THE BEST SPLIT

Buddy **Marterre**

Splits are easier than you might think. And I'm going to explain how to make my favorite kind. Perhaps you are thinking about expanding your operation or perhaps you just wish to limit your overwinter losses without varroicide treatments. My 2013 article "*Why Treat for Varroa?*"[1] asks a legitimate question. In it I show that the marginal benefit (or the percentage of additional survival over no treatment) of any chemical used for *Varroa* is only about 7%. And the chemicals required (even the "soft" ones) are bad for your bee's health and accumulate in your beeswax. National averages over the last seven Winters show a paltry 69 % colony survival – and that's with treatment.[2] So in a hypothetical example, if you had used chemicals on all of 14 hives, 10 would've survived, and if you had not used varroicides, nine would've survived anyway. But how do you get those nine out of 14 to survive without harmful treatments? And how can you cover your losses so that you have 14 or more survivors the next Spring – without chemicals? Easy. Perform reverse splits after the honey flow in the Summer on your best hives. And you might even wind up with more than 14 . . .

Splits are a great cultural *Varroa* control because they both split the mite population and break the brood cycle. They are also an easy way to rear your own queens, prevent swarming, and expand your operation. But you

To use one of these templates you must have Microsoft Excel. If you have a Windows based machine, Excel 97-2003 works and if you have a Mac, Excel 3.0 works. Download the template of your choice depending on the type of queen rearing you plan to perform.

Open the file; change the BOLD DATE of your primary procedure in the yellow cell or box, and save the file as a new file using the "save as..." command. This keeps your original template file intact for future use. Then print the new file in landscape format (you may need to ensure that the file prints on one page by using "fit to 1 page" under scaling or page setup), carry it with you to the bee yard, and follow the instructions. Orange cells are for important procedures; do not change the contents of those cells manually.

Refer to "Calculating Queens" in the February 2014 issue of Bee Culture for more instructions.

Reverse Split Queen Rearing Calendar

To Receive A Copy Of This Excel File Please Send An Email To Our Capable And Reliable Publications Assistant Amanda@BeeCulture.com And She Will Reply With The File Attached. Please Put "Splits" In The Subject Line Of Your Email.

Drone Brood	Age	New Queen Stage	Age	Date	Procedure
		egg layed	*0*	June 12	
ast old egg!	*0*	very young larva	*3*	**June 15**	**Make reverse split** w/ queen and very little capped brood, a few frames of empty drawn comb and 1 - 2 frames honey. Feed donor 3 gallons. Use very small entrance in split.
		larva capping	*8*	June 20	Examine the donor colony and **cut out all but 2 - 3 queen cells**: keep the youngest ones that are uncapped and contain queen larvae and lots of royal jelly. Feed donor more.
		pupa	*12*	June 24	Feed donor 3 more gallons sugar syrup and feed split if necessary. ? Transfer 5 more frames without capped brood to split?
		emergence	*16* / 0	June 28	Quit feeding donor to allow empty drawn comb for new queen to lay in. Feed split if needed.
		orienting	2	June 30	
		begin mating	4	July 2	*[Adequate mating weather is 45 minutes of > 69 degrees on a sunny afternoon.]*
st new egg?		peak mating	6	July 4	[Earliest possible egg laying date for new queen in donor.]
ne capped	1 / *6*	end mating	12	July 10	**Check donor for a** ?-12-day-old **egg-laying queen**. Assess donor for Varroa mites.
		egg laying	15	July 13	**Treat donor (HopGuard)** during capped-broodless period if eggs seen and threshold met. *If no eggs/queen, transfer eggs and nurse bees in from another colony and repeat.
st new caps	*12*		18	July 16	[Earliest possible capped brood date in donor.]
			21	July 19	Check donor's brood pattern and **cut out any supercedure queen cells**. (The donor bees may try to supercede the new queen - low brood pheromone during the interruption).
		phermone mature	24	July 22	

se this file: change the BOLD DATE in the YELLOW BOX (the day of the reverse split), save as a new file or worksheet, and print in LANDSCAPE

od Luck and HAVE FUN!

Buddy Marterre

can also use them to increase the number of colonies that you have to overwinter with. And splits can improve *Varroa* tolerance by selecting from your own survivor queen mothers for breeding "stock" year after year. The reverse split has many advantages over a regular split, particularly if you are doing a split after the honey flow in the Summer time. The only disadvantages that I have found with reverse splits is that: 1) you have to find the queen in a strong colony in the hot sun right after you've taken the honey from the hive. The bees aren't generally very happy to see you under those circumstances. And 2) you usually have lots of other things to do during that time (like process honey).

How does a reverse split differ from a regular split? You merely transfer the old queen from the donor colony to the split or nuc instead of keeping her at home in the donor. But because you are transferring the queen, there are some other fine points to make it work really well as a *Varroa* control that you might as well take advantage of. What – other than doubling your number of colonies to overwinter – do you accomplish with a reverse split? First, it allows you to do your splits with the colonies that were both the most productive and with the queens that you not only want to breed from, but also want to keep for another year. The most productive colonies are the most likely to succumb to *Varroa* mites over the Winter, but this way you can increase your chances of keeping that productive queen for another year (or two, if you do this two years in a row). I have successfully kept a gentle very productive queen for 3¾ years this way before she finally started slowing down. And in my experience nucs survive better over the Winter with an established queen than a newly bred one. Also, in a reverse split the donor colony's new queen is reared from the eggs of a successful queen mother. So in your second year of doing this, the new queen is reared from a survivor, who likely is *Varroa*-tolerant. Reverse splits also solve the small hive beetle (SHB) nuc problem in the Summer because the split contains an established queen and will not be devastated by SHBs like a queenless nuc would be during this time of year. Although the donor colony is queenless, it is strong in numbers, and SHBs won't be able to get a foothold there either.

Reverse splits are also an excellent method of cultural *Varroa* control. By moving the established queen into a nuc with little or no capped brood, very few *Varroa* mites will be transferred to the split. And all the *Varroa* mites that are left in the original colony will be exposed during its ensuing brood cycle interruption. These phoretic mites can either be groomed off by their hygienic host bees or, if you plan on using a non-toxic method, only one brief treatment will kill almost all the remaining mites in the colony before the new queen's brood is capped and she begins the fall brood nest expansion. And if you do your reverse splits in the late Summer, the new queen should have three or four brood cycles with a very low mite load to build up before the Winter. There's also a lower robbing potential with reverse splits as the donor colony is the one receiving most of the sugar syrup, and it is the strong colony whose bees would otherwise be doing the robbing.

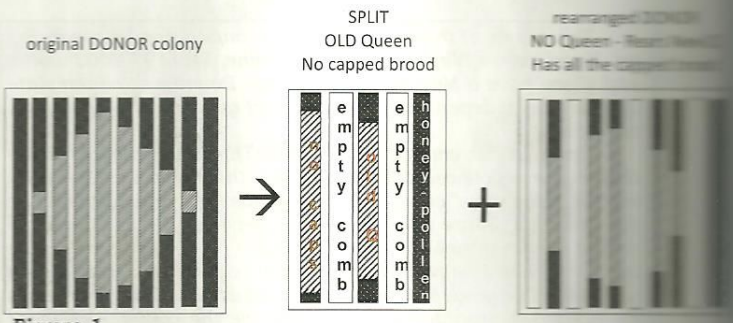

Figure 1.

And since the split has an established queen, it too is less likely to be robbed than a queenless nuc.

Furthermore, think about how you've positioned yourself for the following Spring. There is a low swarm potential in the populous donor colony because it now has a young queen. And the colony with the old queen isn't likely to swarm either because she'll be busy expanding into her new space. Therefore both colonies are likely to make a lot of honey the next year.

So how do you do it? Use the Reverse Split Queen Rearing Calendar and the instructions in *Calculating Queens*[3] from the February 2014 issue if you like. See Figure 1 of this current article as a diagram to explain the instructions and refer to Figure 2 for the dates and reasoning behind the procedures. Making a reverse split is basically the same as making any other split, but you move the frame WITH THE OLD QUEEN from the donor

Age	Queen Stage	Age	Drone Brood Stage
0	Egg Layed (to become new Q)		
2	* Split Day	*0*	Last Drone Egg Layed by Old Queen
7	* Cut Capped Queen Cells		
16 / 0	New Queen Emerges		
4	Earliest Virgin Queen Mating		
7	New Queen Starts Laying Eggs		
10	* Check For Egg-Laying Queen	*24* / 0	Last Old Q's Drone Brood Emerges
16	New Queen's Brood Capped	6	First New Queen's Brood Capped
~ 21	* Cut Supercedure Cells		

Figure 2.

colony into the split. You also remove either four or nine other frames from the donor and place them into either one or two five-frame nuc boxes with a new bottom and top of course. The new colony then contains the old queen and is called the split. Transfer as little capped brood as possible from the donor to the split. Transfer frames with a little uncapped brood and clinging bees and empty drawn comb, and transfer at least one frame of honey. Arrange the new split (assuming it is five frames) as follows: Place at least one frame of empty drawn comb near the middle for the old queen to lay eggs on. Place whatever egg and open brood frames near the empty drawn comb, and place a frame or two of nectar/pollen on the outside. The reason you don't transfer capped brood to the split is that 2/3 of the *Varroa* mites are in the reproductive or non-phoretic phase under the wax cappings and you want to leave the vast majority of the *Varroa* mites in the donor colony. Reduce the entrance drastically to prevent robbing, move the split to a new location (or set it beside the donor if you don't have one), and feed it some sugar syrup, unless there is incoming nectar.

You will need to expand this split colony before Winter as its queen is actively laying eggs; personally I try to get them up to 10 (and sometimes 15) frames before Halloween. Then use five or 10 frames of stored empty drawn comb or foundation or better yet no-foundation frames to add to the rearranged donor colony so that its original size is maintained. Feed the donor colony right away with lots of sugar syrup. Those bees have to rear a queen and draw beeswax.

Keep all or most of the capped brood frames in the original donor colony. That donor colony MUST have a frame near the center that contains eggs in order for its bees to rear their new queen. The donor hive also MUST contain at least one frame that is heavily bee bread-laden as bee bread (moist pre-digested pollen) and the nurse bees that are already feeding on it are the key ingredients to raising big queens. Dry pollen is NOT the same as bee bread[4] and neither is a pollen substitute[5] (see Figure 3 for a comparison of bee hemolymph protein content based on food source in caged bees after six days). Your newly developing queen only has four or five days as a developing larva to eat that royal jelly so that she grows up big.

You need to go back to the original donor hive in exactly five days (the split is made on day 0) and cut out all but two or three of the least developed queen cells (ensuring a healthy queen larva and lots of royal jelly first). See Figure 4 for a photo of what constitutes the kind of cell you want to keep (the photo has some of the comb pealed back to show the day two queen larva). Once you have found your two or three young "keepers," shake bees off all the other frames to find capped queen cells that are hiding under adult bees and cut all of the remaining ones out (if already capped at day five, they started with

Figure 3

Caged bee hemolymph protein concentration after 6 days:	
27.6 ug/ul	if fed bee bread
11.4 ug/ul	if fed pollen
2.2 ug/ul	if fed sugar

- Cremonez, et al, 1998

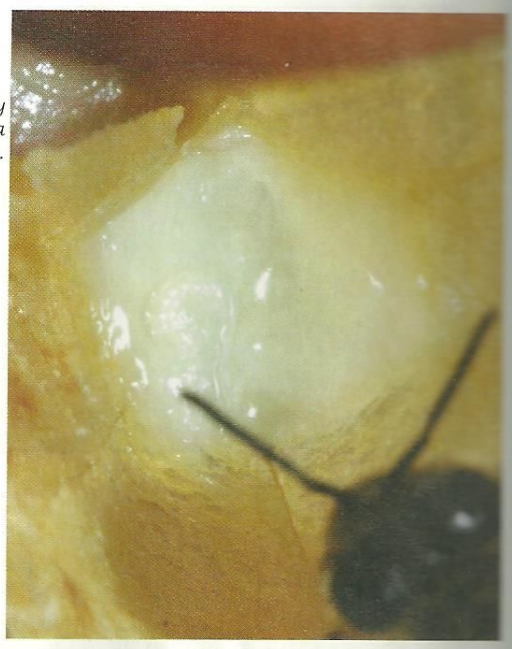

Figure 4. *Day three queen larva on royal jelly.*

too old a larva which will develop into an inferior queen). Make sure to leave only two or three keeper queen cells that are uncapped, contain developing queen larvae, and are each sitting on a heap of royal jelly.

You want to rear the biggest queen you can. Bigger queens have a bigger spermatheca and therefore hold more sperm and are even better mated than smaller queens.[6] And queen size is all based on the nutrition they receive during those five days. So you only have a five day window of royal jelly feeding for your potential queen to be big and beautiful and lay lots of eggs for two or three years!

To achieve the best possible queen development, you KEEP the larvae whose cells are the LEAST developed (certainly not capped yet) five days after you make the split. Let me explain: Since queen cells are capped on about day 8½ after the egg was laid (which was day 0), any potential developing queen in a queen cell that is already capped five days after the split didn't start getting royal jelly feeding until it was a day four larva. That's a larval age that is too old to develop into a big queen. You want the developing queen larva that was fed royal jelly right from the time its egg hatched at the very end of day two (or at the very latest as a day three larva). Such a queen cell won't be capped yet five days after the split. And at six days of queenlessness, unless the nurse bees started with day one eggs at the time of the split (which is uncommon), ALL the queen cells will be already be capped, so you won't be able to tell which queen larvae got the best nutrition. And don't be fooled by capped queen cell size on the side of the comb as it's unreliable. I typically only keep two or three of the youngest cells. One queen cell will work if that's all you have. But if you leave more than three, in all likelihood at least one of the emerged virgins will fly away rather than stay for a fight that she knows she's going to lose. If she does fly away, she'll take a bunch of bees with her (an afterswarm) and further weaken your donor. See Figure 5. Which one would you cut and which one would you keep? So why leave more than one? Sometimes a queen doesn't develop, and dies in her cell before emergence. Also, if you leave

Figure 5. *Two queen cells.*

two or three, it gives the colony a chance to decide which queen they prefer. I've always liked the concept of letting the bees choose which larvae to rear into queens AND which virgin they like the best too.

Check the donor again about six days after the first good mating day (four – 12 days after virgin emergence, requiring only 45 minutes on a warm sunny afternoon), or 24 days after the original split for an egg-laying, mated queen. If you see eggs, do a *Varroa* assessment (the sugar roll test[7] is best) that day. If you do not see eggs, check back after four more days as your new queen may not have started laying yet. Once you see eggs, do your *Varroa* assessment and look for brood.

After you close the donor, feed more sugar syrup. There shouldn't be any capped brood in the donor colony at this point because all the previous queen's drones will have emerged and it is too soon for the new queen's brood to be capped. Thus your original donor hive now has at least a five-plus day period of no brood under wax cappings. That means all the *Varroa* mites are exposed! If the colony achieved treatment threshold for your area, one quick and simple *Varroa* treatment with a non-toxic substance such as HopGuard or one Dowda powdered sugar dusting will drop the vast majority of the mites. If you do the Dowda method, be sure you catch and kill the live mites so that they don't crawl back up into your hive. Although HopGuard has gotten some bad "press" from folks who don't understand how it works on the internet, it is an excellent product that is all natural and very effective. A single HopGuard treatment (with one strip per five deep frames of bees) is all you need to kill 90+ % of the colony's *Varroa* mites *during a capped-broodless period.* Personally when I've checked at this stage, my mite counts have actually been very low as apparently I have bred very tolerant bees with this method, so I still haven't treated any colony with anything for seven years now.

Recheck that donor colony again in about 10 more days (or five weeks after the original split procedure). Yes, recheck it again. This time you're checking for capped brood to ensure that the new queen is well mated and not a drone layer. Also, look for and cut out any queen cells you find at that time. Bees have been known to question a newly reared queen's quality and try to supercede her.

Initially the donor from your reverse split has a lack of brood pheromone because of the brood cycle interruption, and the new queen hasn't yet reached QMP pheromone maturity, so you may see them. If you do, just cut those supercedure cells once (make sure you get them all). The bees will reassess her (now that there is more brood pheromone) and realize what you already know: she's big and awesome and is laying lots of eggs! Now just continue feeding both colonies sugar syrup and pollen/substitute as necessary unless there is a good nectar flow and pollen stores are adequate – until both colonies are sufficiently populous and stored-up to overwinter in your area.

You've just doubled your numbers from your best colonies, reared great big queens from your best donor mothers, avoided destruction from SHBs, prevented robbing, prevented swarming next Spring, and improved the genetics of your local population of bees! All without harmful varroicides! Give yourself a hand. Or better yet eat some of that honey you should've been processing. BC

Bibliography

Cremenoz, Tania M., David de Jong, and Marcia M. G. Bitondi. *Quantification of Hemolymph Proteins as a Fast Method for Testing Protein Diets for Honey Bees* (Hymenoptera: Apidae).