on this checklist may not apply to all honey beekeeping operations.

Section 1: Bee Health Management

1.1 Bee Sources

- ☐ bees are purchased / introduced from local, certified, and recognized suppliers
- ☐ when purchasing / introducing bees, all federal and provincial acts and regulations are followed and recorded
- ☐ introductions are inspected and assessed for the presence of pests – appropriate actions are taken
- ☐ introductions are placed in new or disinfected hives, and handled with clean and disinfected equipment
- ☐ treatments comply with federal and provincial acts and regulations, and product labels are followed
- ☐ bee health is monitored and recorded after introduction

1.2 Prevention: Minimizing Susceptibility to Pests

- ☐ weather and environmental conditions, both in the field and in the hive, are monitored and measures are taken to promote bee health
- ☐ bees have access to quality water and feed supplies.
- ☐ measures are taken to avoid disturbances when bees are handled, transported, placed, and stored
- ☐ direct and indirect exposure to pesticides is minimized through situational awareness and by monitoring bee health
- ☐ cultural control techniques and monitoring of pests are used to maintain strong colonies
- ☐ preventative chemical treatments are limited and used according to provincial recommendations

1.3 Prevention: Minimizing Exposure

- ☐ hive equipment is designed, used, and maintained to reduce exposure to pests
- ☐ apiaries are placed, oriented, and monitored to reduce exposure to pests
- ☐ management techniques are used to prevent robbing, drifting, and swarming

Preventative measures and caution are used to reduce exposure to pests during

- ☐ transportation
- ☐ splitting
- ☐ uniting or equalizing colonies
- ☐ collecting supers
- ☐ extracting

1.4 Diagnosis and Monitoring

A monitoring program is in place and considers

- ☐ current knowledge of area risks
- ☐ coordination of monitoring with treatment periods
- ☐ bee lifecycles
- ☐ pest lifecycles
- ☐ seasonal operation activities
- ☐ record keeping and tracking
- ☐ early recognition of concerns
- ☐ sampling/collection
- ☐ handling of pests
- ☐ use of laboratory to confirm diagnosis of disease and pests
- ☐ treatment efficacy
- ☐ training

1.5 Standard Response Plan

- ☐ provincial treatment recommendations are obtained and followed
- ☐ the recommended Canadian Integrated Pest Management Program for honey bees is followed

Chemical treatments are used, together with cultural management methods:

- ☐ chemical resistance is avoided
- ☐ treatments are rotated (if applicable)
- ☐ chemical interactions and buildup are avoided
- ☐ treatment thresholds are monitored and followed, if applicable
- ☐ provincial apiarists or bee specialists are consulted for test result interpretation
- ☐ label directions are followed
- ☐ applications are thorough and consistent
- ☐ applications are timed to seasons and life stages
- ☐ bee health is monitored after treatment

Non-chemical (cultural) techniques for managing equipment with live bees are incorporated:

- ☐ strong colonies are maintained
- ☐ infected or infested colonies are segregated
- ☐ healthy bees are introduced to uncontaminated equipment
- ☐ queen excluders are used
- ☐ comb interchange between colonies is minimized
- ☐ at least 20% of brood frames are replaced each year
- ☐ colonies are requeened every 2 years with stock with desirable traits
- ☐ screened bottom boards are used
- ☐ drone brood trapping is practiced to manage *Varroa* mites
- ☐ bottom boards are scraped at least annually

1.6 Elevated Response Plan

A communications/notification plan is in place for

- ☐ staff
- ☐ bee authorities (provincial apiarist, inspectors)
- ☐ associations
- ☐ other

- ☐ risk-based communication triggers are in place

Bee management protocols are in place:

- ☐ colony and equipment movement, sales, and introductions are suspended
- ☐ affected colonies are segregated
- ☐ access to affected colonies is restricted
- ☐ personal and equipment biosecurity measures are followed
- ☐ quarantine measures are followed
- ☐ visitor protocols are followed, and signage is posted

Section 2: Operations Management

2.1 Obtaining Production Inputs

- ☐ clean water, carbohydrates, protein feed, and treatments are provided to the bees as required.
- ☐ sucrose or high fructose corn syrup (HFCS) suitable for bees are used
- ☐ alternate water source(s) are provided
- ☐ pollen and protein supplements are irradiated
- ☐ treatment products are registered, and label instructions are followed

2.2 Handling and Disposal of Production Inputs

- ☐ honey spills are cleaned up as soon as possible
- ☐ feeders and containers are new or disinfected
- ☐ closed feeders are used
- ☐ feeders, feed, and water containers are sealable and constructed of material that is easily cleaned and disinfected
- ☐ pail feeders are labelled for feed and/or treatments
- ☐ feed is stored away from bees and processing
- ☐ feed and water that has been in contact with infected or infested bees is sealed and disposed of
- ☐ dead bees are routinely removed from water sources and feeders
- ☐ chemical treatments are stored according to label instructions
- ☐ supply inventory is used “first in/first out”
- ☐ expired and excess products are disposed of according to label instructions
- ☐ reuse of pesticide strips is avoided

2.3 Obtaining Bee Equipment

Acquired used equipment

- ☐ is avoided if it has a history of disease
- ☐ is purchased from local, trusted, and certified suppliers that are ideally with a pest control program; unfamiliar suppliers are investigated before buying used equipment
- ☐ is accompanied with a health/inspection certificate
- ☐ is isolated and monitored for one year if used hive equipment includes live bees
- ☐ with an unknown health status is isolated and disinfected – irradiation, heat treatment, hot paraffin wax, or chemical (bleach)

Imported used bee equipment:

- ☐ current federal and provincial import and transport regulations are followed
- ☐ provincial registration requirements are followed
- ☐ records are kept and maintained
- ☐ permits are acquired
- ☐ if ordered, methods and times for quarantine, treatments, and disposal are followed

2.3 Obtaining Bee Equipment

Selection or construction of new hive equipment:

- ☐ hive bodies are clean with tight joints and tight-fitting parts
- ☐ hive boxes can be tightly stacked but do not bind
- ☐ galvanized metal parts and nails are used
- ☐ equipment is constructed with clean smooth wood cuts
- ☐ pressure-treated wood and toxic materials are avoided
- ☐ new or irradiated plastic foundations are used

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

- ☐ an equipment identification system is used – numbering, colour, maps, dates, or Global Positioning System (GPS)
- ☐ provincial regulations concerning identification of hives and apiaries may apply
- ☐ routine inspections of structures and for the presence of pests are performed
- ☐ suspect colonies are visited last

Equipment exchange and replacement is

- ☐ segregated
- ☐ minimized
- ☐ routine
- ☐ follows cultural management practices and incorporates biosecurity methods
- ☐ apiaries and equipment are maintained and repaired as required
- ☐ equipment is disinfected before reintroducing bees

When storing equipment

- ☐ supers are dried before storing
- ☐ pollen and propolis are removed from stored comb
- ☐ supers are wrapped
- ☐ sufficient space and orientation to ducts is provided to promote air circulation

Dead bees, bee products, and contaminated equipment are properly

- ☐ handled
- ☐ stored
- ☐ disposed of

Honey extraction is avoided from

- ☐ contaminated equipment
- ☐ brood combs
- ☐ infected colonies (unless extracted last – followed by disinfection of used equipment)

2.5 Personal Sanitation

- ☐ hands are washed after handling contaminated equipment or bee products
- ☐ hands are washed between apiaries

- ☐ disposable or reusable gloves are carried and worn
- ☐ reusable gloves are washed and disinfected after use or between apiaries
- ☐ gloves are changed routinely
- ☐ contaminated gloves are disposed of carefully
- ☐ hands are washed before putting on gloves
- ☐ clothing is routinely washed with a bleach solution and thoroughly dried

- ☐ extra clean and disinfected hive tools are carried
- ☐ tools are disinfected after handling diseased or infested equipment or bee products
- ☐ tools are cleaned and disinfected when moving between apiaries
- ☐ visible debris is removed from tools before disinfecting

- ☐ used personal gear and tools are disposed of in the landfill or by burning

2.6 Design of Facilities

- ☐ loading areas are paved
- ☐ roadways and pathways are graded and drained
- ☐ spring loaded self-closing doors are used
- ☐ smooth structural materials that are impervious to rust, corrosion, and rot are used
- ☐ surfaces are easily cleaned
- ☐ exteriors are maintained to deter pests
- ☐ air circulation is promoted
- ☐ concrete floors are sealed
- ☐ facilities are bee tight and, ideally, insect and rodent proof
- ☐ one-way exit methods are used that allow bees to escape
- ☐ appropriate temperature- and humidity-controlled storage is provided
- ☐ temperature and humidity are monitored
- ☐ adequate ventilation and air circulation is provided in wintering facilities to remove heat, moisture, and carbon dioxide
- ☐ lighting is minimized in facilities where bees are stored

Segregated storage areas are provided for

- ☐ receiving bees
- ☐ infected, infested, or suspect hives
- ☐ hives from different apiaries (wintering facilities) or destined for pollinating crops in pest-free areas
- ☐ toxic products
- ☐ disinfection
- ☐ storage and repairs of hive equipment

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

- ☐ new apiary sites are inspected and assessed for risks before placing bees
- ☐ transportation and operational equipment and surfaces are clean of debris and honey spills
- ☐ honey spills are cleaned daily
- ☐ the premises, buildings, vehicles, and equipment are routinely inspected for risks
- ☐ areas used for cleaning and disinfection are located away from apiaries and other production facilities
- ☐ drainage water is contained or controlled to minimize biosecurity risks

2.8 Control of Weeds and Nuisance Pests

Monitoring includes

- ☐ weeds
- ☐ nuisance pests
- ☐ disturbances to hives and surrounding area
- ☐ dead bees
- ☐ nests
- ☐ weakened colonies

Management:

- ☐ facilities and apiaries are kept free of attractive environments for pests
- ☐ facilities and apiaries are kept free of presence of dogs or cats
- ☐ bees are moved to a new location, or measures are taken if pests are discovered
- ☐ facilities and hives are maintained in good condition – pest proofing
- ☐ areas around apiaries and hives are mowed
- ☐ selected sites are away from wildlife habitats
- ☐ fencing is used
- ☐ predators are trapped
- ☐ Poison (permitted) is used appropriately for pests requiring this treatment
- ☐ colonies are raised off the ground
- ☐ wasps are monitored and nests removed
- ☐ hives are located in areas where they cannot be easily vandalized or subject to theft
- ☐ if possible, surveillance cameras are used

2.9 Training and Education

A training/education program includes

- ☐ joining local associations
- ☐ accessing government resources and professionals
- ☐ developing Standard Operating Procedures (SOPs) for operational processes

A training plan includes knowledge of

- ☐ biosecurity principles, risks, and importance
- ☐ bee health
- ☐ monitoring
- ☐ record keeping
- ☐ recommended management practices
- ☐ treatment
- ☐ sanitation processes
- ☐ acts and regulations

The training plan includes

- ☐ training schedules, key training times, and updates
- ☐ in-house training
- ☐ on-the-job training
- ☐ self study
- ☐ formal qualification
- ☐ translation if applicable

Equipment, Storage, and Extraction Facility: Cleaning and Disinfection

Terminology

"Disinfectants" are chemical compounds that are applied to inanimate (non-living) objects to destroy or irreversibly inactivate disease-causing organisms.

"Disinfection" refers to the inactivation of disease-causing organisms and includes, but is not limited to, chemicals, heat, and ultraviolet light.

Product Regulation

Health Canada regulates the registration of disinfectants in Canada and provides a drug identification number (DIN), listed on the disinfectant container, prior to their marketing.

Selecting a Disinfectant

Disinfectants are evaluated by Health Canada, using strict criteria; however, efficacy is determined under controlled laboratory conditions. On a farm site, disinfectants are to be used according to the manufacturer's recommendations. Disinfectant selection is based on a variety of factors, such as the following:

- the chemical properties of the disinfectant;
- the type(s) of organism targeted for inactivation;
- the cleanliness of materials to be disinfected;
- the composition (e.g. wood, metal, rubber) of the surface to be disinfected;
- the temperature of surfaces and disinfectant;
- contact time;
- concentration;
- application method;
- the presence or use of other chemicals;
- pH;
- characteristics of the water (presence of dissolved solids, degree of contamination);
- environmental considerations (the presence of streams and wildlife); and
- cost.

These factors will affect the likelihood of a disinfectant performing as indicated by the manufacturer.

Choose broad-spectrum disinfectants with minimal toxicity that are easy to apply and that are effective under a variety of environmental conditions.

Disinfectant Storage

Disinfectants have a different shelf life, depending on the chemical composition of the product, and often have a "best before" date. Chemicals degrade over time, reducing the effectiveness of the product; this often accelerates after a product has been opened. Use unexpired disinfectants, and ensure lids, tops, and bags are securely fastened for storage. Store in cool, dry, dark areas or according to manufacturer's recommendations.

Disinfectant Application

Follow the manufacturer's recommendations for application, paying strict attention to the concentration required and contact time. Some disinfectants require rinsing as their final step. Follow local government regulations regarding the application of disinfectants to ensure compliance with environmental legislation.

Once disinfectants are mixed with water or other chemicals, their shelf life decreases dramatically, and thus require regular replenishing. This may be daily for some products and weekly for others.

Disinfectants are most effective when applied to clean dry surfaces. Organic material (litter, soil, manure) on equipment, tools, gloves, and structures significantly reduces the activity of disinfectants, so these surfaces must be cleaned prior to disinfectant application.

- Emphasize dry cleaning to reduce the time required for wet cleaning.
- Provide supplementary heat to raise facility temperatures to allow wet cleaning and disinfection to occur.
- Focus on critical areas where bees or bee equipment are stored to reduce the volume of water applied.
- Dry clean the ventilation system.
- Add propylene glycol, and use machines that are capable of heating water to increase the effectiveness of detergents and disinfectants and to prevent wash and disinfectant solutions from freezing.
- Thoroughly dry the equipment or facility after any cleaning stage to enable pathogen inactivation.

Cold and Wet Weather

- Raise the temperature in the facility.
- Use warm to hot water when using detergents and disinfectants.
- Increase the concentration and surface contact time of the disinfectant. Cold temperatures, rain, and wet surfaces can significantly reduce the concentration of cleaning and disinfectant solutions.

Additional Measures

- Be aware that steam cleaning can reduce the amount of water required and increase temperature to reduce pathogen load.
- Consult with commercial cleaning companies, disinfectant manufacturers, industry experts, and veterinary professionals on sanitation measures when environmental conditions impair routine cleaning and disinfection.

Further Information

Health Canada

Sample Record Keeping

This appendix provides sample record keeping forms that could be used by honey beekeepers to assist with biosecurity management within their operations and to ensure appropriate records are in place for traceability if a biosecurity risk is suspected or confirmed.

Beekeepers are encouraged to customize their record-keeping system to their own operations, using the forms in this document as guidance.

Principles of Record-Keeping Practices:

1. **Complete records in "real time" whenever possible. Recording after-the-fact (from memory) can often lead to errors.**
2. **Have records that are as accurate as possible. Unconfirmed diagnosis or suspicion of a pest should be identified as such.**
3. **Be aware that errors in entering information should be struck-through, dated, and initialed, rather than erased or otherwise obscured.**
4. **Know that dated and properly identified digital camera images are a useful supplement to written records.**
5. **File all documents such as receipts, invoices, diagnostic reports, and permits in a secure location.**

AFB = American foulbrood; SHB = small hive beetle

1.0 Bee Origin

Hive #	Queen Stock								
	Queen Identifier (# or colour mark)	Supplier Name	Queen Installation year/month	Source/Strain (e.g. parent colony or name of supplier)	Queen accepted? Replacing rejected queen(s)?	Mother ID (if applicable)	Sire ID (if applicable)	Pros (e.g. hygienic behaviour)	Cons (e.g. swarming, aggressive behaviour)

Hive #	Colony Source				
	Type P = package bees N = nucleus colony SW = swarm capture SP = split U = united	Acquisition year/month	Source/Strain (e.g. parent colony or name of supplier)	Behaviour/health observations on receipt	Isolated? y/n

Hive #	Treatments given when acquired					
	Type	Start date	End date	Who administered	Reason	Efficacy

Hive #	Colony Disposition			
	Type SP = split U = united N = new hive O = sold or given away to anther beekeeper D = destroyed	Hive # to	Disposition year/month	Comments

2.0 Assessment

Hive# _____ **(keep one record for each hive)**

Date of inspection	Location	Frames			Weather	External Observations
	(e.g. Apiary # or winter storage location)	Number of frames of bees	Number of brood frames	Describe frame removal exchange	(e.g. windy, overcast)	(e.g. signs of predators, hive damage, vandalism, dead bees on ground or at entrances)

Visual signs of diseases, parasites, or insect pests (internal observations)					
Brood diseases (e.g. scale, chalkbrood, sacbrood, perforated and sunken cell cappings, etc.)	*Varroa* mites (e.g. in brood and on adult bees, bees with deformed wings)	Dysentery or fecal matter on frames or entrances. Other signs of Nosema disease.	Small Hive Beetle	Wax Moth	Other visual signs, ill health, and suspected cause (e.g. chilled brood, pesticide poisoning, stress)

Dead bees on bottom boards	Bee Behaviour	Brood pattern	Queen/ Swarm Cells	Queen Presence	Queen Condition (egg laying)	Colony Strength (Bee population)	Comb building	Drone cells	Aggres-siveness (jumping, stinging)	Cleanliness
N = none F = few S = several E = excessive	Normal Abnormal (Bees not flying, lethargic, disoriented, crawling, twitching)	P = poor A = acceptable VG = very good	Number	Yes No	P = poor A = acceptable VG = very good	P = poor F = fair S = strong C = crowded	P = poor A = acceptable VG = very good	N = none F = few S = several E = excessive	L = low A = average H = high	(e.g. number of cells cleaned out of 100 cells killed with liquid nitrogen after 24 hours)

Honey and Pollen Stores and Production					
Honey and Pollen Reserves L = low A = average H = high	Are reserves sufficient until next inspection? Yes/no	Honey Production: # frames of honey stores, hive weight, kg of honey	Honey Production Trend: Up Down Steady	Pollen Production: # frames of pollen stores, kg of pollen	Describe frame additions, removal, exchange

3.0 Monitoring and Treatment

Year _____ Apiary # _____ (keep one record for each apiary each year)

Varroa Mites									
Hive #	Inspection Date	Mite count (Level)	Describe Cultural, Physical, or Mechanical Treatments	Chemical Treatment Type	Comments (e.g. dose if different than label rate, environmental conditions)	Treatment date applied	Treatment date removed	Administered by	Efficacy

Tracheal Mites									
Hive #	Inspection Date	Mite count (Level)	Describe Cultural, Physical, or Mechanical Treatments	Chemical Treatment Type	Comments (e.g. dose that differs from label rate, environmental conditions)	Treatment date applied	Treatment date removed	Administered by	Efficacy

Nosema Disease								
Hive #	Inspection Date	Infection level	Describe Cultural, Physical or Mechanical Treatments	Chemical Treatment Type	Comments (e.g. dose that differs from label rate, environmental conditions)	Treatment date applied	Administered by	Efficacy

Other Diseases									
Hive #	Inspection Date	Disease type	Describe Cultural, Physical, or Mechanical Treatments	Chemical Treatment Type	Comments (e.g. dose that differs from label rate, environmental conditions)	Treatment date applied	Administered by	Efficacy	Comments (notifiable diseases, bee inspector, quarantine etc. if applicable)

Small Hive Beetle									
Hive #	Inspection Date	SHB observed (yes/no)	Describe Cultural, Physical or Mechanical Treatments	Chemical Treatment Type	Comments (e.g. dose that differs from label rate, environmental conditions)	Treatment date applied	Administered by	Efficacy	Comments (notifiable pest, bee inspector, quarantine etc. if applicable)

Wax Moths								
Hive #	Inspection Date	Presence or damage N = none L = low M = moderate H = high	Describe Cultural, Physical or Mechanical Treatments	Chemical Treatment Type	Comments (e.g. dose if different than label rate, environmental conditions)	Treatment date applied	Administered by	Efficacy

4.0 Bee Susceptibility to Pests

Year _____ (keep one record for each apiary each year)

Apiary # or location	Apiary Placement					Transportation	Nearby apiaries		
	Landowner contact	Date Placed	Date removed	Crop	Stocking rate/ha	Beekeeper contact (if shared loads)	Beekeeper contact	Bee type	Distance

Apiary # or location	Nectar flow		Supplemental Carbohydrate feeding						Supplemental Protein feeding				
	Dates	Observations (e.g. crop stand, alternate foraging/ water source)	Type/ Source	Added treatments	Quantity Placed	Quantity consumed	Date placed	Date removed	Type/ Source	Quantity Placed	Quantity consumed	Date placed	Date removed

Apiary # or location	Weather	Crop Pesticide Applications								Disturbance
	Extremes and dates	Date and time	Name of applicator	Weather conditions at time of spraying and +/– 2 days	Pest target	Pesticide, formulation, rate	Distance between apiary and field sprayed	Observed impact on bee health	Result of bee sample test	Observations

5.0 Sales and Shipments

Date Shipped	Item (description) queens, bees, bee products, bee equipment, beekeeping inputs, etc.	New/ used	Quantity	Shipped to whom	Shipped to what location	Shipping method/ carrier	Treatments applied before shipping	Health history and status	Originating reference (e.g. parent colony, hive #, apiary)	Documentation Provided	Comments from customer

6.0 Equipment

Equipment Type	ID number	Quantity	Location	Acquisition					Inspection			
(e.g. hives, brood chambers, brood frames, honey supers etc.)	Hive #, Lot number etc.	number of units in lot if more than one	Apiary or storage facility	Date Acquired	New or used	Treatments before/after receipt	Supplier	Documentation	Date	Who inspected	Condition N = new G = good R = repair needed D = disposed	Observations & Notes

Equipment Type	ID number	Disposal			Repair				Disinfection				Anticipated replacement date	Comments on equipment performance
(e.g. hives, brood chambers, brood frames, honey supers)	Hive #, Lot number etc.	Who disposed of	Method	Reason (damage, scheduled cull, AFB)	Date repaired	Who repaired	Describe repair	Reason (routine, rodent damage, etc.)	Treatment date	Who disinfected	Disinfection method	Reason (routine, AFB, etc.)	year	(e.g. tight fit, tendency to rot or rust)

7.0 Facilities

Facility	System	Equipment	Inspection				Repairs and Upgrades			
Indoor wintering facility, honey house, supplies storage, garage, etc.	Heat, ventilation, humidity control, CO_2 monitor, etc.	Vehicles, fork lifts, moving equipment, processing equipment, etc.	Date inspected	Who inspected	Condition N = new G = good R = repair needed D = disposed	Observations & Notes (e.g. bee tight, debris, cleanliness, damage, accuracy of monitors	Date repaired	Who repaired	Describe repair	Reason (routine, damage, etc.)

Facility	Cleaning				Disinfection					Anticipated replacement
Indoor wintering facility, honey house, supply storage, garage etc.	Date cleaned	Who cleaned	Method (e.g. sweeping, power washing)	What cleaned (floors, walls, vehicles)	Treatment date	Who disinfected	Disinfection method	What disinfected (walls, floors)	Reason (routine, AFB, etc.)	Year

8.0 Supplies Inventory

(Keep one record for each type of production input that is used in the operation, updating at least annually.)

Product _____											
Date Received	Quantity	Cost	Supplier	Lot Number	Expiry Date	Date Used	Apiary or hive placement identifier (i.e. where product used)	Inventory at Year end	Estimated quantity to order for next production year	Notes: product rotation plan	Comments: Application, efficacy, storage conditions, supplier reliability, order lead time required

9.0 Contacts

Type	Name	Title	Organization	Address	Telephone Number	Email	Website	Date contact last updated
Provincial apiarist/veterinarian								
Extension specialist								
Bee inspector								
Other regulating authority								
Beekeeping association								
Diagnostic services								
Suppliers								
Customers for bees/supplies								
Neighbouring beekeepers								
Landowners where bees are placed								
Customers for custom pollination								
Hired transport								
Staff								

10.0 Visitor Log (if under quarantine order or if high-risk alerts in area)

Name	Location visited	Reason for visit	Date	Arrival time	Departure time	Sanitation procedures to carry out when returning from/ going to other operations

11.0 Training

Name of Employee	Position	Supervisor or trainer	Date started	Experience	Courses attended, qualifications, and certificates (program and date)	Date of initial orientation on biosecurity for operation	Date of last update	Date and confirmation that Standard Operating Procedures have been read and are understood

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
Federal Government - Canadian Food Inspection Agency – Office of Animal Biosecurity (OAB) Project Management Team	
Tim Talbot	Biosecurity Specialist, OAB
Lorne Jordan	Chief Biosecurity Specialist, OAB
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