Best Management Practices

Simon Fraser University Honey Bee Research Colonies

This document contains general best practices for honey bee colony management, followed by recommendations that apply more specifically to colonies maintained at SFU for research purposes.

General Management

It is recommended to maintain a record book to log management, pest controls, etc. The Canadian Honey Council has recently commissioned an online Bee Biosecurity Handbook containing practical tools/spreadsheets for recording pests, colony health, treatments, etc. These record keeping tools may be downloaded either as pdfs, or in modifiable formats as word or excel documents that may be accessed at: http://www.honeycouncil.ca/handbook.php

Whichever method is used - whether spreadsheets or a simple notebook, it is important particularly for research colonies to record management, pest levels, and treatments. It is also recommended to label colonies with weather-proof labels to allow for reference to specific colonies in management documents and decision-making.

1) Colony lay-out: where possible, colonies are best oriented in an east, south, or west facing direction, with good exposure to the sun, and some buffer/protection from strong winds, generally on the north side. Bees also need access to water both for cooling in summer and to dilute stored honey for consumption and will therefore make use of nearby streams, ditches, ponds, swimming pools, or hot tubs. To avoid nuisance bee behaviour around neighbouring water sources, beekeepers may want to provide fresh water with “floaters” on top for bees to land on and prevent drowning. Water with a salt content or a specific scent may become very attractive to bees.

2) Equipment: colonies need to be housed in sound, clean equipment, in an appropriate size for the quantity of bees in the cluster. This will change throughout the season as the colony grows or shrinks, generally starting with one standard deep Langstroth box filled with 10 deep frames. Drawn-out frames that have been previously used by bees may need to be “decontaminated” if there is suspicion of previous disease such as American foulbrood, chalkbrood, or nosema disease because remaining spores may still be active and may infect new colonies placed in the old equipment. Boxes of old equipment may be sterilized by electron beam irradiation – in BC
the Iotron facility in Port Coquitlam provides this service for beekeepers (see Useful Information, p.7). Screened bottom boards are useful as a passive way to regularly remove a small proportion of phoretic mites and also in pest monitoring for Varroa mites using a sticky board underneath the screen. Generally, colonies are provided with both a lower and an upper entrance, which promotes good air flow throughout. Depending on time of year, proximity to other colonies, and size of the colony, entrances may need to be partially or severely reduced to allow the colony bees to more easily defend against potential invaders/robbers such as wasps or bees from neighbouring colonies. A secure inner cover with a front opening sits on the hive box, topped by a larger waterproof hive lid.

3) Bees: bees can either be sourced locally as packages or nucleus colonies in spring/summer or ordered from offshore (eg, NZ) in late winter and spring as packages.

4) Feeding: honey bees need supplemental feeding at certain times of the year when local nectar and pollen are unavailable or weather prevents access. Beekeepers need to be aware of such dearth periods and keep their colonies well-fed to prevent starvation or robbing from nearby colonies. Colonies being newly established from packages will need continuous sugar syrup feeding for the first 1-2 months, plus supplemental pollen patties. Sugar syrup is fed from within the colony, either using a frame feeder or a top feeder that is enclosed so only the colony bees have access.

5) Yard hygiene: good beekeeping practices can greatly impact the health and well-being of individual colonies. These include:
   a. Keep all comb and hive parts securely closed and put away so bees cannot visit/rob/transfer disease between colonies.
   b. Only provide supplemental food (sugar syrup, pollen) from within individual colonies to avoid communal transfer of disease (ie, no barrel feeding).
   c. Avoid leaving scraps of burr comb and bottom board scrapings, etc. in the bee yard – they should be bagged and removed from the apiary to prevent potential disease transfer.
   d. Avoid spilling sugar syrup when feeding as this may instigate robbing behaviour.
   e. Narrow down colony entrances in times of dearth or with small colonies to allow for adequate colony defense from wasps and other bees.
   f. Hive tools should be regularly cleaned and scorched to help prevent transfer of disease between colonies.

6) Queen/brood management - queen and/or brood checks should be done regularly:
   a. Late winter/early spring – to confirm queen has survived the winter broodless period
   b. Late spring – to monitor for potential swarming preparations
   c. Late summer – to gauge the queen’s productiveness and decide whether she can last the winter or if the colony needs to be re-queened
   d. Late fall – to ensure the queen is still producing well as the colony prepares for winter.
   e. Queen replacement – every 1-2 years, depending on history, queen quality, etc. Good quality local queens are available between May and September, and some may confer heritable Hygienic Behaviour traits to their worker force, which will aid in the reduction of pest and disease levels.
Pest Management

An Integrated Pest Management (IPM) approach is recommended, specifically including: learning the biology of specific pests of concern; using preventative cultural practices, mechanical controls and apiary hygiene; monitoring pest levels; determining treatment thresholds; only applying approved chemical controls when needed; following label instructions closely and rotating chemical treatments. A brief description and treatments for some of the most common pests and diseases follows, but the CAPA publication of Honey Bee Diseases and Pests, 3rd Edition (see references) is highly recommended for a more solid background.

**Brood diseases:** brood inspections should be done regularly, but at a minimum in spring, summer, and fall. At least 3 frames of brood in each colony should be examined. Hygienic queens will provide some resistance to brood diseases.

1) American foul brood – look for perforated cappings, scale or brown/dead larvae that are sticky or ropey with a strong foul odour. Suspected AFB samples may be sent to the BC Ministry of Agriculture (BCMAL) for confirmation. As AFB produces persistent long-lived spores, treatment includes removing infected frames for burning or autoclaving/disposal and putting bees onto foundation or clean comb and feeding sugar syrup with oxytetracycline (see BCMAL Bulletin#205). Severe infections may require killing off the colony and burning all frames. It is essential to keep suspect frames/colonies secure before removal from the yard so that bees in other nearby colonies do not rob them and thus also become infected.

2) European foul brood (EFB) – signs of EFB include discoloured, twisted larvae and a strong sour smell. Treatment – oxytetracycline (see BCMAL Bulletin#202)

3) Chalkbrood – signs of chalkbrood are larvae/pupae turning into white chalky mummies, which may eventually turn black. There is no treatment for chalkbrood other than requeening with hygienic lines of queens which are more resistant to brood diseases. Comb can be irradiated at Iotron to prevent reinfection of new bees with leftover spores or chalkbrood mummies.

**Adult disease:** Nosema – signs of nosema infection include weakened colonies and dysentery either on the front of the colony or on the top bars. Nosema infection can be confirmed by sending a sample of bees to BCMAL. Treatment is with Fumagillin in sugar syrup (see BCMAL Bulletin#203).

**Varroa mites** – currently the biggest honey bee pest management problem: monitoring mite levels must be done in spring, mid-summer (after honey removal) and fall, followed by mite treatments if necessary (see BCMAL Bulletin#222, Varroa mite detection methods) and re-monitoring to be confident the treatment was effective. Common methods of monitoring for Varroa mites include (most to least accurate) using sticky boards under screened bottoms for 24h or 48h, by collecting a sample of 200-300 bees and either washing in alcohol to determine % infestation or using an icing sugar shake, or using an uncaping fork to examine drone pupae for mites (least accurate). The Canadian Honey Council recommendation for immediate treatment (=high levels of mites) is:
Sticky board, natural drop, 24h  5 mites
Alcohol wash  3-4 mites/100 bees
Sugar shake  3 mites/100 bees

This is a general guideline only, and will depend on size of colony, amount of sealed brood, etc. Checking mite levels post treatment is also recommended to ensure that the treatment was effective. The biggest issue with Varroa mites is their capacity to vector viruses between bees as they puncture and feed on new bee hosts. These viruses include: Kashmir bee virus, Deformed wing virus, Black Queen cell virus and several others (see BCMAL Bulletin #230, Honey bee viruses). A colony with very high levels of mites (and also high virus levels) may exhibit disease symptoms characterized as “Parasitic Mite Syndrome” in which the mite/virus complex causes the population to decline, brood becomes sick, larvae die and turn grey or brown in the cell, and adult bees may have shriveled or deformed wings. At this stage, even with treatment for Varroa mites, the colony may not survive, as there may not be enough healthy bees remaining to regenerate a level of robustness.

Mite treatments – the choice of mite treatment will depend on time of year, temperature, timing of seasonal honey flows, and severity of infestation (see BCMAL Bulletin #221, Varroa Mite Controls). All colonies in the yard should be treated at the same time to avoid mite transfer via drifting bees from untreated, infested colonies to those that have just been treated.

SFU Beekeeping Challenges

Several challenges present themselves in keeping research colonies at SFU. These include: high elevation, which often means more cold, snow, and rain than other Lower Mainland locations with less good forage weather; reduced amount of forage due to the high density of forest lands surrounding the university; long distances for workers to fly to obtain forage; predation by bears; frequent intrusions by researchers/students to carry out experimental requirements (possibly endangering the queen); periods of neglect by researchers/students when other priorities prevail; un-harmonized bee management priorities of different user groups; potential lack of bee management expertise by users.

Specific SFU Recommendations:

Winter preparation: Insulation or wrapping. It is recommended that at a minimum, colonies are provided with insulation between the inner cover and outer hive lid. Colonies may also be wrapped in tarpaper or commercial bee blankets. This is not generally done in southern BC but at SFU if researchers require access inside the colonies to retrieve bees throughout the winter months, exterior wrapping will help to keep the cluster loose and possibly allow for more brood rearing longer into late fall and earlier in January/February. If exterior wrappings are used, care must be taken to ensure bees can access the upper and lower entrances, which are also necessary for ventilation.

Fall feeding: Colonies should be well fed with sugar syrup in late summer/early fall so that they will have enough stores to maintain the cluster throughout winter, and the cluster should be large enough that the colony can retain its core temperature and survive the cold, wet winter period. It is
recommended for a single deep colony to weigh 60 lbs and for a 2-box colony to weigh 100 lbs prior to winter.

**Winter feeding:** SFU colonies may require more frequent feeding than colonies in other areas of the Lower Mainland due to the lack of forage and good foraging conditions. If colonies become light (=low food stores) between the months of November to February, spare stored honey frames can be placed immediately adjacent to the cluster. If spare honey frames are not available, a paper towel or coffee filter can be placed directly on the upper bars onto which granulated sugar is directly placed and sprayed lightly with water or sugar syrup. Dry granulated sugar may also be placed on the inner cover if the cover has a hole through which bees can access the sugar, although it may not be consumed as readily. It is not recommended to feed sugar syrup during the winter months due to the high levels of moisture this will create in the colony and the inability of bees to evaporate that moisture in cold temperatures.

**General Feeding:** Beginning in February, SFU colonies will benefit from being fed pollen supplement patties. Throughout the spring, pollen patties may be replaced as they are consumed until sufficient forage becomes available for brood rearing to be maintained without supplements (usually April/May). Sugar syrup can be fed beginning in mid-March once temperatures reach 12-15C, and it is recommended that feeding be coordinated so that all colonies in the apiary are fed at close to the same time to prevent robbing by bees from colonies that don’t get fed.

**Preventing Bear Damage:** Bears on Burnaby Mountain constitute a threat to SFU honey bee colonies and equipment from spring through to fall, especially when cubs are present. Bears quickly develop a taste for honey and even more so, the honey bee brood which is a great source of protein and lipids. Even within the compound behind a 6-8 foot galvanized fence, bears can still gain entry – both by climbing adjacent trees, and digging underneath the fence. Therefore a well-grounded electric fence is recommended, and it must be kept turned on 24/7.

**Swarm control:** Colonies need to be provided with ample space to contain stored food and brood, with empty combs in which the queen has room to lay, in addition to adequate space for an increased population of workers throughout the spring and summer. This can be accomplished by providing additional brood boxes and/or honey supers prior to a honey flow, and also by spacing out congested frames of brood, alternating with empty frames to relieve congestion. (See BCMAL Bulletin #404, Swarming)

**Colony manipulations:** Researchers using SFU colonies need to be cognizant of the other colonies in the apiary and as much as possible keep frames covered/inaccessible to other bees while a colony is open in order to prevent stimulating robbing behaviour. This can be done by temporarily placing removed frames into a spare lidded nucleus colony box while the parent colony is being manipulated. If colonies need to be kept open for a considerable period of time for experimental reasons during dearth periods, a robbing cage can be used. This is just a fully screened cage (such as a camping/dining shelter) that can temporarily be placed around an open colony to prevent access by bees from other colonies. Similarly, during the rain if a colony needs to be kept open for a long time for research needs, a large umbrella can
be put over the pallet to help prevent colony damage. Generally it is best to avoid extensive colony manipulations during inclement weather or periods of robbing.

**Pest Controls**: It is recommended to monitor regularly and keep pests below high threshold levels to prevent damage/loss of colonies. Required treatments should be applied to all colonies in the apiary at a similar time to avoid transfer of pests/pathogens via drift of infected/infested bees from untreated colonies back to those that have just been treated. It is crucial to keep colonies as healthy as possible and maintain good beekeeping practices in order not to negatively impact other colonies and research projects in the same apiary.

**Summary**

Honey bee colony management at SFU comes with challenges related not only to the geographical area, but also to the specific research demands for which the bees are required, often necessitating much higher frequencies of manipulation and disturbance than colonies that are kept for honey production or pollination. Research colonies will therefore often benefit from a higher level of nutrition and care than is required by regular colonies kept for other purposes. With that in mind, BCMAL Bulletin #103 – the Beekeeping Calendar for British Columbia, is a useful guide to conditions that may be expected throughout the year, with the understanding that wet winter conditions are generally more prevalent and last longer on Burnaby Mountain. The BCMAL Seasonal Management Bulletins will also provide some good background for colony management throughout the year.

Although beekeeping at SFU may come with challenges, in balance, honey bee research colonies offer far more rewards than challenges, including a highly manageable research organism for answering our questions, and the opportunity to understand and become immersed in the unique and fascinating world of bees.

Written by Heather Higo, MSc
March 2016
References:

Eccels, Les; Kempers, Melanie; Thurston, Daniel; Gonzales, Raquel. *Honey Bee Best Management Practices: Canadian Industry Gap Analysis and Harmonization*


BC Ministry of Agriculture and Lands Beekeeping Bulletins (see Useful Information below for specific topics)

http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/animal-production/bees/beekeeping-bulletins

Canadian Honey Council (online) Bee Biosecurity Handbook (by Svenja Belaoussoff – presented at BCHPA Semiannual General Meeting, Kamloops, BC. March 12, 2016)

http://www.honeycouncil.ca/handbook.php


Useful Information: (these bulletins may be printed off from the BCMAL website (above) for quick and easy reference)

1. BCMAL Bulletin #103 – Beekeeping Calendar for British Columbia
2. BCMAL Bulletin #202 – European Foulbrood
3. BCMAL Bulletin #203 – Nosema
4. BCMAL Bulletin #204 – Antibiotics for the Control of Bee Brood Diseases
5. BCMAL Bulletin #221 – Varroa Mite Controls
6. BCMAL Bulletin #222 – Varroa Mite Detection Methods
7. BCMAL Bulletin #223 – Pettis Test- Detecting Varroa Mite Resistance to Apistan, Apivar, and Coumaphos
8. BCMAL Bulletin #230 – Honey Bee Viruses
9. BCMAL Bulletins #401, 404, 406, 410, 411, 414 – Seasonal Management
10. Iotron Industries Canada Ltd. (Electron beam processing services) 1425 Kebet Way, Pt. Coquitlam, BC V3C 6LC (604)945-8838 Contact: Peter Burgess pburgess@iotron.com
**Sample (modifiable) Spreadsheet from online CHC Bee Biosecurity Handbook:**

<table>
<thead>
<tr>
<th>Bee: colony assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>person responsible for this record:</strong></td>
</tr>
<tr>
<td><strong>bee yard # / location</strong></td>
</tr>
<tr>
<td><strong>assessment date (d/m/y)</strong></td>
</tr>
<tr>
<td><strong>colony moved from another location since last assessment y/n</strong></td>
</tr>
<tr>
<td><strong>queen presence y/n</strong></td>
</tr>
<tr>
<td><strong>if y: condition</strong></td>
</tr>
<tr>
<td><strong># queen / swarm cells</strong></td>
</tr>
<tr>
<td><strong>brood pattern:</strong> p=poor a=acceptable vg=very good</td>
</tr>
<tr>
<td><strong>colony strength:</strong> p=poor f=fair s=strong c=crowded</td>
</tr>
<tr>
<td><strong>comb building:</strong> p=poor a=acceptable vg=very good</td>
</tr>
<tr>
<td><strong>aggressiveness (jumping, stinging):</strong> l=low a=average h=high</td>
</tr>
<tr>
<td><strong>winterability:</strong> p=poor a=acceptable vg=very good</td>
</tr>
<tr>
<td><strong>dead bees on bottom boards approximate #:</strong> n=none f=few s=several e=excessive</td>
</tr>
<tr>
<td><strong>mite levels:</strong> l=low a=average h=high</td>
</tr>
<tr>
<td><strong>drone cells:</strong> n=none f=few s=several e=excessive</td>
</tr>
<tr>
<td><strong>cleanliness:</strong> # cells cleaned out of 100 cells killed with liquid nitrogen after 24 hours</td>
</tr>
<tr>
<td><strong>bee behaviour:</strong> normal / abnormal (bees not flying, lethargic, disoriented, crawling, twitching)</td>
</tr>
<tr>
<td><strong>sufficient honey and pollen reserves until next inspection? y/n</strong></td>
</tr>
<tr>
<td><strong>honey production:</strong> (e.g., # frames of honey stores, hive weight, kg of honey)</td>
</tr>
<tr>
<td><strong>honey production trend:</strong> up, down, steady</td>
</tr>
<tr>
<td>pollen production:</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>(e.g., # frames of pollen stores, kg of pollen)</td>
</tr>
</tbody>
</table>

| describe frame additions, removal and exchange |

| required beekeeper action: |
| (e.g., treatments, feed) |

| Initials | | | | | | |