SMALL SCALE QUEEN REARING

Non-Grafting Methods of Queen Rearing

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Last month we looked at using swarm cells as a quick way to produce queens in a hobby or sideline beekeeping operation. This time we will explore several relatively simple non-grafting methods to produce a moderate number of queen cells. These methods allow the beekeeper to time the age of the queen larvae, and narrow the window of variation in the age of the queens so produced. We will introduce the concept of cell starters and cell finishers, which are also a main part of commercial queen rearing. However, we will look at ways to use strong but otherwise ordinary colonies for cell production, and bypass the need to set up special colonies used just for cell production. Our focus will be to look for ways to produce high quality queen cells on a one time or as needed basis.

A few biological realities

In most colonies, the production of queen cells is segregated into two different biological patterns, or stimuli, that trigger behaviors in bees to produce queen cells. The exception occurs when a colony is naturally ready to produce swarm cells. Otherwise, the bees must receive certain stimuli to start queen cells. We will use at least two behaviors: the *emergency cell building response* as well as an *overabundance* of *nurse bees* seeking larvae to feed.

We use the emergency queenless response all bees have because they are sensitive to the absence of the queen and her brood when both are taken away from them. The bees immediately respond by evaluating any worker larvae given to them as potential queen candidates. This is usually done by putting a large number of young bees (those that have never foraged) into a confined hive body without a queen and without brood. The mother queen and all the brood are removed. After an hour or two of queenlessness, worker larvae are introduced into the mass of bees and they will select certain cells to begin raising queen bees. Without any open brood in the hive, the nurse bees will seek larvae to feed since they were just doing that in the hive before they were shaken into the new container. These bees are usually given food in the form of stored honey and pollen, and may be fed with a syrup container as well. Because the bees are confined, the syrup is also a source of water for the bees, which need hydration for proper royal jelly production as well as for cooling. Another source of water for confined bees is water soaked in a sponge. When bees are confined in a hive for cell starting the hives are called *cell starters* or *swarm boxes*.

Cell starters are good for starting a large number of cells overnight, but they cannot complete what they have started. The nurse bees age, and the colony is not balanced with forager bees, so the cells are poorly built. For these reasons, another type of hive arrangement is used, one with a more normal hive arrangement, but set up to use another biological queen replacement behavior, *the supersedure response*. These we call *cell finishers or cell builders.* They work by establishing a queenless area in a strong hive where the queen is unable to walk and spread her pheromone. To do this open brood frames are moved above a queen excluder, and supplied abundant pollen and honey, and given sugar syrup as well. This attracts the nurse bees to crawl up through the excluder and feed the young larvae. These bees respond to the strong brood population and reduced queen pheromone by taking very good care of started queen cells that they are given. Interestingly, the cell finishers are not very successful cell starters because there is open brood present that reflects an existence of a strong queen and deters cell initiation. It is a fine line, but just remember that *finishers are poor at starting queen cells, and starters are poor at finishing them.*

There are many, many methods of starting and finishing cells, including some that use only one colony to do both duties. My objective is to outline some basics and give some key points about cell starting and finishing without getting into the heavy mental lifting involved in learning of all the different variations there are on the subject.

When to raise queens

It is possible to raise queen cells anytime you have brood. But I've never tried it in January or February here in Connecticut where I live and keep a few colonies. The limitations are always the drone supply and steady good weather for flying and mating, and those are almost always lacking for my bees in the Winter.

Queen rearing could start in April in New England if the drone supply is good. Rather I suggest you wait until May when the dandelions and fruit bloom are going to supply growth conditions for the colonies you use for cell starting and cell finishing, as well as provide abundant, vigorous bees for the nucleus mating colonies you need to make up for queen mating.

Queen Rearing Method Number 1 – Queen cells built on a partially cut comb

Most beekeepers can find good frames of newly emerged larvae in the Spring in the colonies they manage. They are often solid frames with larvae floating on

Strong colonies could be moved from a warmer location in the very early Spring into New England for queen production, and the colonies would undoubtedly contain adequate drones for mating. Drone holding colonies might also be brought in, or packages filled with a mixture of drones and queens shaken in the south and shipped for mating. Once they arrive, however, the beekeeper is still faced with two enormous challenges: one, keeping alive the drones that have been brought in, and two, having suitable weather for good mating flights by virgin queens and by drones.

beds of royal jelly. Since queens usually concentrate on one side of a frame at a time as they lay eggs, this provides uniform aging of the eggs, and thus the larvae found on the comb. Not every queen does this, I know.

It is just one small step, then, for the beekeeper to add a suitable frame for cell construction to the colony that is to be mother to the new queens. For reasons that will be clear in a minute, this frame should be built on thin natural wax foundation. No plastic, no wires, no reinforcement. Fasten three or four 3-inch wide starter strips that are cut at the end to form a triangular point. These must be held securely from the top bar with hot wax and a wood strip. When the colony is growing nicely, put the frame with starter strips into the hive and let the bees build it out and the queen lay into it. Put this frame directly in the middle of the brood nest. A quick check will tell you when the queen lays into it, and then you can time your queen rearing activities. The bees often build drone comb around the triangular points.

When the frame is filled with eggs that have hatched within the last 24 hours and are floating on royal jelly, you can start the process. Remove the frame from the hive and gently brush the bees off the comb.

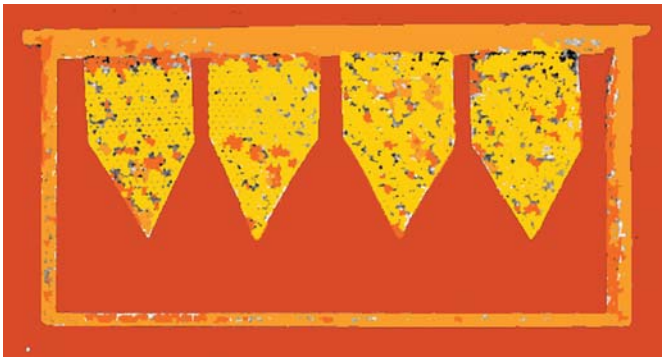
Using a sharp knife, trim back the comb pieces to the original shape so you have three or four triangular edges that contain appropriate aged larvae for the cell starter colony. Queen cells will be produced along the edge of the comb, and you will be able to cut these cells off the frame for use in the mating nucleus.

Having watched the frame carefully, you should know the day you expect the larvae to be hatched (and fed) and ready for the cell starter. Several hours before you remove the frame and trim the triangular pieces in the comb, set up a cell starter as follows:

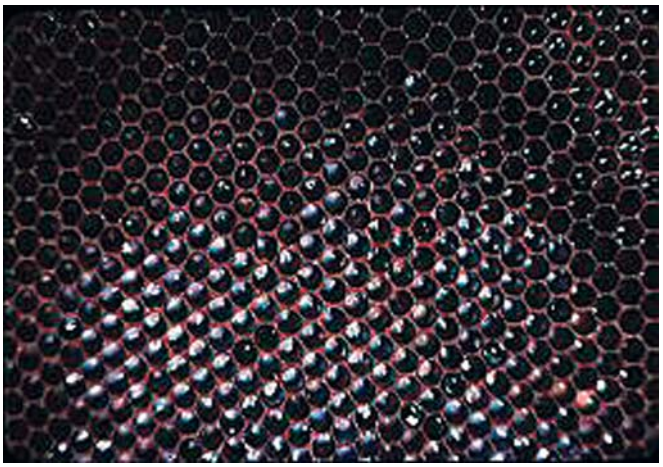
1. Assemble a starter box out of a five-frame nucleus with screen stapled to the bottom of the box to keep the bees inside and to allow ventilation. In the box put a frame of honey and pollen and a used but clean (soap free!) sponge dripping with water.

2. Go to a strong hive you have selected and locate the brood nest and find the queen. Set her aside so she is not accidentally added to the starter box. Shake all the bees on the brood frames into the starter box. Bees that fly back to the parent hive are older bees so don't worry about them. You only need the young nurse bees in the starter colony. You want two or four pounds of nurse bees in the starter, and a good strong colony in the Spring should have this.

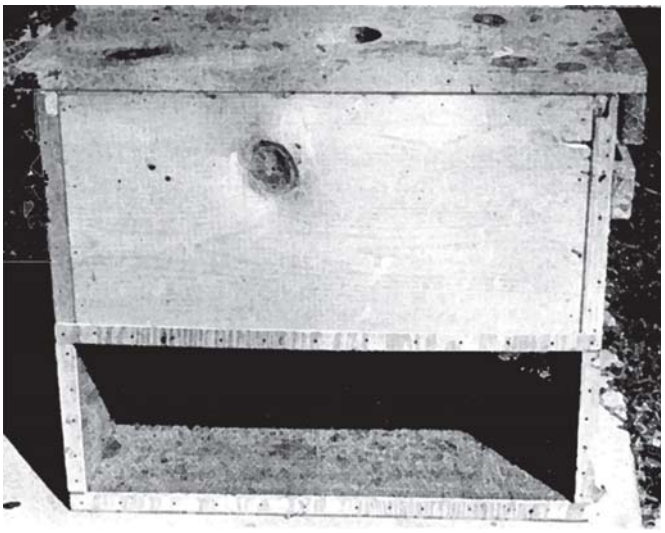
3. Close up the starter (with bees, honey, pollen and water) and take a break – lunch or dinner even.



Cut thin beeswax foundation into three or four strips ending with triangular points. When you determine the breeder queen and colony are able, place the frame in the brood nest and let the bees draw out the comb, and the queen lay worker eggs into it. Gently check every day or two for progress. When the frame holds larvae that are one day old or younger, cut the comb back to the worker foundation, and place in the starter colony. (Adapted from Queen Rearing and Bee Breeding *by Harry H. Laidlaw Jr., and Robert E. Page, Jr., published by Wicwas Press.)*



Young larvae, floating on a bed of royal jelly. This is an older frame that shows the white royal jelly the larvae are floating on. Look for this on the new wax built from the starter strips.



Starter box. The text describes making a simpler version than this by stapling screen onto the bottom of a five-frame nucleus box. This starter is extended, and has screen sides for ventilation. Shake the young bees from a strong hive for use as a starter colony overnight. The bees are returned to the parent hive the next day when the started cells go to the cell finisher. (From Queen Rearing and Bee Breeding *by Harry H. Laidlaw Jr., and Robert E. Page., published by Wicwas Press.)*

In the Alley/Smith method of producing queen cells, a queen is stimulated to lay eggs into young comb. When the larvae are 24 hours old, the comb is cut into strips and hot-waxed onto a wooden bar that sets in a frame. One, two or three of these bars may be used depending on colony strength and seasonal buildup. Here the beekeeper has removed two cells and left one, allowing the bees to build cells with room in between. (Adapted from Better Queens*, self-published by Jay Smith in 1949.)*

About two days later the bees have reformed the worker cells into queen cells. Cells produced in this method are usually webbed together, and must be carefully cut apart for use in the mating nucleus. (Adapted from Better Queens*, self-published by Jay Smith in 1949.)*

Beekeeper Rollie Hannan Jr. working a cell builder/finisher in his queen yard. This colony consists of three deep hive bodies. A laying queen is active in the bottom two chambers, but is kept out of the top hive body by a queen excluder (note the unpainted wood strip). Rollie has moved three or four frames of open brood (hatched larvae) above the excluder. There are frames containing pollen and nectar next to the brood. When the cells are added, they are placed in the center of the open brood and the nurse bees, attracted to the open brood, crawl through the excluder and care for the queen cells as well as the worker brood. Note the migratory lid with a hole cut into the center. This allows Rollie to keep feeding the cell building without opening the colony.

Then go to the colony with the frame you will use for the queen cells, remove the bees and trim the wedges out to leave the triangular pieces containing worker bee larvae.

4. Bounce the starter box so the bees fall to the bottom of the box. Gently slip in the frame with the queen cells. Close the colony. If the nighttime temperatures go below 50°F., put the starter in a protected shed or even a closed garage (after you get permission from you spouse). If temperatures are warm, place the bees on blocks so they will be able to ventilate through the screen on the bottom.

5. Anytime the next day you can move the started cells and put them into a cell finisher colony.

6. Make up a cell finisher by going to a strong hive and find the queen. Select four to six frames of open brood (eggs and larvae) and put this in a separate hive body over a queen excluder over the brood nest. Replace the missing brood frames with drawn empty comb. Make sure the queen is below the excluder! Above, add frames of honey and pollen.

7. Add the frame of started cells to the finisher colony. You will be able to see where the bees have reshaped the wax around the cells and have started to lavishly feed the larvae inside. But don't count your queens yet, since the finisher will probably not care for all of them.

8. Feed the finisher, either with a division board (frame) feeder, or with a jar on a migratory lid with a hole cut to hold the jar. Keep the feeder or jar filled until the cells are sealed.

9. Now it the time to mark your calendar. Most books say that queens take 16 days to develop, but I figure at least one of them will be precocious and will emerge on day 15. Here is your queen math lesson:

Egg to larva	3 days
Larva in parent hive	1 day
Night sent in starter	1 day
Total	**5 Days**

Subtract the days spent already from 15, giving you 10 days. Subtract one day from this, since you want to move the cells one day BEFORE they emerge. That gives you nine days. Go to your calendar and count nine days ahead and write MAKE NUCS – CELLS RIPE. Notice if you have anything planned that day, like your wedding or something, and plan to make the nucs up a day or two earlier, but not much more than that, or they will be in their own cell building business and mess up everybody's hard work so far.

10. On that ninth day, remove the frame with the queen cells. You may have a dozen or two cells in formation, but some will be side-by-side and impossible to separate. Count these as a single cell, and introduce them together into a nucleus. The queens will work this out in a time-honored battle of the fittest.

11. In your mating nuclei, add the queen cells you have cut from the frame using a very sharp knife. You will probably need to make space on the frame, just under the top bar, to make room for the cells. Cut out a portion of the comb and honey or brood, and gently but firmly affix the cells to the frame. Make sure the cells point downward into open space so the queen will be able to emerge safely.

12. The queen should emerge and mate, and may start laying eggs in about two weeks. Check the nuclei at that time for eggs and a new queen swollen with more. You may want to leave her there for a few days to lay up the nucleus, or the nucleus itself may become part of your increase plan for the season.

Typical cell frame with two cell bars in use. There is room for a third at the bottom. Rollie used the grafting method to produce these cells, but cells started using the Alley/Smith method would be handled in the same manner.

This method is often called the Miller method, after Dr. C.C. Miller.

Queen Rearing Method Number 2 – Queen cells on strips of comb

This method is nearly identical to the first, except you can expand the number of queen cells you produce by cutting *strips of properly aged larvae* and waxing them onto a cell bar.

1. Prepare a frame (or frames, if you want to produce queens from multiple queens) with thin foundation you can easily cut. Allow the bees to draw out the wax foundation and the queen to lay into it.
2. When you have day-old larvae floating on a bed of royal jelly, you can prepare them for the starter colony.
3. Carefully brush off all bees and place the frame on a flat surface. You need to select the best side, since only one side can provide larvae for your use.
4. With a sharp knife, cut horizontal strips of larvae, excising them from the frame.
5. Carefully remove the salvage side of the comb without damaging the larvae on the good side. Good luck, this can be delicate work.
6. Use melted beeswax on a small paint brush to fas10 the strip onto the center of a cell bar that fits into a frame (this is Winter work you can do now, when it is snowing).
7. Once the strip is fastened and the wax cooled, carefully remove (or crush) two larvae and leave one. Use a large nail or ice pick. The cells should look like this when you are done; with O being a larva and X being a cell that is empty or you removed the larvae:

O X X O X X O X X O X X O X X O X X O X X O X X O X X O

This example leaves 10 larvae for cell production.

Jay Smith promoted using no more than five cells per bar as a means of producing top quality queens. Put no more than three of these cell bars with larvae into a single starter colony. Once you have experience with this system, you are free to adjust to your own experience base. I advise you remain conservative and produce fewer, high quality queens.

8. When the cells are ripe, carefully cut them off the cell bar and use them in a cell finisher as described above.

In summary, we have discussed two relatively simple methods of making cell starters, cell finishers and making queens without transferring larvae using the grafting method. This method, as you may tell, has the following advantages:

1. It can be done by most beekeepers with existing equipment.
2. It does not require the transferal of larvae from the frame to a grafting cell.
3. It produces a moderate number of well raised queen cells that will produce excellent queens.
4. It is a conservative method of raising queens.

The main disadvantages are:

1. You are limited to a few dozen queens at a time.
2. You need to have the frames prepared in advance and be skilled at cutting delicate combs, something certain beekeepers have difficulty doing.

This method is often called the Alley Method, after Henry Alley. It is also called the Smith method, after Jay Smith.

Finally, there are queen-rearing systems, like the Jenter system, which require special purchases and equipment. While I have personally never used any of these systems, there is no reason why you shouldn't spend YOUR money and give it a try! But try one of the above and see if it works for you. BC

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