Managing Varroa

Conclusion

Chemical-free Beekeeping: Controlling Varroa by Disrupting the Brood Cycle

The Story of Central Pennsylvania Beekeeper Warren Miller

by SYLVIA FELDMAN
photos by ROY HENDRICKSON

To keep bees in the 21st century, you have to be part farmer and part scientist. Sometimes it seems like you have to be part alchemist as well. I've been keeping bees for about 25 years. For me, it was love at first sight. I can think of few greater pleasures in life than working with bees on a sunny day.

I have a few small bee yards and manage just over 100 hives in central Pennsylvania. In the past several years I've been able to improve the survival rates of my bees by approximately 300%—all without the use of chemicals. I attribute my success to a few related factors. About ten years ago I started raising my own queens and selecting for certain traits that help my colonies thrive. I've been making sure that my hives go into the winter with a young queen that is acclimated to northern conditions. Annual re-queening offers some promising benefits; however, unless you get the timing right, it isn't enough to appreciably increase colony survival rates. Timing is everything.

If you do the math, you realize that I got involved with bees in the mid-1980s—just before the time when all of the trouble with Varroa began. I kept about a half dozen hives for five years before mites hit central Pennyslvania. But, like most beekeepers, I suffered some pretty significant losses in those days. At the time, I tried to combat my losses with chemicals.

Converting From Chemicals to Chemical-Free Beekeeping

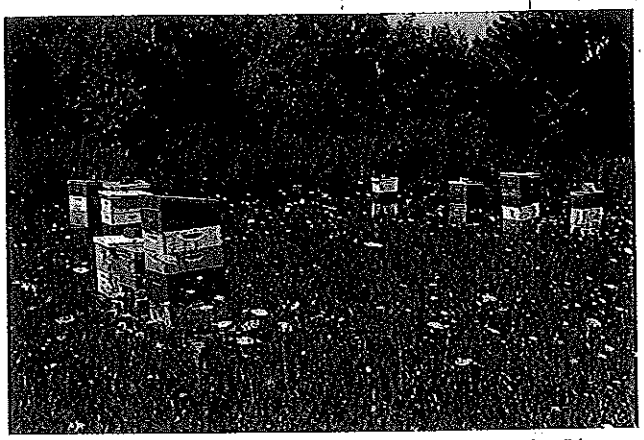
For eight years in the 1990s, I used Apistan strips. Chemical treatment was standard protocol in those days. At the time, I thought I was doing my hives a favor. Some of the treated hives lived, and some of them died. I'm a frugal guy, and I started wondering why I was spending money on treatments that didn't give consistent results. I was also getting a little resentful; I realized that I was spending my time managing mites when I really wanted to be managing my bees.

So, in 1999, I stopped using chemicals to treat my hives. My bees and I went cold turkey. My first year, I lost 9 of my 12 hives, which left me with a 25% survival rate. Typically, I'd have 3 to 4 hives make it through the winter without chemical treatment. Usually, one of those hives would stand out as a good producer. I started paying attention to that hive. A lot of bee researchers are paying attention to sick hives, and they're learning a lot from them. I think there's something to be said for taking the approach of paying attention to our healthy hives.

For instance, one of the big discoveries that caught my attention was the fact that Africanized honey bees are not affected by varroa mites in the same way that their European cousins are affected. The reason seems to be that Africanized honey bees constantly swarm or abscond from their hive. This breaks the mites' breeding cycle and keeps the mites from devastating a colony. It occurred to me that there must be a way to mimic this behavior yet maintain the qualities of the European honey bees to which we have grown accustomed.

Initially, I started requeening my hives with the daughters of my best hive. This

Warren Miller and Sylvia Feldman



(l) Overview of Warren's Black Walnut Body Shop yard. (r) Abandoned farm buildings provide the ideal winter windbreak in the R.W. Bird yard.

strategy yielded improved results with respect to survival and production. Then, I started to really concentrate on raising my own queens.

In 2002, I again lost 75% of my hives. I had stopped managing my bees with chemicals, but I had yet to develop a management plan to replace the chemicals with a physical manipulation that would yield better survival traits in my colonies.

Now, I typically lose less than 20% of my hives. Through queen selection and annual requeening at a time that is beneficial to the bees, I've boosted my apiary's survival rates significantly, as well as increased the honey production in my colonies.

Warren's colony losses this past winter were in the 20 to 25% range (15% for production colonies and 40% for overwintered nucs), according to Roy Hendrickson.

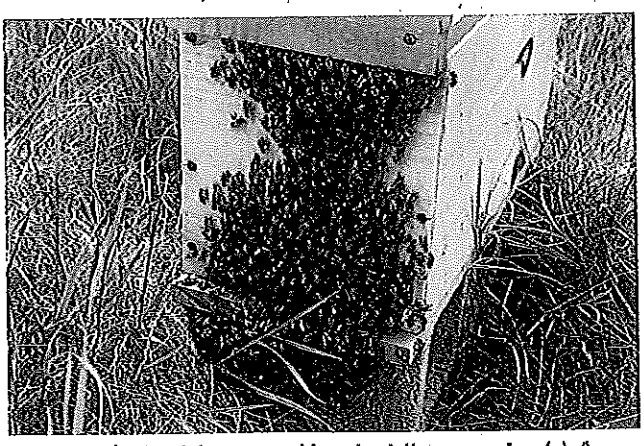
Know your enemy's strategies

To be successful with bees, you have to know your enemy. In 2004-2005 I managed about 50 hives, and took some time to learn as much as I could about the mite lifecycle. The science confirms what we see as soon as the weather starts to get warm—that honey bees and mites are in a breeding race in the spring. Each species produces as much brood as possible. However, unlike the mite lifecycle, the honey bee brood cycle is influenced by the presence or absence of a nectar flow. After the nectar flow has peaked, the honey bee queens reduce their egg-laying. Brood production decreases.

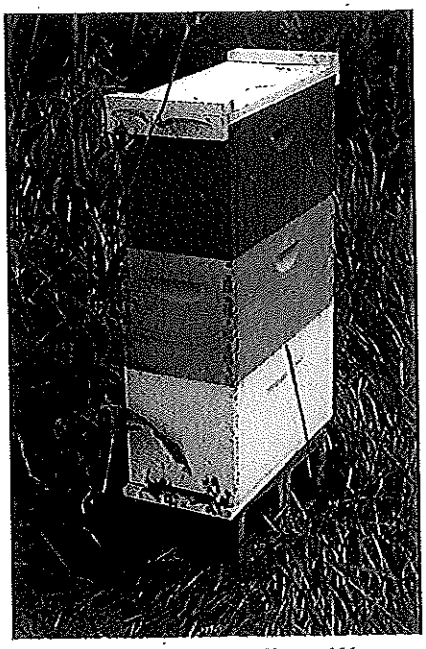
Mite reproduction, on the other hand, never slows. An exponential increase in the mite population, coupled with dwindling honey bee brood production, takes a significant toll. In early spring, when bee and mite populations are increasing simultaneously, a hive might have, at most, 20% of brood cells infested with mites. In mid-July, however, with decreasing bee brood levels and increasing mite populations, as many as 80% of a hive's developing brood cells or more become infested with female mites looking to reproduce. This results in a high percentage of hatching bees that have developmental problems due to the mites literally sucking the life out of them. It furthermore allows the many bee viruses to flourish and destroy your colony as it tries to prepare itself through the late summer and fall for the upcoming winter

It's a vicious cycle. But by interrupting this cycle, you can improve both honey production and hive survival rates. To do this, you will need to requeen your hives at the beginning of the honey flow whenever that may occur in your area. In central PA, this means I will remove the queen by the end of May or early June. This also allows your queen to build up the hive population and produce the bees so they can make a honey crop. I was never of the mindset to requeen a colony in early spring. The quality of early spring mated queens is inferior to queens mated later in the season, and the technique interrupts the colonies' spring buildup. This is an important time of year to assess which queens will be chosen to become the breeders for that season, so I manage them to build up as much as possible and use Walt Wright's checkerboarding technique to help prevent swarms.

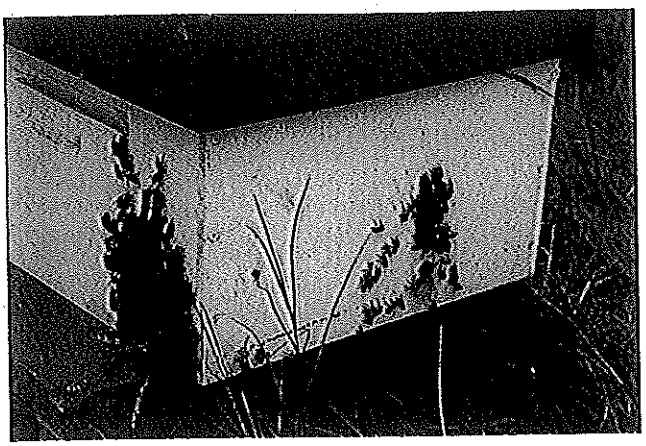
In preparation for requeening, however, you will want your hives to be queenless for about 2 weeks prior to requeening. This queenless and subsequent broodless period interrupts the buildup period of the mites and really sets them back at a critical time. While your hives are queenless, they will have no open brood for a period of time. And, importantly, without open brood, mites will have nowhere to hide and nowhere to reproduce. This gives the bees a chance to fight off Varroa infestations and the subsequent detrimental effects naturally. The timing of this management technique is critical. Another advantage associated with a broodless period is that when the queen is removed at the height of the honey flow, the bees will not have the chore of feeding brood. They will concentrate their efforts on



(l) The Bird yard also contains a small queen mating station that doubles as a Nuc holding yard. (r) A populous five-frame nuc in need of additional space.



During the honey flow Warren uses strong nucleus colonies to draw foundation.



This hive body contains four separate two-frame queen-mating units.

gathering nectar and producing honey. This is similar to the technique used by the Killions to produce comb honey, and is written about in their book, *Honey in the Comb*.

Another benefit to this technique is the introduction of a young, vigorous queen during the final stages of the honey flow. This young queen will begin her career in the middle of the summer nectar dearth; however, she does not have the experience to know that she should slow down her egg production. This young queen will continue to lay a prolific egg pattern and will swell the population of the summer hive with young bees. This will keep your colony working hard during the summer months and will subsequently build the population of bees that will produce your winter bees during September and October.

Disrupting the Brood Cycle to Combat Varroa without Chemicals

Here's a summary of what I recommend, and why. Note that the times are dependent on the honey flow, and that you will have to tweak the timing of this method if you live somewhere other than central Pennsylvania (Zone 5).

1. **Pull queens out of the hives at the beginning of the honey flow.** Here in central Pennsylvania, this usually is around the week of June 1. Your objective is to eliminate brood within the hive for a period of time. Without bee brood, the mites have nowhere to lay their eggs. During this time frame, without intervention, mite populations typically escalate exponentially. It is important to note that the most dangerous time in a mite's life is when she is not protected by a capped brood cell. During a broodless period, any new mites that emerge from the cells will have nowhere to run and nowhere to hide.

   Disrupting the brood cycle doesn't completely eliminate mites from the hives. Rather, it gives the bees an opportunity to knock mite populations down to a manageable level. And with no brood, the bees have fewer mouths to feed. This equates to an increase in surplus honey. If the queen that I remove from the hive has some potential, I will put her in a nuc and allow her to grow her new colony population and prepare for winter. It took me a few years to realize I was wasting a lot of good queens during this process, as early on I would remove the queens with a little extra pressure and introduce them to the fencerow. However, now I watch these colonies build up in the spring. If the queen is good, I will keep her for other uses.
2. **Be vigilant about cutting out queen cells twice within the next 7-13 days.** The bees will desperately try to raise a new queen and I have learned to not only cut cells at seven days after removing the queen, but to look again at about day 12 to catch any I missed on the first trip. They will be fully capped, bigger and easier to see if missed them initially.
3. **After about 2 weeks, introduce a new mated queen.** If you are planning to introduce a queen cell into the hive, you can do so during your second visit to cut queen cells on day 12 or 13. Ideally, your hive should not be queenless for more than 18 days. After about 18 – 22 days you run the risk of laying workers starting to develop.

   If I plan to requeen the hive with a mated queen, I will remove one that has been laying for a week or so from one of my mating nucs and I will run her in the front door or simply drop her in the top of the hive. Over the years I have found that a queenless colony will accept a laying queen if she is introduced immediately after being removed from another colony. I have waited up to about an hour, but have not held her in the cage any longer. I believe the pheromones she is producing as a result of her current laying activity allows her to be accepted by the new colony on a very consistent level.

   The first time I tried this introduction style many years ago I figured a drop of honey on her back as she ran in would help with the abrupt introductions. In the excitement of the moment I squeezed the bear a little too hard and there she was glued to the porch. Well the guard bees rushed out and cleaned her off in about five minutes and in the door she ran and was laying eggs the next day. Requeening your colony with a ripe queen cell on day 14-16 after removing your queen will keep the chemistry in the hive on track and they will continue to function as a normal hive. The introduction of the cell will also extend the period of time the colony is queenless and will reduce the mite levels even more. Just make sure the virgin queen returns from her mating flight and begins to lay eggs because this colony has been queenless and now broodless and laying workers will develop quickly.

As you can see, disrupting the brood cycle of your bees (and your mites) isn't much more complicated than requeening. If you are planning to requeen your hives anyway, or if you are hoping to implement a chemical-free method of mite control, I encourage you to consider the potential benefits of requeening at a time when disrupting the brood cycles will be a benefit to your colony. I no longer count mites on my production colonies. Although I do count mites on my breeding stock, I have to admit that it is empowering to get away from managing mites and back to managing bees.

Raising Queens and Selecting for Beneficial Traits

Raising queens is a little more complicated; but a good queen is another important component to colony survival. Ten years ago when I started queen rearing, I raised queens from my best hives. I assumed that the best queens would produce the best daughters. I gave little thought to genetics, or to why one hive might have performed better than another. At that time, I would spend time watching the activity at the front entrance and simply pick the best looking hive with the most activity. That queen became that year's breeder mother.

In 2000, without much record keeping, I

started to rear queens using several different methods. My goal was simply to raise a number of queens to requeen my production hives. At the time, I didn't really have a plan for them. I enjoyed raising them, and was able to build the equipment that I needed to house and manage them.

A few years later, as my apiary expanded to 50 colonies, my efforts became more focused. I started to produce more queens and increase my hive numbers. My rationale was that with more colonies from which to choose, the better the genetic pool would become and the better my queens would be.

Eventually, I decided on a set of standard criteria to use to determine which queens should be breeders. The first and most important consideration was that the queen had to survive the winter and build a viable population for the next season. Once a colony had survived a winter, its queen was eligible for breeding. If, however, at any time a noticeable disease was present within a colony, that queen was automatically removed from the selection process. Any colony that showed signs of chalkbrood, viruses, or other diseases was excluded from the queen rearing process.

Developing Hive Records to Yield More Consistent Results

Ultimately, my hive records became more sophisticated. I developed a rating scale in the field, and recorded my observations on an Excel spreadsheet. This made it easier to calculate which queens earned the highest marks. Today, the criteria that I use to determine which queen becomes a breeder are based on the following observations:

1. 30% of the score is based on the number of frames of capped brood the hive has at the peak of the dandelion bloom. This measurement is taken approximately six weeks before the main honey flow, with the assumption that the developing bees at dandelion bloom will be the field workforce during the main flow. This could not be accomplished if you feel the need to requeen in the early spring, and will prevent you from prematurely dispatching a potentially great queen. Give her a chance to see what she can do in the early spring.
2. 25% of the score is based on temperament. I assign a rating that takes behavior into consideration. I watch how the bees react when a frame is removed from the hive. Do they run, or are they still? Does the queen continue to lay? Or is she running around on the frame? I also wave my hand above the open frames to see how they will react. Bees with a mild, non-aggressive temperament are assigned a higher score.
3. 15% of the score is based on brood pattern. To earn high marks, the queen has to lay a solid pattern. She has to lay wall-to-wall and in successive frames. When a new frame is added to the brood nest, checkerboarding, she should fill it immediately.
4. 15% of the score is based on colony strength. I assign a number that takes into consideration overall strength, as well as strength in comparison to other colonies in the yard.
5. 15% of the score is based on the amount of honey that is produced by the colony.

I have a few queens that have been able to survive and produce during their third year, and build up their colonies to a respectable level. Ultimately, I plan to use only three-year-old queens as breeders.

Without using any chemicals on my hives, I repeatedly achieve high winter survival rates and honey production that typically exceeds the Pennsylvania average. I attribute the success of my apiary—in no small part—to the quality of my queens and to requeening at a time of year that helps my hives combat Varroa.

As much as a high quality queen can benefit a colony, it's important for new beekeepers to remember that a good queen is only one component of a successful apiary. A good queen is certainly important, but it's not a substitute for good beekeeping practices.

Sometimes I hear beekeepers say that they are too busy to manage their hives, and that they'll get to it in a week or so when they have some free time. If you want to be successful with bees, you have to manage them on their schedule—not yours. Without good management techniques, even the best queen in the world is not going to be a panacea for your apiary. An old farming adage that comes to mind is that "you have to make hay when the sun is shining." Managing honey bees is an agricultural pursuit, and we need to manage on the bees' schedule—not ours.

Improving Quality of—and Access to—Northern Queens

If your apiary is small, you may find it difficult to consistently improve your queen stock. Fortunately, you may have better access than you realize to northern queens of good stock.

The Pennsylvania State Beekeepers Association is currently developing the Pennsylvania Queen Project. We are forming a consortium of northern beekeepers with the objective of improving stock throughout the region and eliminating the use of chemicals in our beehives. This effort is being pursued in partnership with the researchers at Penn State University. Together, we are developing a uniform testing protocol so that beekeepers from around the state will be able to test known stock comparatively, and then identify the best queens as breeders. These breeder queens will be used to produce daughters that will then be redistributed back to the beekeepers and made part of the testing process. The ultimate goal of the project is to raise northern queens with superior production, temperament, and longevity without the use of chemical treatments. Sustainable agriculture is our wave for the future.

Whether you are a beginner or an experienced beekeeping veteran, I encourage you to experiment with the techniques that I've outlined. If you are accustomed to using chemicals on your hive, I realize that it can be intimidating to try something new—especially if it contradicts a lot of the marketing hype being espoused by the pharmaceutical companies. Don't let that stop you. It is possible to have improved survival rates in your apiary using natural management practices. And if you can eliminate chemicals, both you and your bees will be healthier and happier. Good luck and don't be discouraged. The first few years without chemical treatments can be hard to overcome, but the long-term effects are definitely worth the pain.

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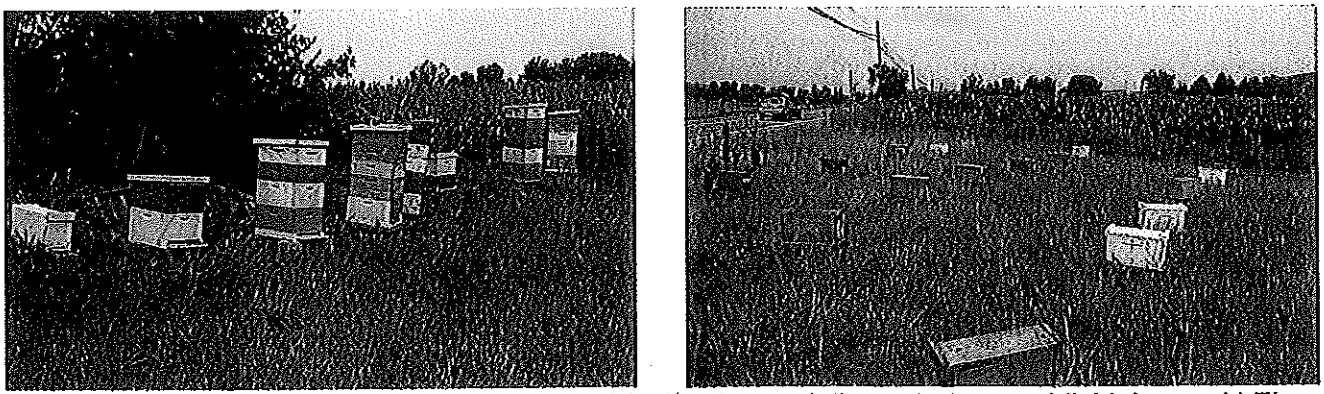
Sylvia Feldman has been keeping bees for 11 years and is currently President of the Centre County Beekeepers, Centre County, PA



(l) The Zion yard. This location is frequently used for local association meetings and field days. (r) The Zion yard also includes a queen-mating station, adjacent to a nearby highway.