DEALING WITH DEADOUTS

by MEGHAN MILBRATH

Honey bee colonies die. At some point you will stand over the sad sight of a dead colony, and will have to make decisions about what to do with the equipment. Do you dump a new package of bees straight into the hive and move on with life? Do you burn everything in a fit of rage and quit beekeeping? The right answer is likely somewhere in between, where we take some action to make the hive better for the next inhabitants, but we don't overdo it and set ourselves back. How do we know how much work we should do? When we deal with deadouts, we need to find a balance: On one hand we want to save work and precious drawn comb, while on the other hand we want to reduce risk to the bees.

In this photo, I am taking a box of honey from a deadout and adding it to a neighboring hive. While it is possible to transport pathogens in honey, it is less likely than frames from the brood nest. Usually, when I find a deadout, I will give any boxes of sealed honey to a hive in the same apiary. They can use it, and protect it from pests. Photo by Emily Noordyke

The boxes, lids, and bottom boards from a winter deadout can usually be safely reused with not too much effort. Scrape off dead bees, and take time to repair and repaint what needs it. Most of your focus should be on the comb, because that is where most of the risk lies. There are three reasons why you would want to get rid of old comb: It can hold pathogens, it can hold pesticides, and it can be structurally unusable.

Pathogen risk — Old comb can contain many pathogens. Colonies with old comb are more likely to have chalkbrood (Koenig et al., 1986), nosema disease (Bailey and Ball, 1991) and American foulbrood (Gilliam, 1985). It even seems like the varroa mite prefers old combs; one study showed that old combs were four to five times more infested with varroa than new combs (Piccirillo and DeJong, 2004). We know that some pathogens like *Nosema* and *P. larvae* (the bacterium responsible for American foulbrood) can last for years in wax, but we know much less about the viruses that are responsible for so many bee deaths these days. We do know that it is possible for viruses to end up in wax (Coldwell et al., 2017, deGuzman, 2019), but we don't know much about how long they last, or if viruses in wax remain infectious to honey bees.

Switching out old comb does seem to help with pathogen loads. One study on virus risk showed that there was a higher presence of Acute Bee Paralysis Virus in colonies where comb replacement was not common practice (Molineri et al., 2017). Colonies that had comb switched for foundation in either the spring or fall had less nosema the following spring than colonies raised on old combs (Fries, 1988). Likewise, colonies infected with AFB that are shaken onto new comb have much lower infections than those left on old comb (Pernal et al., 2008).

Pesticide risk — Because wax is made of hydrocarbons, it acts like a sponge, holding onto many chemicals. Studies have shown that most hives contain pesticides in the wax and stored pollen (Mullin 2010). Because in-hive pesticide exposures are so complex (each hive has its own signature blend of chemicals), the effects of these stored chemicals are really difficult to study. However, there are studies that show that *Nosema ceranae* infections were higher in adult bees, and occurred earlier in young bees reared in combs with high pesticides (Wu et al., 2012). Even in the absence of nosema, bees reared on high-pesticide combs had delayed development and died earlier (Wu et al., 2011), and there is a relationship between a high number of chemicals in the hive and the risk of mortality and negative queen events (Traynor et al., 2016).

Structure — New brood comb is pure wax, but old brood comb is a combination of wax and silk and propolis, and has different properties. Just before pupation, honey bee larvae cover the walls of their cells with silk. Each following generation will apply more silk to the walls, and the cells

Adorable yet destructive. Mice can ruin your hive, defecating everywhere, eating comb and frames. If you find a deadout, the most important thing you can do is mouse proof the remaining equipment. Photo by Emily Noordyke

become smaller and smaller and the ratio of silk to wax greater. In nature, bees move the brood nest within the cavity, and generally will raise brood on newer comb, using old comb for food storage. When we restrict the broodnest, bees are forced to reuse the same comb over and over. A study at the University of Georgia showed that brood nests made of new comb had more brood (larger area), and that the bees that emerged from cells in new comb were of higher weight (Berry and Delaplane, 2001). A recent study from the Middle East found that colonies with newer comb (1-3 years old) had higher numbers of overall foragers, more foragers with pollen loads, a higher rate of storing pollen, more worker brood, and greater colony size than colonies on older comb (Taha and Kahtani, 2020).

While we do know that there are advantages to raising bees on new comb, there is also a cost to getting rid of old comb. Tom Seeley (1985) estimated that it would take 7.5 kg (16.5 lbs.) of honey to rebuild the broodnest. A study of the effects of shook swarms found that ninety-five percent of the comb needed by the colonies was built within 45–50 days, at an average cost of 19-20 kg (42-44 lbs.) of honey (Guler, 2008). When we look at a deadout, we want to weigh the risk of pathogens and pesticides with the cost from creating new wax.

Usually we like to deal with risk by measuring it and then making a plan based on what we find. However, it is virtually impossible for most beekeepers to measure the pathogens or pesticides in the wax in their hives. We can't know how bad the comb is when we are deciding to discard it. In some cases, such as when we suspect American foulbrood, we need to get rid of all the comb in the hive. However, most winter colony deaths these days are not from AFB, but mite-related viruses, and we really know very little about the risk to bees of viruses in wax. Rather than making scientific calculations, we can use some common sense rules to choose how much to discard. We want to remove the frames that will likely have the most pesticides and pathogens.

Rule 1: Remove poop. It is always a good rule to limit excreta inside structures, and beehives are no different. Remember, the new inhabitants are going to be cleaning the hive with their mouths. The same mouths they will use to share feed with each other and their young. Bee feces can contain pathogens. Kashmir bee virus (Hung, 2000) and chronic bee paralysis virus (Ribière M, 2007) have both been identified in worker bee feces, and there are likely many more. When beekeepers think of bee poop, they often think only of spotting on the frame.[1] While frames with spotting are good to remove, keep in mind that larvae also defecate in the cells (everybody poops!). If you have a frame with dead/dying brood, or that had been used to raise brood, those should be the first to go.

Rule 2: Pollen doesn't get better with age. It is a protein, and even if it is properly stored, it will break down and become less nutritious over time. Bees happily move nectar and honey around, but don't usually move stored pollen. Pollen is also highly likely to contain both pesticides and pathogens. A frame full of old pollen may look like a great resource, but it should be the first thing to get culled. If the pollen is entombed (covered with wax), that is even more motivation to get rid of the frames, because entombed pollen has been associated with high pesticides and colony mortality (vanEngelsdorp, 2009).

Rule 3: Remove the oldest frames. Many people recommend marking the frames with the year that you make them. It's a great idea, because if you are consistent, you can tell how old each frame is, and remove the oldest. If you are like me, you will do it only one spring, and you will know that back in 2015, you were feeling optimistic about how much time you would have to devote to marking frames. Even if the frames aren't marked, you can get a good sense of which ones should go on the chopping block by their color and cell size. Dark frames with small cells should get culled.

Rule 4: Anything that came from someone else's operation should be removed as soon as you can. If you buy a nuc, even if it is from someone you know and trust, it is good to get rid of those frames. You don't know their history, and it is much better if you can take biosecurity seriously, and limit outside equipment in your bee yards.

You can cull frames right away, or you can make decisions when the weather is warmer and the comb is less fragile. The bottom box is likely going to have the most brood frames and pollen, so I will often bring that back to the shop, leaving the rest of the hive in the field. Either way, my main concern is keeping out mice. Mice can quickly move in, fouling your frames, ruining comb, and chewing through top bars. Other pests like hive beetles and wax moths won't show up until summer/warmer weather, so they aren't a concern during the winter. I use old queen excluders, corks, screens, and lids to make sure that my boxes are mouse proof.

How to reuse old frames.

While the wooden parts of frames can contain some pathogens, they are way less risky than the wax comb. You can get rid of the entire frame if you are super risk averse, or you can just replace the comb. I use beeswax

foundation, so I melt out the wax in a melter, and put in a new sheet of foundation. If you use plastic foundation, you can scrape the wax off and reuse the foundation. However, it is essential that you re-coat the foundation with clean beeswax. If you just put the scraped plastic foundation back in the hive, the bees will not follow the foundation at all and make a huge mess. It often isn't worth it to melt down old comb from the brood nest. Old comb is usually mostly silk, and there will be little wax, and the wax that you get is going to most likely have pesticides, so it isn't good to sell (you don't want someone making coumaphos flavored chapstick). I use what comes out of my melter to make firestarters.[2] Usually it isn't worth the effort, and you can just compost the pollen/wax scrapings.

Usually, when we assess risk, we like to have measurements, so we can know the danger to our bees. However, it is virtually impossible for the average beekeeper to assess the risk in the combs. You aren't going to rent a lab and test for every virus and potential chemical.

I have been making an effort this year to really get rid of old frames. It is hard to throw away drawn comb, when I know how badly I will want it midsummer — you will look at a frame, and think about how easy it would be to just let the bees use it. However, it is important to think about all the things you can't see — the pathogens and pesticides that are in old comb that can really slow down the growth of your new colony. You can keep the nice looking frames, and those without brood and pollen, and a new colony or split will do great on a combination of used drawn comb and fresh foundation. Remember, you can never know the overall risk to your bees with certainty, but you can make an effort to at least reduce the hazards in the hive.

[1] When most beekeepers see spotting in the hive, they automatically blame nosema. However, nosema isn't the likely cause. The type of nosema that we usually see, *Nosema cerana*, isn't associated with in-hive spotting at all. Spotting just means that the bees had to go empty their rectums, but they couldn't. This combination could be from too small of a cluster (usually from viruses), bad food (yeasts, etc.), or any other pathogen that upsets digestion. Regardless, these are good frames to remove.

[2] Take a cardboard egg carton, and fill it with sawdust. Heat up wax slowly, and when it turns liquid, slowly pour it into each cell of the egg carton. Let it cool, and when you need to start a fire, rip off one cell, and light it!

Extra boxes of drawn comb stored to keep mice out. It is great to keep comb outdoors, as multiple freeze-thaw cycles can also kill pathogens. Just make sure that mice cannot get in and ruin the equipment. Photo by Emily Noordyke

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