Methods of Making Increase Colonies

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My first beekeeping book,* Increase Essentials, *was first published in 2006. A great deal has happened since then. Colony Collapse Disorder appeared. Many beekeepers moved away from package bees to increase nucleus production, and developed a wide array of amazing methods to make increase nuclei. Many routinely winter these colonies with different levels of success. So, as we work to produce a second edition of* Increase Essentials, *we will put both new and updated materials out to the thousands of people who have purchased the book. For them, I hope that they will see it as an upgrade, and for those who have not read the book, I hope it will incentivize them to read it. In this issue we continue the discussion about making increase nuclei.

Selecting colonies for increase production

At the first hive inspection in late winter or early spring, select the colonies that are thriving and growing rapidly. In Florida, southern Texas and the Southwest, this may be in January, while in the northern tier of states and Canada this may not happen until March or early April in average years. While you may feed all your colonies to keep them alive, select certain colonies you want to "push" brood and bee production, to make new increase colonies. Give them constant sugar syrup stimulation and pollen patties or pollen substitute. This allows the bees and the queen to produce a large amount of brood, and this will grow your bee population. The bees will respond to the push in February or early March in northern states and in lower Canada.

Deciding which colonies in your apiary will be used for increase production depends upon your objective and your beekeeping conditions as expressed as potential nectar flows. Here are three strategy examples:

- *Every colony will be used to provide brood and bees* adequate to produce one or more increase nuclei. This is an ideal program when all hives are about equal in strength and you have been successful at keeping winter loss low and the colonies are responding well to stimulative feeding. If your colonies go to California for almond pollination, you can remove a nucleus or two from each colony when the hives are successfully returned to you. By doing this, you accomplish two goals: first you will make new colonies at a point in the colony cycle when they are producing surplus bees, and second, removing bees and brood will seriously discourage these hives from swarming.

Strong colony that survived the winter was converted into increase colonies.

- *Only certain colonies will produce increase nuclei.* While you might use just the strongest colonies to make increase nuclei, beekeepers like Vermont's Mike Palmer routinely sort out the lower quality colonies and use only these to form increase nuclei. These are 'C' level colonies that will require effort and still only produce a below average honey crop. He uses only the strongest colonies for clover honey production, following a rigorous swarm prevention program of adding supers early and other methods. Keep your 'A' and 'B+' strength colonies for honey production or pollination and put the rest of the hives into making increase.
- *All colonies are converted to nuclei.* The most severe system of making increase nuclei is commonly used by larger sideline and most commercial beekeepers. All colonies are completely dismantled at some point in the seasonal management cycle and made into a number of new increase nuclei colonies. Each colony receives a minimum of three frames of brood, food frames, and left-over comb. This is an excellent time to remove

old combs and add new foundation or starter strips. Some beekeepers set up an assembly-line production facility at the base apiary or in the field to collect colonies, pull frames and add queens. There are an amazing variety of methods commercial beekeepers use to accomplish this extensive colony manipulation. The advantages are clear—you end up with colonies with all new queens, potentially new brood combs, and have entirely eliminated swarming as a major management focus, in addition to setting back the varroa mite build up in the original colonies.

Timing increase nucleus production

Timing management manipulations is a key part of learning beekeeping. If you have been feeding colonies, but make increase colonies too early, you will set back both the parent colony and the new colony. If the size of the unit is too small, it will require additional food for energy to keep the colony warm which may slow growth. Remember, it takes much more energy for several small colonies to build up than one large colony. Wait until nighttime temperatures are above freezing before you start the production of increase nuclei. Watch *nighttime low temperatures* and wait to make up nuclei increase colonies until nighttime temperatures moderate and there is abundant food coming in. This is late April and early May in the northern states, but every year is slightly different. Watch the weather!

Increase nuclei made too early in the season often have spotty dark brood areas where the brood was chilled (and killed)

Worker and drone flight at the entrance of a hive in the spring may be used as one measure of a colony strong enough to use to make increase colonies.

Queens in cages from a holding hive. The careful use of a holding colony ensures strong queens when needed if weather or bee conditions delay the production of increase nuclei.

when the small colony cluster drew in on a cold night and abandoned the fringes of the brood area. While sealed brood is rather resilient to brief exposures to cold, I have also seen entire frames of sealed brood that were killed when left out in a strong and chilling wind before they were added to the new hive. Such early, and somewhat clumsy efforts, are totally counterproductive.

Waiting for further development and better weather will pay dividends. I try to use biological timing systems, based on key plants in bloom that will contribute to buildup. I delay the production of the *very first* increase nuclei until the soft maples are in bloom. This is the earliest I would attempt to make such increase. Of course, there are many reasons to wait even longer, and I suggest you wait so the parent colonies get stronger.

To think of it another way, push your colonies to the point they will soon start building swarm cells. Then make increase nuclei as quickly as you are able. If you are one week late, there will be a lot of your bees hanging in the nearby trees, and that is NOT the focus of this article.

The queen bank

Too often, the determining factor for making increase colonies is the pre-scheduled arrival of queen bees from the South, West or Hawaii. In the northern tier states, many beekeepers attempt to rush the season by scheduling queens for arrival in early April, when environmental conditions may or may not have supported full colony growth and brood rearing. If you find that your queens have arrived too early or you cannot delay their arrival from the queen producer, you are wise to set up a queen bank to store them rather than rush to make up nuclei too early. A queen bank is just like a queen cell finisher used in queen rearing—a queen-less hive body with several frames of open and sealed brood, positioned over a queen excluder, situated over a strong hive containing a highly productive queen. Surplus queens are kept in separate cages without attendant bees on a holding frame so they receive food. Feed this colony with sugar syrup. If you have tested and find a high level of *Nosema apis* or *ceranae*, add medication to the syrup. There is no point in medicating queens if there is no *Nosema* in the hive—this requires frequent sampling and examination under a high powered compound microscope.

Queen banks may be used at any time in a beekeeping operation to store queens that are not needed *today*. Banks are better than leaving queens in mailing cages on the woodshop table, since the worker bees in a hive will better attend to their needs than worker bees shipped in mailing cage. Banks are also used to finish or 'ripen' sealed queen cells, to hold virgin queens, and to store mated queens before sale or use in the operation.

By waiting until weather conditions improve, you can make increase nuclei with safety and confidence. First-time increase nuclei makers are advised to wait until the weather conditions are stable for the season. This is mid May or early June in the northern USA, and should anticipate the appearance of swarm cells—or allow you to use swarm cells on brood frames—and reduce the population of bees and brood in each strong hive.

(Continued in March issue.)

Check www.wicwas.com for the new book *Swarm Essentials* by Steve Repasky and Larry Connor. Watch for the second edition of *Increase Essentials* on this same website.

For the Love of Bees and Beekeeping

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The Rise and Fall of the Dust-ructor

It was an idea whose time had come. Varroa mites were raging as the front-runner of beekeeping problems; the synthetic chemicals used to control them were coming under scrutiny as problems in their own right, and non-chemical alternative remedies were looking smarter and better all the time. And what could be a safer alternative than powdered sugar?

The idea of treating bees (and mites) with finely ground dusts such as wheat flour or confectioner's sugar had been around a while, the idea being that dust impedes temperature-sensing organs on the mite's forelegs that it uses to locate bee hosts, or impairs the mite's ability to keep its grip on the bee[1], or induces a grooming response from bees that dislodges mites[2]. Moreover, once a mite is dislodged and falls onto a dusty hive floor, it may have trouble moving around and eventually die of starvation. A handful of early studies suggested a degree of efficacy in dislodging mites with dust, either for diagnostic purposes or outright control, but these references were for the most part hidden away in non-English literature or obscure conference proceedings. But by the early 2000s there were new studies giving the matter more exposure in mainstream journals. Mite dislodging rates between 77%[3] to more than 90%[4,2] were being reported, and American beekeepers and bee scientists were taking notice. But no one can pretend that it was a revolution taking place. For starters, there was no consensus on such details as mode of delivery, quantity of dust, timing and intervals of treatment, or even the basic question whether dusting worked.

A convincing field-scale study finally came out in 2009 from Florida – and the results were not promising[5]. Amanda Ellis and her co-workers dusted the top bars of brood combs every two weeks from April until the following February and found no difference in colony strength or mite populations between dusted colonies and non-dusted controls. When I read these results, I was ready to write off powdered sugar once and for all, but that was not to be.

My intrepid staffers Brett Nolan, Ohad Afik, and Jennifer Berry weren't quite as pessimistic as I and reasoned that several questions remained unresolved. To begin, they argued that (1) the efficacy of dusting had not been adequately tested in the context of a brood-free period (bee colonies in Florida are rarely brood-free), and it was exactly a brood-free period when one could expect maximum control when the whole mite population was on adult bees and vulnerable to dislodgement. They also argued that (2) more than one delivery method should be tested – especially one that could work at a commercial scale, and finally, they thought that (3) more than one treatment interval should be tested. In short – they dreamed up a whole new experiment[6], and who was I to resist such youthful initiative?

But before we could do any work, we had to come up with something about that point #2 – dust delivery at a commercial scale. Brett and Jennifer had an idea about a forced-air device that would blow sugar dust into the hive entrance, avoiding the need to open and manipulate individual colonies. Realizing the vision ultimately

Fig. 1. The Dust-ructor is a shop vac with a hose modified to pass through a PVC chamber accommodating 120 g powdered sugar.

Fig. 2. UGA Bee Lab personnel Brett Nolan and Charlie Gwyn run the Dust-ructor through one of its many beta tests.

Fig. 3. Blowing powdered sugar into a hive through the bottom screen

involved a shop vac, a few PVC plumbing parts, and several trips to the home improvement store. Beta testing and refinements led to a contraption with the likeness of a vacuum cleaner. The shop vac hose was modified to pass through a PVC chamber which accommodates 120 g powdered sugar (Figures 1-2). The device could deliver dust to hive interiors when applied either in the hive entrance or through the bottom if the hive was fitted with a bottom screen (Fig. 3). And with a final flair of panache it was named the Dust-ructor in a nod to the scientific name of its target, the mite *Varroa destructor*. Excitement was in the air.

In rapid succession we put together 64 single-story Langstroth colonies, divided them between two apiary sites, and assigned each colony one of 8 treatment combinations: (1) beginning powdered sugar treatment in January (broodless) or in March (brood increasing), (2) applying treatment every other month for 9 days (4 treatments 3 days apart) or applying one treatment every 2 weeks, and (3) applying powdered sugar with a sifter on frame top bars then brushing it down between frames or blowing powdered sugar in the hive entrance with the Dust-ructor. The experiment ran from January to the following October, and we regularly took measurements of colony strength and mite levels. A parallel apiary of 8 colonies was set up and run as a non-treated control group.

Our first question was simply whether powdered sugar works. Our treatment numbers in multiples of 8 let us perform essentially 8 independent comparisons between treated colonies and non-treated. In only 2 of these 8 independent comparisons did powdered sugar significantly reduce colony mite levels. Not exciting.

Our next step was to look at the balanced 64-colony experiment to see whether we could detect any effects from the date of initiating treatment, mode of application, and treatment intervals. In one month (October), mite levels were lower in colonies in which treatment had begun the previous January instead of March, suggesting that powdered sugar works better when treatment is started early to exploit a winter brood-free period. In another month (May), colony bee populations were higher in colonies treated with the Dust-ructor, suggesting that applying powdered sugar with forced air at the entrance was less disruptive to bees than exposing and dusting frame top bars.

When it comes to the most important thing – colony survival – things weren't very promising. Among the 8 non-treated control colonies, three (38%) were still alive by October. Average survival among treated colonies was virtually the same at 39%.

In summary, we found:

- Powdered sugar reduced mite levels in only 25% of independent tests.
- Efficacy may be better if treatment begins early during a brood-free period.
- Dusting with forced air at the entrance may be less disruptive to bees than manually dusting and brushing frame tops.
- Powdered sugar did not improve colony survival rates.

In short, the rising star of the Dust-ructor was plateaued.

But I have belabored this non-remarkable experiment because I think it captures a lot of the state of modern bee health science and the kinds of beekeeping practices we'll be seeing in the future. Powdered sugar seems to fall under that category of remedies that "won't hurt and might help." It appears to be relatively harmless to bees[4]. In my opinion, powdered sugar joins bottom screens, drone brood trapping, and genetic honey bee resistance on the list of "soft" remedies for Varroa mites – practices that individually cannot be expected to keep this serious parasite at bay, but when used together might do the trick. Who knows? The Dust-ructor may still have its place in the world. But bee health can no longer be understood as a linear chain of one cause > one effect > one cure – that "cure" (more often than not) being an antibiotic or acutely toxic synthetic miticide. Bee health management will become more knowledge-based and less chemical-based, and research like this is where it comes from.

Footnotes

[1] References cited in Fakhimzadeh 2001. PhD dissertation, Univ. Helsinki, Dept. Appl. Biol. Publication no. 3

[2] Macedo et al. 2002. J. Apic. Res. 41: 3-7

[3] Aliano and Ellis 2005. J. Apic. Res. 44: 54-57

[4] Fakhimzadeh 2001. J. Apic. Res. 40: 105-109

[5] Ellis et al. 2009. J. Apic. Res. 48: 72-76

[6] Berry et al. 2012. J. Apic. Res. 51: 367-368