



Beekeeping depends on mentorship and hands-on experience, so it is great to share your hives and time with others. Make sure that you are careful when you visit neighbor hives, or when you have visitors or helpers work with your bees. Request that they wash suits, or even better, have some spares on hand that they can use. Don't allow visitors to bring high-risk items like gloves or hive tools, and make sure that everyone washes up before and after they work with the bees.

Beekeeping Basics

Biosecurity in the Bee Yard

by MEGHAN MILBRATH

Biosecurity is a set of preventative measures designed to reduce the risks of infectious disease transmission to and among livestock. It means doing everything you can to reduce the chances of an infectious disease being carried onto your farm/property by people, animals, equipment or vehicles. Biosecurity is a key part of raising livestock, and most people who are raising other animals take biosecurity really seriously. In the beekeeping world, while we often talk about disease treatments, we rarely discuss biosecurity, and almost no one has detailed biosecurity plans for their beekeeping operations. The topic of biosecurity wasn't really on my radar either, until I started to work with veterinarians, and we started to compare disease management between bees and other livestock. The more we talked, the more I realized how many bees and beekeepers could benefit if more beekeepers had biosecurity plans and incorporated biosecurity principles.

Last winter, I was invited by the University of Hawaii Extension to train veterinarians through hands-on bee clinics at multiple farms around the state. As employees of the Department of Ag and University Extension, we wanted to make sure that we could not be the cause of bringing disease to these host farms, so we followed strict biosecurity guidelines. I was asked not to bring any beekeeping equipment whatsoever from the mainland, and when I arrived at each location, the tires of our vehicle were sprayed with disinfectant prior to even entering the property. Before I opened my car door, I was handed booties so the soles of my work boots would never touch the ground. I wore nitrile gloves, and used only tools that were already present in the yard. We were practicing good biosecurity measures to minimize the chance of disease introduction. I thought about how many times beekeepers have shown up to a class with dirty suits, tools, and boots, and no discussion at all about disease introduction.

I also raise pigs, and I have learned a lot about biosecurity from the swine professionals at Michigan State University. When I get my feeder pigs from the breeding facility, there are clear signs directing me where to go, keeping me off most of the farm, and far away from the breeder sows. Doors are locked to visitors, and all employees go through

a thorough shower in/shower out process every day. The facility takes great care not to introduce new pathogens to the herd, because they know how quickly a disease can spread through animals in close contact. I can compare this to people who purchase queens, driving directly from their bee yard to the queen producer, and going right back into the hives, with no consideration on either farm about when and where they are contacting bees.

Some beekeepers may practice excellent biosecurity, but most beekeepers do not give biosecurity and disease prevention the same level of planning and attention as many other types of livestock operations. Granted, there are many differences between beekeeping operations and other livestock. No other livestock is as mobile, crisscrossing around the country, and no other livestock intermingles as much (could you image if cattle drifted or robbed other yards?!). However, these characteristics of the apiculture industry are all the more reason that beekeepers need to be extra vigilant about biosecurity.

Biosecurity is a set of everyday methods/practices/protocols that will prevent or greatly reduce the introduction of diseases or pests to farm animals (external biosecurity), and also to contain the spread of any disease between farm animals (biocontainment). Beekeepers should develop a set of methods/practices/protocols to prevent the spread of disease at multiple levels:

- Prevent pests and diseases from coming into our yards or operations.
- Prevent the spread of pests and diseases from hive to hive.
- Prevent the spread of pests and diseases from yard to yard.
- Prevent the spread of pests and diseases from our operation to other operations.

A good beekeeper should have a set of preventative measures designed to reduce the risk of introduction and spread of pests or diseases in bees and they should have a plan to minimize the impact of pests and diseases on their bees and on other beekeepers.



Your plan should include an explicit protocol for old and broken equipment, so it is not left around like in this photo. Include steps for where equipment is stored, how to decide what to cull, and how it is destroyed. Include further detailed instructions for what to do if the equipment came from a diseased hive. Too often beekeepers leave old equipment to deal with later, and it can represent a disease and pest risk to colonies in the area.

You may view a biosecurity plan as a lot of extra work and cost. However, good biosecurity can easily save you money in the long run. Biological pests and pathogens are incredibly costly to beekeepers, and can result in extremely large, but often unaccounted for expenses to many beekeeping operations. Everyone knows that a healthy colony will make much more honey than a diseased colony, yet very few beekeepers actually account for the cost of diseased-caused crop loss in their balance sheets. How much money did you lose because your colony had EFB all summer? How much time did your bees spend pulling out diseased brood and hive beetle larvae instead of making honey? How much did it cost you to drive to your bee yard an extra time to apply a treatment? Most beekeepers do not know the economic impacts of disease on their operation. Not only do diseases and pests cause loss in honey yields, but they also cause damage to or loss of equipment, increased labor costs, treatment costs, and loss of bees. When honey prices are low and pollination contracts can fluctuate, it is essential that beekeepers examine their operations to ensure that they are minimizing their losses from disease.

It is not enough to just think about disease risk. A good biosecurity plan should include all partners and employees, it should be written down, and it should be reviewed and updated every year. You should structure your plan to include everyday practices as well as protocols in the case of an outbreak or an emergency. The Healthy Farms Healthy Agriculture program (<https://www.healthyagriculture.org/>) has many resources to help you understand the basic aspects of biosecurity. They provide the following tips:

- Remember, planning is a process. Start where you are now.
- Implement a few important things first; add more later.
- Determine what will or will not fit in the daily routine.
- Plan ahead with protocols that everyone on the farm and visitors will need to follow if an outbreak occurs.
- Include a process for observing and monitoring herd health, and for reporting unusual or suspicious signs.
- Be sure to communicate to employees and visitors about your biosecurity protocols and how they can comply.

WHAT SHOULD A PLAN INCLUDE?

The first step is to evaluate your risk. Think about both pests and pathogens. Consider where disease can enter your operation: purchased equipment, robbing bees, contaminated extraction facilities, or on the tools or hands of visitors. Also consider how easy it is for disease to spread within your operations. How do you move and store equipment? What hygienic measures do you take between yards? What periods are your bees especially stressed or susceptible to disease? In beekeeping our greatest risks are usually from moving between yards, visitors/other beekeepers that visit our bees or farm, and purchasing equipment and bees. Your bees may have other risks. Maybe you are in a high-density bee area. Maybe you need to reduce drifting within the yard, or maybe you have decades of old equipment lying around that are supporting pests.

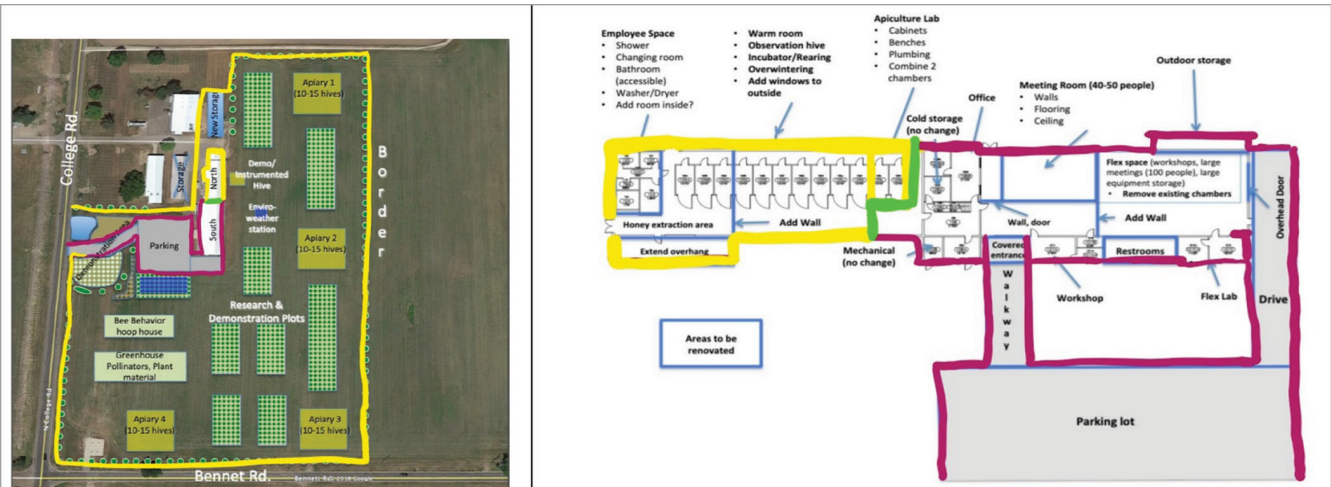
Once you have evaluated your key risks, write out protocols to prevent disease introduction and spread. Use templates for other livestock or other countries; Canada¹ and Australia² have lots of guidelines, and the Healthy Farms Healthy Agriculture Initiative has biosecurity plan documents and templates so you can get started on building a plan for your operation (<https://www.healthyagriculture.org/prevent/biosecurity-plan/>). Take advantage of local professionals. Food animal production veterinarians are used to working with livestock producers to develop customized biosecurity plans for agricultural operations; a local food animal vet may have examples of other plans, or they may be willing to work with you to develop one. Use state and federal resources; get to know your state Apiary inspector, your extension specialists, and Bee Informed Partnership Tech Transfer Team members. All of these specialists can keep you up to date on current outbreaks and reportable diseases.

Once you have a plan, the most important thing is that you actually use it. A plan won't be useful if you and others in your operation don't follow your own guidelines, so make sure you focus on changes that can reasonably be implemented. A biosecurity plan only works when it is followed consistently. It is important to take the time to develop a comprehensive biosecurity plan, but it is even more important to make sure that it will work for your operation. Make sure you have a plan that is manageable and appropriate for you and your bees.

There are three main aspects to biosecurity: eliminating sources of infection from outside your operation, limiting disease spread within your operation, and paying attention to the susceptibility of your animals.

Common elements of a bee biosecurity plan:

- 1) Methods to reduce incoming sources of infection:
 - a. Find ways you can limit people and vehicle traffic. Use a perimeter buffer zone to control who enters your property and a line of separation to protect beehives from exposure.
 - b. Enforce downtime away from bees — ask that beekeepers who come to work with your bees not be in other hives for a day ahead of time.
 - c. Make sure that visitors are aware of your guidelines — no outside equipment, washing hands, clean suits — and maintain a visitor log.
 - d. Thoroughly vet sources of equipment, supplies, and bees, and only purchase from people who also have good systems for monitoring and managing disease. If possible, sterilize incoming equipment before use.



The figure on the left is an overhead view of a honey bee facility that is used for keeping bees, but also has visitors. The yellow line is the "perimeter buffer area" that indicates the entire facility. The main building through itself is outlined by a "line of separation." A closeup of the building is shown on the right, with clear boundaries for visitors (red), and employees only (yellow). Boundaries should be clearly mapped and marked, and all employees and visitors should be aware of the requirements and training for each area.
Figure by Katie Lesko

- e. Isolate new and arriving bees and equipment, and do not mix into your operation until you are sure that they are safe.
- 2) Methods for limiting spread within your operation:
- a. Wash hands between each yard. Use soap and water if possible, and use hand sanitizer when washing is not possible.
 - b. Use washable boots and disposable gloves when possible, especially when dealing with diseased, suspect, or outside hives.
 - c. Keep written hygiene standards for workers and tools — clean smokers, hive tools, and other apary equipment of wax and propolis, and practice frequent washing and disinfection. Keep multiple hive tools on hand so you can easily switch between yards or after sick hives. Bring a spray bottle of 50% bleach solution to spray down harder-to-clean items like leather gloves and smoker bellows, and scrape off wax, propolis and hive materials often.
 - d. Implement practices to reduce robbing and drift, including careful hive placement, use of multiple colors, entrance reducers, and quick removal of weak colonies.
 - e. Use a quarantine yard to isolate new or sick hives.
 - f. Develop disease surveillance and management plans for both general practice and emergency response. Early detection means easier control. Actually develop a schedule and budget for sample testing.
 - g. Keep track of woodenware and implement a barrier system (divide your operation into smaller sub-units) to prevent operation-wide outbreaks or contamination. Use spray paint or other visible markers so everyone can easily keep equipment separate.
 - h. Develop a protocol for sanitizing extraction equipment.
 - i. Control nuisance pests by cleaning or burning old equipment quickly or through targeted pesticide use. Clean up deadouts and old wax as quickly as possible. Consider the cost to your own operation as well as to others in your area.
 - j. Think about places where you can "drag" pathogens around all day — frequently clean things you often touch like phones, steering wheels, handles, etc.
 - k. Keep clean spare gear ready, and have a plan for quickly dealing with contaminated equipment and tools.
- 3) Methods to reduce susceptibility:
- a. Identify times of high risk or stress and consider practices to improve health during these times.
 - b. Focus on consistent good nutrition.
 - c. Deal with weak or queenless hives immediately.
 - d. Never let varroa levels reach damaging levels.
- Be realistic about the changes you include. You don't have to change all of your practices in one season. Pick a few goals that can easily be changed or improved in the short term. Make a list of long-term goals to achieve when feasible. Remember to train and inform staff and visitors.



An MSU bee truck after working a yard of sick colonies. We did some things right here — note the bucket of bleach water for used hive tools and the in-field hive tool cleaning station. We also changed out nitrile gloves after each sick hive. It would have been even better if we had created a checklist so that we would have remembered to bring a trash bag.



Think about where you leave hive materials, and make sure your protocols are detailed enough to guide you through every situation. In this photo, we are cleaning out a dead hive. If this hive died of starvation, we may be fine leaving the dead bees right in the yard. If the hive could have died from disease, it may be better to scrape them into a bucket for safer disposal. Write out how you will deal with cleaning woodenware, hive tools, and your hands after dealing with dead colonies.

Biosecurity requires the cooperation of everyone who is in contact with your bees. Evaluate your plan and adjust it accordingly. Maybe set a yearly review where you evaluate compliance, efficiency, costs, etc. Remember, compliance is key — a plan only works if you can follow it, and it improves your operation.

Regardless if you are a hobby beekeeper or a huge commercial producer, we can all improve the way we prevent and manage diseases. We can be motivated by the costs of pests and diseases to our own operation, but we must also consider the costs to the industry on the whole. Currently, honey bees in the United States experience incredibly high rates of disease — not only varroa mites, but bacterial and fungal diseases like EFB and chalkbrood. Thousands of colonies are lost annually to disease, and a lot of money is spent treating disease. Most honey bee diseases and pests are maintained only in honey bee colonies. This means that we as beekeepers have a lot of control and a lot of responsibility to reduce the disease risk and the disease burden shared by other beekeepers. While it may seem that implementing a barrier system or washing hive tools daily are extra work, it is not unnecessary work. Taking the time to create and implement a proper biosecurity plan can significantly reduce overall long-term costs, and can help protect the health of bees in your operation and throughout the country.

REFERENCES

- 1 <https://www.inspection.gc.ca/animal-health/terrestrial-animals/biosecurity/standards-and-principles/honey-bee-producer-guide/eng/1378390483360/1378390541968?chap=0>
- 2 <https://beeaware.org.au/wp-content/uploads/2019/05/Biosecurity-Manual-for-Beekeepers.pdf>

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