Thriving Hives: Cleaning and Sterilizing Beekeeping Equipment

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Introduction

Honeybees are susceptible to many types of diseases and parasites, most of which can spread easily through equipment.[1] Your hives' health and safety depend on your attention to detail and efforts to keep your equipment clean and sterile. This includes all hive tools, frames, smokers, and even your protective clothing.

It is important to note that there is a difference between equipment being clean and equipment being sterile.[2] Cleaning equipment includes removing all visible contaminations on the surface, including dirt, dust, wax, propolis, etc. Sterilization involves completely eradicating microbes on the surface of the equipment, including bacterial spores, bacteria, viruses, and fungi. Both are important, but sterilizing equipment is an essential step in avoiding disease and parasites, reducing the likelihood of colony collapse and increasing the overall health and productivity of your hives. This document will examine the many details of proper equipment sterilization, including when and how to do so, and tips on how to maximize the health of your hive.

There are several different methods for sterilizing beekeeping equipment. The methods listed in this paper are not exhaustive but are some of the most cost-effective options. Each method has pros and cons, specifically in terms of what it will and will not address. However, it is important to note that the only way to get rid of American foulbrood (AFB) is to euthanize the infected colony and dispose of everything it has contacted.[3] Infected colonies may be treated with an antibiotic to keep them alive, but they will always be infected and may still pose a threat to other hives. It is possible to kill AFB spores through irradiation, but you will still have to euthanize the infected colony.[4]

Remember that any time you save honey or wax in frames, you run a higher risk of harboring harmful pathogens, spores, and insects. It is much harder to get rid of these things when they can hide in honey and wax. While there may be advantages to saving drawn comb and capped honey, many potential harms exist. Research shows that diseases like chalkbrood and nosema are spread by old comb.[5,6] Old comb is also 4 times more likely to carry varroa mites.[7] If you plan to save frames with drawn comb, the honey frames would be your best option. For more information on wax processing and wax moth, please reference additional Thriving Hives fact sheets.

When Should You Clean and Sterilize Your Equipment?

Beekeeping equipment such as hive tools, frame holders, and gloves should be cleaned thoroughly after each use to avoid transmitting diseases and parasites within the bee colony. Ensure that tools and protective clothing

are free of debris and propolis in between uses. It is especially important to clean your hive tools in between each use. There are several ways to do this, but the two most effective ways are detailed below.

If you acquire any tools or frames second-hand, it is critical to sterilize them properly. It is also important to sterilize all equipment before the first use each season or when moving tools from one apiary to another. If one of your hives dies, recognize this as another important time to sterilize, even if the dead hive wasn't diseased. If you suspect exposure to any pathogens or parasites, it is crucial to sterilize all equipment— everything. While this process doesn't guarantee that your bees will always be healthy and parasite-free, it decreases risk for your hives and helps give you confidence in knowing that you are doing everything you can to care for your hives.

Cleaning Hive Tools

Cleaning your hive tools regularly will go a long way in keeping your hives healthy. You will want to do a thorough cleaning at least once a month, but you should wipe down your tools with a cleaning cloth every time you use them. Here are some thorough cleaning options.

- **Option 1:** Use a propane torch to heat the hive tools until they are red-hot, which kills microorganisms. Once they have cooled down, scrub the tools with a bleach wipe to remove remaining debris. You can use a reusable cloth for this, but remember that propolis is notoriously impossible to get out, so use a cloth that is okay to ruin. You can also use disposable cleaning wipes easily found in stores or online. Some beekeepers prefer to use metal scrubbers like steel wool or Brillo pads, as they are most efficient at removing propolis.
- **Option 2:** Soak the tools in a 10% bleach solution overnight, scrub off any remaining debris, and rinse. Remember that whenever you use chemicals on your equipment, you must let them air dry before using on your hives again.[8]

Sterilization Steps

Precautions and Preparation

Take precautions to ensure your health.[9] Some sterilization methods may require wearing personal protective equipment such as gloves, face masks, goggles, aprons, or even a respirator. Before you begin sterilizing your equipment, ensure that you are familiar with the necessary precautions and that you have all the required protective gear.

In addition, it is important to gather all necessary equipment before you begin. It's a hassle to begin the process and then realize that you are missing the tools or materials necessary for effective sterilization. Have water, scrubbing tools, and a designated drying area prepared before you begin.

Select Sterilization Method

There are several methods to choose from, described in detail in the Sterilization Methods section of this fact sheet. The primary options are heat sterilization and chemical sterilization.[10] Irradiation is also an available method, but it is typically only a viable option for commercial beekeepers, as it must be done in a specialized facility.[11] Irradiation does work extremely well, so it is regrettable that it's not more widely available. If you live near a facility, you

may prefer sending your equipment for sterilization by irradiation. If not, the at-home methods are still great options.

In selecting your sterilization method, consider the materials used in making your equipment. Read the manufacturer's suggestions on what methods to use and heed warnings about what methods should not be used to keep your equipment from getting damaged and ensure it lasts longer. Become familiar with the method you select before beginning. Reading material from other trusted sources can help.

Additionally, consider what issues your hives are facing when selecting your method. If you have concerns about a specific problem and are not sure what method to select, it's always good to consult your apiary inspector for help. If you know or suspect that your hive has AFB, work with your inspector to dispose of contaminated equipment.

Initial Cleaning and Sterilization

Disassemble all equipment before you begin your cleaning to ensure that you can get debris from all the nooks and crannies. Your first step after disassembly is to freeze everything at 20 °F or lower for at least 24 hours. This step is important as it will kill harmful bugs that may be lurking on your equipment, including all stages of wax moths.[12] Note that this will not, however, kill bacteria, viruses, or harmful spores. At this point, if you are planning to store frames of wax or honey, refer to the fact sheet about wax moth prevention. Otherwise, scrape all remaining wax, propolis, honey, etc. off the frames with a hive tool and wash all surfaces thoroughly with water. You may want to use a hose or pressure washer to remove stubborn substances. It may also be useful to use boiling water for this step, which can melt and loosen some substances stuck to your frames.

Once your equipment has been frozen and cleared of debris, proceed with sterilizing. Be thorough and patient in this process. Remember that it will be time-consuming, so plan your schedule accordingly.

Drying and Inspection

After sterilizing your equipment, allow it to air dry in a clean environment. Do your best to keep it away from dust and insects to ensure that it doesn't get contaminated. After it has completely dried, inspect all equipment. Look for any damage and take note of remaining residue. Anything left on the equipment should be cleaned off, as bacteria and spores may be hiding underneath.

Reassembly and Storage

Once you are satisfied that everything is completely clean, reassemble anything that you've taken apart. Ensure that your chosen storage location is clean and dry, as this will help to prevent contamination. You should also check stored equipment regularly for pests, as wax moths may get in and contaminate everything, which would require you to repeat the whole process.[13] It is ideal to store your equipment in an airtight container. Alternately, using a clean and well-ventilated storage location is the next best option. By following these steps, you can help ensure that your beekeeping equipment remains sanitary and safe for your bees, reducing the risk of disease and pest infestation.

Sterilization Methods

Heat Sterilization Methods:

Torching

This sterilization method involves using a propane torch to heat the equipment's metal parts until they become red-hot. This process kills many types of bacteria and viruses on equipment surfaces as long as no other debris is present.[14] Once heated, allow the equipment to cool before use. This method is highly effective and costs very little. It also works quickly and requires little effort on your part.

You can also sterilize hive boxes using the torch method. When using this method on wooden hives, it's important to avoid creating any smoke, as you don't want the box to catch fire. The objective is to simply char the wood. It is crucial to get all the nooks and crannies of the hive box thoroughly to ensure that everything gets sterilized.

It is worth noting that this method has some drawbacks. It can be dangerous if not done correctly, as the propane torch is a fire hazard, and the boxes may catch fire even

if you are very careful. Be sure to use caution when using a propane torch and follow all safety guidelines to ensure that the process is done safely and effectively.

Note: Research on what this method will and will not eliminate is inconclusive. If you suspect your hives to have serious diseases, it is best to err on the side of caution and use a more aggressive method.

Boiling

With smaller tools and equipment, boiling as a sterilization method is a great option. Overall, it is less labor-intensive than other methods and may also take less time. This method does require that you purchase washing soda or sodium carbonate (note that this is different from baking soda which is sodium bicarbonate). It can be found online and in most stores for a low price. Mix some of the washing soda into a pot of water. You will want a soda-to-water ratio of about 1:5. Boil the water and submerge the tools for 5-10 minutes, rinse, and let cool before using again. If you are ambitious (and have a giant pan), you can use this method to sterilize frames as well.

Note: This method is not effective against American and European foulbrood. If these are a concern, use other sterilization methods.

Chemical Sterilization Methods:

Acetic Acid Fumigation

To sterilize equipment with acetic acid, you will need an 80% solution, which you will likely need to purchase online. Additionally, you will need protective rubber gloves, goggles, a respirator, and water close by to wash off any acid you come in contact with.

On top of the hive you plan to sterilize, stack another box with no frames in it. Place a non-metal dish inside the empty top box and fill the dish with at least 500 ml of acid. Cover the hive and use plastic wrap or tape to seal all external seams to ensure the fumes don't escape. Leave everything to sit for a week before checking to see if all the *acid has evaporated. If it has not, seal again and wait until all acid has evaporated.*

Bleaching

Household bleach is made of water and about 3% sodium hypochlorite, the chemical needed for sterilization. When using this method, take the same precautions that you would use for the acetic acid method. Mix 1 part bleach with 5 parts water and completely submerge all equipment parts for about 10 minutes. Rinse everything thoroughly.

Note: Both of the above methods will work to kill just about everything except AFB.

Best Practices

Setting a regular cleaning and sterilization schedule can be extremely helpful, as it can keep you on track and ensure consistently clean equipment. Regular cleaning and sterilization can also prevent the buildup of pathogens. Additionally, it is important to keep detailed records of what you do and when. Note when you sterilize and what method you use, along with any other information that you may want to remember about the process. Make sure to record observations from your hives to track hive progress over time.

Ensure that you have proper ventilation any time you sterilize equipment. If you are inside, ensure that you have doors and windows open and fans running to avoid breathing in harmful fumes. This is extremely important to protect yourself, as breathing the fumes can negatively impact your health.

Resources

- Agriculture Victoria: This blog post has some helpful tips and information on how to clean your hives and equipment.
- National Bee Unit - Hive Cleaning and Sterilisation: This guidepaper from the UK's Animal & Plant Health Agency, National Bee Unit on hive sterilization has some great photographs that can help you understand how to implement some of these practices.
- Hygiene in the Apiary - Beekeeping: This manual from a European Union-funded bee research project goes into more detail about disinfection specifics and how to handle specific types of equipment.
- Wax Moth - a Beekeeping Pest: This Australian source goes into detail about wax moths and the danger they pose, how to recognize them, and other information that you may need to know.

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