THE GRAFTING METHOD OF CELL PRODUCTION

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In this final article of three dealing with queen cell production, we will look at the methods laid out by G.M. Doolittle and published in his book *SCIENTIFIC QUEEN REARING* in 1888. Doolittle's methods have been studied and then modified by nearly every beekeeper that has used them, yet the core ideas remain constant, and have served as the starting point for a majority of queen cells produced in the world. I'm not going to rely on Doolittle's discussion, but rely on my own experiences raising several thousand queen cells each week from February to October, and doing it for several years. My own training came from Dr. G.H. "Bud" Cale, Jr., creator of the Starline, Midnight and Cale 875 hybrid bees, as well as Harvey York of the York Bee Company in Jesup, GA.

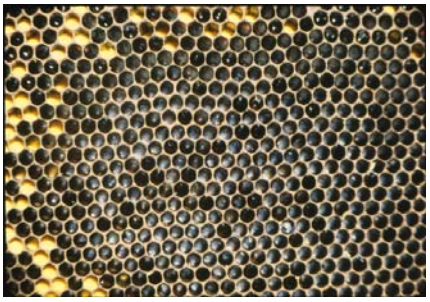
Beekeepers sometimes reject the grafting or transferal method of cell production because they have had a bad experience trying to graft larvae. I like to remind them that many commercial beekeepers use young employees specifically for this reason, for their eyes are sharper and change focus with great ease. If you have not grafted before, and you are 50 years old or older, grafting may be a challenge for you. But it can work – just try it – again and again if necessary. Use a hand magnifying lens and a flashlight if that helps. Then find a neighbor kid to mentor or hire, who is reliable, and have them help you out!

Let's go step by step through this process, and raise a few queens.

1. Grafting Mother Colony. Any colony with a queen laying fertilized eggs may be used as a source for larvae for grafting. You should, of course, select the *best queens you have* and set them in the area where you plan to raise cells. Most commercial queen producers keep grafting mothers in the area immediate to where they produce queen cells. This speeds the grafting process, since they do not have to move colonies or brood frames in and out for grafting. In the case of valuable grafting stocks, these colonies should be kept in a secure location, at least behind a locked gate. Many producers restrict the queen to a single deep hive body so it's easier to find the queen and her graftable larvae. The queen in the colony shown here is kept in a queen excluder limited region located in the center of the hive, and has access to one frame at a time. Rotated every day, these frames provide a steady supply of correctly aged larvae (average of 24 hrs) for grafting. Unfortunately, it means someone must rotate the frames every day, so only those operations that produced cells six or seven days a week will find this useful.

The concept is easily modified for single grafting events by adding drawn comb four days before the graft date, and biologically restricting the queen to this frame by eliminating other open combs. If the queen and colony desire to produce eggs, this will be where they must deposit them.

Most beekeepers find larvae while grafting by using a hunting process, locating the larvae of the correct size on a variety of frames in the hive. These larvae are usually on the outer edges of the comb, where they are subject to the greatest temperature variations of the cluster. This is one reason why is possible to select a larvae that looks the right size, but is older than it appears.

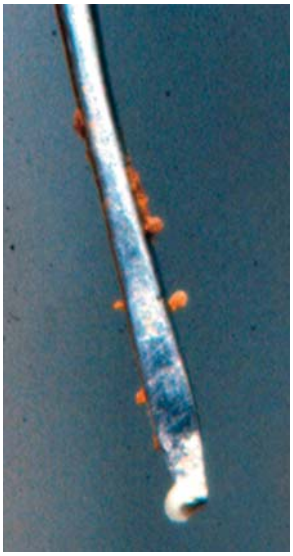


2. Graftable larvae. This frame is one from a colony managed for uniform aged larvae. These larvae are up to 24 hrs past emergence (average 12 hrs). The colony has been fed sugar syrup and there is plenty of pollen in the colony. This has stimulated copious amounts of royal jelly production, and the newly hatched larvae float on the bed of royal jelly. This jelly makes it easier to move the larvae, since the grafting tool will go into the jelly layer and *under* the larvae.

3. Priming Queen Cell Cups. One challenge of grafting is to maintain a humid environment within the queen cell. I use royal jelly diluted 50:50 with tap water (The royal jelly is kept frozen until used). A small amount of royal jelly is placed at the center of each cell cup. Here wax cell cups have been fastened to grafting bars with hot wax. There are also plastic cups on the market. I would not mix wax with plastic cells, but lack data to show side-by-side preference. The dilute royal jelly mixture is ultimately removed by the bees and new royal jelly supplied to replace it. During the grafting process the beekeeper is easily able to remove the larvae by floating it off the royal jelly. The dilute mix also keeps the environment around the larvae moist.

When I do not have royal jelly in the freezer, I dry graft, which means that I put the larvae on the bottom of a queen cup without any additional moisture. (You cannot use water, for it will kill the larva). When I do this I only graft a few cell bars at a time before I put them into the hive. Plus, I keep the grafted cells covered with a moist towel. Cell bars are put into grafting frames. They are narrower than regular frames (facilitating movement in and out of the hive), and may be one of several designs.

During a large graft, take grafted cells to the starter colonies a few at a time. Do not wait until the end of the graft or you will have a lower acceptance.



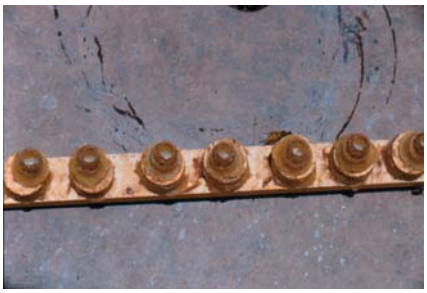
4. Grafting Tool with Larva. The small C-shaped larva in the bottom of the brood cell must be located and removed by a grafting tool. I made this stainless steel tool from a commercial model I ground, filed and polished to a very fine point. I like to lift the larva by the center of the C, and then reverse this on the bed of royal jelly mixture in the bottom of the cell bar. I try to avoid turning the larva over, as this may kill it. While grafting it is routine to damage the wax comb in the effort the remove the larva. This is why the grafting tool has wax on it above the tip. There are many grafting tools on the market. Try several until you find, or make one you are comfortable with.

5. Grafting Set Up. With a light aimed down into the cells, the grafter has a well-lit work area, and can see the larvae by repositioning the comb against the upright support. The cells laying on the table, are then filled in sequence from one end to the other. I often turn the frame over, as this person has done, so I am able to see the larvae better.

6. Starter Set Up. This is a five-frame nucleus box made into a starter. About five pounds of nurse bees were shaken from several colonies to provide a large amount of royal jelly production. The bottom of the starter is screened, and a feed can is placed on the lid, where syrup is taken through a hole. I like to graft in the afternoon, put the grafted cells on here overnight, and then move the started cells in the morning. The bees in the starter were used two or three times and then put into a hive with a queen. The starter contains the grafting frame, one or two frames of pollen and honey, and empty comb for syrup storage.

7. Cell bars on frame covered with bees. Several pounds of nurse bees cluster over the started cells. The frame is turned over and the bees carefully shaken back into the starter box.

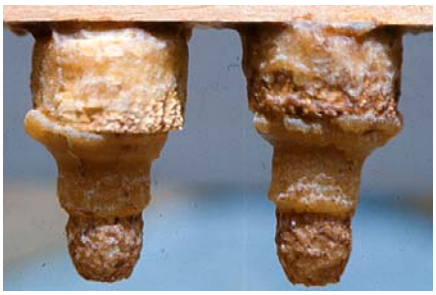
8. Double rows of cells in starter. With the bees removed, you can see the success of the graft. This frame is holding six grafting bars of 15 cells each, but can hold as many as nine grafting bars. As a result of my experience, I feel that the larger numbers sometimes used in operations are ideal for a limited time period, and must be reduced whenever the percentage of started cells or the quality of the food stores is reduced.



9. Started cells on cell bar. These cells show the amount of feed given the larvae in a cell starter. The edges of the cells are chewed and thinned (in tender wax cups) or wax is added (in plastic cups and tough cells made from older wax).

10. Started Cells on frame. These are cells from a starter. This frame holds two cell bars. The number of cells was reduced to increase the percentage of acceptance. Staples are driven into the frame to hold the cell bars. These frame and cell bars will be moved into the cell finisher.

12. Multi-aged cells in finisher. This is a cell bar from another beekeeper's finisher colony. This operation adds one bar of cells at a time, and keeps up to three different ages of cells in the builder at all time. This has the possible advantage of only a small number of new cells being fed and under construction at any one time.



11. Cells in cell finisher. These two cells are from a cell finisher colony. This clearly shows where the bees have added wax to the cell cups. These cells were not produced during the peak of the season, as evidenced by the darker color of the cell wax used in the cups. Bees will continue to add wax and the cells will become more and more mottled.

13. Well-drawn queen cells. These are some cells from a cell builder. The bees have finished cell production, but will continue to add wax as the queen larvae become pupae and then adult queens. Workers continue to be attracted to the cells throughout this period, and will chew the tips of the cells to reveal the queen pupal silk a day or so before emergence. They are apparently responding to the queen pheromone being produced by the developing queen.

14. Dissected queen cell. Once the queen larva has finished feeding on royal jelly, it becomes a prepupa and then a pupa (neither feed). This leaves evidence of the food the bees have provided. The royal jelly fills the cell base in well-fed queen cells, and may be used as proof of good rearing conditions.

15. Cold weather grafting frame. When the season starts up, many cell producers use a grafting frame that puts the cells against the smaller brood area typical of that time of the season. This makes sure the cells are kept warm on cold nights.

16. Queen Cell. This is a completed queen cell, mark of a good effort at queen rearing. The wood cell base serves as something to handle, as well as the part the beekeeper pushes into the brood comb before the queen emerges from the cell.

17. Queen Cells in Cages. Because we worked with instrumental insemination, we caged all our queen cells. Soon after the queen emerged, the wax cells were removed and queen candy was put at the end of the cage. These cages were useful for carrying queens (virgins or mated), queen holding, and for queen introduction.

18. Mating Nuclei Colonies. I recommend use of larger nuclei for mating in northern states and in Canada. A five-frame nucleus can hold two queens if the unit is divided and each unit is given a different entrance. I would set up a five-frame nucleus box with a frame of brood and an extra shake of bees. To this I would add a frame of honey and a ripe queen cell. At the end of the mating season, I leave the last queen to head the colony until I requeen colonies later in the season, build up the nucleus into a full sized colony, or keep the colony or nucleus over wintering.

References

Doolittle's *Scientific Queen Rearing* is easy to find, but the demand keeps the price up. Plan to spend $75 or more for a reading copy.

Consider two current books from Wicwas Press. For hobby beekeepers, consider Roger Morse's *Rearing Queen Honey Bees* ($18). For Sideline and commercial beekeepers the clear choice is Harry Laidlaw and *Rob Page's Queen Rearing and Bee Breeding* ($25).

For further information on any of these books, contact me at LJConnor@aol.com. These books are also sold by this magazine, by various bee supply vendors, and by on line vendors. BC

Dr. Connor may be reached on line at LJConnor@aol.com. When not speaking at beekeepers meetings, he is finishing a book on making new bee colonies, called Increase Essentials.