

Beekeeping Basics

DON'T BE SURPRISED BY SWARMS

by MEGHAN MILBRATH



Photo and queen by Meghan Milbrath

Happiness is a big booming hive in the spring. A strong colony coming out of winter (or any long period without food) means that you did your job as a beekeeper — you kept varroa under control and ensured that your colony had sufficient resources to raise a hearty generation of winter bees. Good job! Before settling into your success, however, make sure that you don't mess it all up by letting that big beautiful colony swarm! Big hives can quickly get away from new beekeepers, and all their hard work can leave the hive on a sunny day.

Swarming itself is not bad, but if the process is uncontrolled, it can have negative consequences for us and our bees. When we manage the swarm process, we give our bees a better chance of success.

WHY DO BEES SWARM?

The ultimate goal of every animal is to reproduce, and honey bees are no exception. Beekeepers should not be surprised that their colonies will swarm, because that is literally the whole point of a colony (from the bees' perspective). We need to teach beekeepers that splitting for swarm control is not an advanced skill, it is a basic and necessary skill — there are not bees that won't aim to reproduce, so there is no beekeeping without swarm control.

Good beekeepers work *with* biology, and follow the cues to recognize which colonies are likely to swarm, identify the conditions that promote

swarming, and take steps to manage the process — before swarms occur on their own. It's a much calmer and happier approach to beekeeping that is safer for you and your bees.

How do we know if a colony will swarm? Most beekeepers will respond that we can tell a colony will swarm if we see swarm cells. However, if we wait until we see swarm cells, we really limit our options, and it may

even be too late. In order to manage swarming well, we need to look for the signs that indicate that the bees are *on the path to making swarm cells*. Bees create queen cells, including swarm cells, when queen pheromone drops. This is easy to see with emergency queen cells — the queen is gone, her scent diminishes, and the bees build cells. Supersede cells are prompted by the fading of a queen's scent as

THE SAD SIDE OF SWARMS

It is risky for the parent hive. New queens usually have about an 80% chance of coming back from a mating flight. This means that about 20% of hives that swarm will die from queenlessness. A hive in the north faces additional risk as they may not be able to build up sufficient workers and honey for winter after a swarm.

It is bad for the swarming bees. Many beekeepers think swarms just live long and happy lives as feral colonies. Unfortunately, survival for unmanaged colonies is really low. Remember, honey bees wouldn't naturally be in your area; they are only living there because you bought them for your own benefit. The least you can do for these animals is give them a fair shot at a long and healthy life.

It is bad for your other bees. For every swarm you let escape, you create an unmanaged colony in the neighborhood of the hives you are trying to care for. Mites grow unchecked in unmanaged hives, and when these colonies collapse, you have basically just "mite-bombed" yourself.

It is bad for your neighbors. Honey bees are cavity dwellers, and the only cavities nearby may be your neighbors' soffits, floorboards, or siding. Your bees can cost your neighbor thousands of dollars in repairs and removal. Swarming can turn your beekeeping hobby into a public nuisance.

It is bad for your wallet. When you lose a swarm, you basically lose a package of bees — worth well over \$100. You also lose their production; swarms generally contain a lot of bees of wax-building age, and you miss out on the value of the comb they would've drawn, and the honey they would later collect.



Backfilling in the brood nest. Some beekeeper (me) didn't put supers on quickly enough, and the workers filled the brood nest with nectar before the queen could lay in them. The center of this frame should have eggs in it, but instead is full of nectar. You can see all the fresh nectar on this frame, indicating there is a pretty good honey flow on. Photo by Sarah B. Scott

she is failing. With swarm cells, the queen scent drops because of the hive conditions, and the bees will begin queen cell construction even though the queen is still in the hive. Bees can sense when pheromone levels change in the hive, but as weak humans, we are terrible at pheromone sensing. We can't use our antennae to sense pheromones, but we can see two conditions that indicate that queen pheromones will be lowering:

1. Backfilling in the brood nest, and
2. Full frames of brood.

Backfilling in the brood nest: In a normally functioning hive the brood nest will hold only brood — the queen will lay an egg in each newly vacated cell. As the queen lays, her glands leave a scent on the eggs, and as the larvae grow, they release their own brood scent. This combination of queen scent and brood scent is key for bees; these pheromones indicate that the hive is healthy and has space for normal function — empty cells for incoming nectar above the brood nest, and room for new eggs within the brood nest. If there is no empty drawn comb above the brood nest, the bees will begin to backfill — putting nectar in the cells where young bees have recently emerged. During a strong honey flow, a big colony will have thousands of workers returning with nectar, looking for empty cells to deposit their load. The numerous

loaded workers will outcompete the queen and quickly fill the open cells with nectar, leaving the queen with no space to lay. Soon the whole part of the hive that should be reserved for brood rearing is instead filled with food.

The brood nest area should be filled with eggs and developing bees, all giving off pheromones. When it is backfilled with nectar, the colony scent drops considerably — lowering pheromone levels. If you remember one thing to look for, let it be this: **Backfilling is the first sign that a colony is fixing to swarm.** Once you see backfilling, you know that you have a large population, and there is food coming in. At this point, you can begin to do your swarm management.

Full frames of capped brood: Full frames of capped brood are a strong signal that it is getting to be time to swarm: The colony has reached a sufficient size — big enough to split, and big enough for both resulting colonies to stand a chance at survival. As the bees in these frames emerge, the hive will experience **lowered brood and queen pheromones.** Brood pheromone is lowered because you will have thousands of brood becoming adults, and their scent will change (and their cells will likely get back-filled). Queen pheromone also is lowered through a dilution effect. Workers in a hive touch the queen to pick up her scent, and they pass it among

themselves. When you have more workers, you have more bees passing around the scent, and each bee experiences less.

The emerging of full frames of brood also causes a generational shift in the workers, changing the balance in the hive. After emergence, workers usually play the role of nurse bee, then wax-builder/house bee, then forager. When thousands of new workers emerge at once, ready to take on their role as nurses, the current cohort of nurses graduates to wax-making house bees — perfect for the colony that needs to set up a new place to live! The new nurse bees can't fly yet, so they stay with the parent hive, but these house and wax bees will fill up their bellies, and go with the new swarm, ready to build a new home.¹ Anyone who has caught a swarm can tell you that these bees are the absolute best for drawing out new wax. It makes sense when you think about all of the newly commissioned bees that are relieved of nursing duty, and ready to build!

These two signs (backfilling, and full frames of brood), indicate that a colony is strong and that there is plenty of food available — and that means that this would be a good time for the colony to swarm.² Like everything in beekeeping, the answer to what time of year we are likely to see swarms is "it depends." The timing of swarming depends on when the colony gets big enough, which depends on the incoming food, which depends on the temperatures. In "Nectar Management Principles and Practices," Walt Wright indicates that swarm season in Tennessee is from apple blossom to hardwood greening. In Michigan, the average bloom time for apples from 1980 to 2012 was May 6.³ That seems about right for the start of swarm season for me. The earliest that I have ever caught a swarm in Michigan is April 30, and swarming is usually done by mid-May. However, I am writing this article from Hawaii, where on one island a beekeeper told me his swarm "season" is April to October, and on another island I was told that it was all year. Talk to local beekeepers and take good notes — write down when you start hearing about swarms every year.

Just like everything in beekeeping, the timing of swarms will change every single year. If there is an early warm up that allows colonies to raise brood earlier, they will swarm earlier, while a cool spring will push them

later. If you feed pollen or 1:1 sugar water in the spring, it may stimulate brood rearing and push the colony toward swarming earlier. Like everything with bees, it is hyper-local. You can ask your nearby beekeeping friends, but the best way to know when to expect swarms is to watch your own hives. **Remember, swarm control happens before swarming.** Don't wait until May 1, or apple blossom, or whatever your cues are to start checking. All of the management techniques discussed in this document are to be performed **before** the swarm leaves — well before you hear reports of swarms.

The main trigger to the swarming process is a drop in pheromones, prompting bees to create queen cells. Young queens will have a stronger queen scent (pheromone), which inhibits the creation of queen cells. Old queens have less overall queen scent, lowering the threshold to start swarming. If a colony with an old queen is too small to swarm in spring, it will generally re-queen itself right after swarm season through supercedure. (I get a million calls for "missing" queens right after swarm season; almost always, if the beekeeper waits, they will find a new queen was in the works.) You can lower the chance of a swarm or a midsummer re-queening by going into winter with a young queen. **Re-queening in late summer/fall with young queens is a key part of getting control of swarm behavior.** You don't even have to kill the old queens (it is okay to admit that you are sentimental about your queens) — you can put them in nucs, or use them elsewhere, or keep them for an emergency. Ideally, you will make a nuc from each hive in late summer with the old queen, and will give the big hive a young queen. That way your main hive will be less likely to swarm, and you have a backup for winter. At minimum, mark your queens and take good notes so you know what colonies are more likely to swarm.

Bees will leave the hive when the conditions are ideal for reproducing, but they will also leave the hive when the conditions are bad. Crowded swarms frequently occur for second-year beekeepers, who are unfamiliar with how much faster a colony will expand when they have drawn comb — they don't realize that a strong colony on a good basswood flow can fill a super in less than a week! They also don't yet know their honey flows well, and when to expect the rush of food. An experienced beekeeper will



Full frames of capped brood.

Photo by Randy Oliver, www.scientificbeekeeping.com

put on two supers in anticipation of a good honey flow (that they know is coming because they know their local blooms). A first-few-years beekeeper will often peek in the hive to see if it is crowded, observe that the top super is only about 50% full, and not add a super ... only to have the flowers turn on the flow the next week, and their bees swarm into the trees. Crowded swarms are 100% beekeeper error. It means that you didn't provide your bees with enough space to account for the incoming nectar. The bees always want to put nectar above the brood nest, but if there is no drawn comb above the brood nest, then they have no choice but to put the nectar in the brood nest, leaving no room for eggs, initiating a swarm. It will take experience to judge if you have the right amount of space — you will need to know your main honey flows and estimate the strength of a colony. This is one of the arts of beekeeping. A rule of thumb is that there is little danger of over-supering a **strong** colony **early in the season**. If you overestimate space, you can always remove boxes later. Just make sure you don't over-super a weak colony — they won't be able to protect all the extra space from pests.

Sometimes the bees leave even if the hive isn't crowded. I'll hear beekeepers say that their bees are so dumb, because they swarmed in September! Or I can't believe my luck, I caught a swarm so late in the season! Usually those bees are absconding. In a situ-

ation where the colony absconds, the conditions in the hive are too poor to support proper colony growth. The most common cause of absconding is when colonies are overrun with viruses — the workers are trying to raise brood, but most of the brood are dying. All this dying brood signals to the bees that the conditions aren't good and it is time to abandon the hive. We also see absconding from over-crowded nucs and overheated hives. The bees just can't live in those conditions, and they hedge their bets in a new location. You can sometimes see bees and queen cells after an absconscion, making it look like a swarm. The bees will generally abscond in the middle of the day. Young bees that can't fly are left behind, and the foragers who are out working will return to a relatively abandoned hive. These poor old and young bees will try to make emergency queen cells. These post-absconscion colonies rarely recover in good health — they have a poor queen that is raised in stressful conditions, and are missing the bulk of the workers that make up the heart of a functioning colony.

Bees give us tons of cues to tell us they are going to swarm. If a beekeeper is surprised by swarms it is usually because they didn't know what to look for. The signs were all there, the beekeeper just missed their significance. This is a situation where you need to learn to "speak bee" to perceive the world from your bees' perspective.



Filled queen cells at the bottom of a frame — indicating that this colony is well on the way to swarming. A quick way to check for these cells is to open the boxes of the brood nest like a clamshell, and peek under the bottom of the top box. Photo by Randy Oliver, www.scientificbeekeeping.com

Pay attention to when the nectar flow starts, watch the brood nest for backfilling, and for when you will have large numbers of bees eclosing.

Swarm management: I just hate that many old books and beekeeping resources still recommend cutting queen cells. Why would you do that?! Please don't. First, you likely won't find every last cell, and you only need to miss one for the colony to still swarm. Secondly, swarm cells are perfectly good queen cells — why kill them? At least make up some nucs. Third, once the cells are capped, the colony may already have swarmed. If you cut the cells, you may eliminate the colony's chance of survival. Finally, and most importantly, you have done NOTHING to eliminate the triggers for swarming. You still likely have a backfilled brood nest, and low pheromone levels! You haven't slowed the urge to swarm at all, and at best pushed it back a few days.

The final step of swarm management is usually a split. However, in Michigan and other northern areas, we usually get nectar coming in before it is warm enough to split a colony. If we do nothing, the brood nest can fill up, but if we split too early, we risk chilling the brood and setting the hive back. Because of this daytime nectar and cold nights, I will generally do my swarm control in two steps. First I add extra space above the cluster, and then I will come back later (maybe a week or two) and make

splits. In step one, I put a deep box of mostly drawn comb (or two mediums) on every hive that is on the bigger side. This does a few things — it gives the bees space above the brood nest, it gets equipment out of my garage, and it allows the bees time to ready the comb before the main honey flow. The only limitation to this method is that you have to have mostly drawn comb — bees will not draw out wax until after swarm season. My opinion on early supering is that everyone should do it. I don't see a downside to putting boxes of drawn comb onto big hives in the spring. I'll be back out to the bee yard to make splits soon, so I can remove them or make corrections then.

Spring management is all about finding the balance between a warm brood nest and space for incoming food. If the colonies are starving, and I am feeding them, then I don't put supers on (they won't be storing food if they need to eat it). I watch closely to see when food could be coming in — paying attention to blooms, days with foraging weather, and bees bringing in pollen.

Do I use reversals? I don't really reverse brood boxes as a measure of swarm control, because reversals won't give you a lot of room in colonies that are big enough to swarm. If colonies are small (and not needing swarm control), I'll often move the box with the bees to the bottom and give them a new box with drawn

comb and foundation. I'll then cull many of the frames in the bottom box.

My bees will stay in their early spring configuration (with empty boxes up top, and no changes to the brood nest), until I start to see signs of backfilling and full frames of brood. At that point, I'll start making splits. There are about as many ways to make splits as there are beekeepers.

Making splits: The best way to gain experience in making splits is to start trying some. At a minimum, you'll be able to keep your bees from going into your neighbor's soffit. If you aren't comfortable making splits, you can try some simple versions like a "walk-away" or "dirty" split. In this method, you just split your existing hive in half, making sure both halves have eggs. One half will have the queen, and the other half will raise a new queen. You can keep both new hives in the same yard, just be aware that the hive in the original location will get all the foragers, so make the one in the new location heavier. A second way to make a walk-away split is to number the frames, and put odd frames in one box and even frames in another (See Fig. 1). Push these frames to the middle, adding empty frames to the outside. Both of these splits require one hive to make a new queen. It is essential that you give the new queen time to develop before you go digging in there. A very common mistake is to open the hive too early and disrupt the process. To prevent mucking it up, write down the day you made the split, and figure out the queen math to determine when you would expect to see brood. Don't open the hive until that date. Don't even peek. Write a stern reminder note on top of the hive if necessary. Nothing good comes from peeking in the hive early. Most of the time when there is a problem, it is because the queen didn't come back from a mating flight. If that happens, just combine the hive back with the original hive. By this time, reproductive swarm season will be over, and you can move on with life, or make another split later in the season.

Some splitting techniques allow you to create the split in the same hive. Using a physical barrier and some distance, the brood are moved away from the queen, and the bees are separated into two clusters within the same column of boxes. Techniques that keep the split in the same hive have a great advantage for those of us in northern climates in that they reduce the chance of chilled brood.

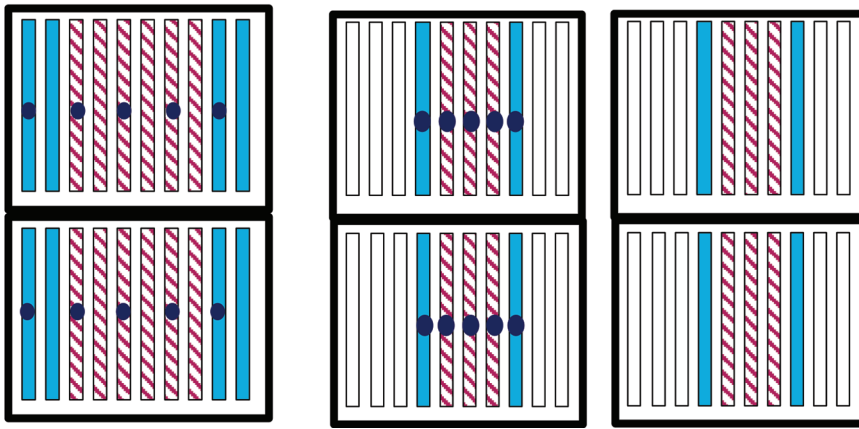


Fig. 1 The leftmost hive is the original hive. All the odd frames go into one hive (middle), and even frames to another (right)—keeping all the bees with the frames they are on. The old frames are pushed together, and the boxes filled with empty comb.

The general set-up for an in-hive split is that the old queen is in the bottom box, with just a few frames of brood, and plenty of open comb to lay (if you take all the brood, the bees will just leave her, so you want to leave enough so there are some nurse bees to take care of her). Usually you add a queen excluder next, to confine her to the bottom box, and some boxes with drawn comb to provide space for nectar above her brood nest, and to provide distance to prevent bees in the top from receiving her pheromone. The brood frames from the original hive are added on the top, with an upper entrance.

Once you get the hive into this position, you have a few options, depending on what you want in the end: two separate hives, one really big recombined hive, or a 2-queen system.

- 1) If you want two separate hives, you can remove the top box and place it in a new location, and provide it with a queen cell or mated queen (or if it is large enough, allow it to raise a queen).
- 2) If you want to recombine the hive, you can use a Snelgrove board. A Snelgrove board is a modification to the double-screen that has a series of entrances that are opened and closed systematically to reunite the hive after the threat of reproductive swarming is passed. (See “The Snelgrove Method of Swarm Control,” by Sid Lehr, March 2020 ABJ.)
- 3) If you want a 2-queen system, which is great for making honey, you can use a double-screen below the top brood box, and allow the bees to raise their own queen (or give them a queen cell), and

then switch the double-screen for a queen excluder once the queen has come back and is mated. If the queen doesn’t get mated, you can just recombine.

One of the biggest reasons that I like doing the in-hive split is that you can set up the original hive on one day, and then think about what to do next. After you have the hive in this arrangement, you have put an immediate stop to the swarming process: The queen has plenty of room to lay, and the bees have plenty of space to add nectar. The next thing you need to worry about is the creation of emergency queen cells in the upper boxes. You need to choose what to do before you have virgins emerging and killing your queen down below (virgins can squeeze through a queen excluder).

A PERFECTLY FINE METHOD OF SWARM CONTROL

Below I’ll outline the method that I have used the last few years for managing swarms. It may or may not be a good method for you (or who knows, it may not be a good method for me, either). I’m writing this in 2020; four years ago I tried this method on a few hives and liked it, so the last few springs I tried it on all my hives, and have been pretty happy with it.

THE BASIC PROCESS:

- 1) During the first spring warm up, and I see nice food coming in: Put extra boxes of drawn comb on the big hives.
- 2) Once I see dandelions and the



Here are two of my hives from last spring. The one on the right is huge and is likely to swarm; the one on the left doesn’t have enough bees to swarm. It is good to mark which colonies need swarm control early in the season so you can plan. Of course, the big colony could always starve, and the small one could grow large enough to swarm if the weather and food were right. If food was coming in, I would reverse the colony on the left, giving it a new deep box above the cluster and removing the bottom box, and I would add an extra deep on top of the hive on the right. Photos by Meghan Milbrath

weather is warmer: Start inspecting for backfilling and full frames of brood.

- 3) When I see backfilling etc.: I'll make an in-hive split on a really nice day.
- 4) A few days later: I'll move the splits from the tops of the hives when I need to and add queens or queen cells the following day.

THE REASONS I LIKE THIS METHOD:

There are a few reasons why I split within the same hive.

- First, during the splitting process, it can get crazy, with bees flying everywhere. With this method, the bees are calm and inside the hive when I want to move them.
- We have limited nice days in the spring. We often get warm followed by cold followed by warm — you get the idea. I want the weather to be nice when I'm digging in the hive, but I don't care what it is like when I'm just moving hives. By separating the digging from the moving, I don't "waste" nice weather driving around.
- As mentioned before, if we get a cold night, keeping the split within the same hive will allow for a little more protection for the brood. The bees can choose themselves how they should separate between the two clusters to keep the brood warm.
- The best part is that it allows me to

take a step back, plan, and gather equipment. I'll make all my splits, and then note how many splits will be coming from that yard. At the end of the day I can go home, have a beer, and figure out where I want to move the splits, what I need for hive stands, how many bottom boards to load into the truck, and how many queen cells I'll need. I don't have to make decisions in the yard when I'm hot and trying to get everything done.

1) MOVE YOUR SPLITS TO A NEW LOCATION

Another great thing about the in-hive split is that you can set up the original hive on one day, and then move the splits on a different day. If you move the bees at night, or on a cool rainy day, you'll bring a lot more bees with you. If you move them on a sunny day, when the foragers are out, you'll leave a lot more bees at the original location. Neither way is right, you just have to choose what you want. One reason that I like moving them on a rainy day, is it allows me to get more work done — I can be out even when the weather is horrible, as it often is in Michigan — but I don't have to worry that I'm damaging my bees or chilling brood.

After I leave the yard on split day, I'll write down how many splits I'll plan on taking from that yard, and I'll load my truck with that many bottom boards, lids, and ratchet straps. On

the day I'm moving the bees, I'll set the bottom boards on the ground next to the hives, and pull each split off, give it a cover, and recover the original hive as swiftly as I can. I'll drive the bees to the new location and leave them alone.

1) ADD QUEENS TO THE SPLITS

I usually add queens the day after I move the splits. You can use mated queens or queen cells. I am generally using cells, because that is what I can get locally at that time. The split is opened, and I'll add in the cell between the frames of brood. I'll write down the date that I need to come back and check the queens, and if they didn't work (the queens didn't get mated), I'll just combine them with another hive.

That's it!

Best of luck to you and your bees this coming swarm season.

FOOTNOTES

- 1 There are some neat swarm control methods that take advantage of the fact that these newly commissioned wax bees can fly but can't orient to the hive, including the Taranov method.
- 2 Many beekeepers think that bearding is a sign of swarming. It does mean that the weather is warm and the colony is big, but it isn't associated with any changes in pheromones, so it doesn't have anything to do with queen cell production/swarming.
- 3 2013 Bloom dates for southwest Michigan tree fruit crops, Mark Longstroth, Michigan State University Extension. https://www.canr.msu.edu/news/2013_bloom_dates_for_southwest_michigan_tree_fruit_crops

Meghan Milbrath is a beekeeper and honey bee and pollinator researcher and Extension specialist at Michigan State University.



An overly crowded hive — shown by the honey stored in the burr comb. This is a lovely sight in October, when you know there is no more honey coming in, but it is not good in a colony midseason. It is a sign of overcrowding in a growing colony. This beekeeper may have missed out on a lot of honey and a lot of brood, and is risking losing the colony to a swarm. Photo by Andria, CC BY-ND 2.0, <https://flic.kr/p/9wsoF>