# The Remarkable Honey Bee

by LAWRENCE JOHN CONNOR

Wicwas Press
1620 Miller Road
Kalamazoo, MI 49001
www.wicwas.com

# SUSTAINABILITY IN BEEKEEPING

More and more beekeepers worry that beekeeping is no longer sustainable, a concern reinforced by a multitude of media reports and survey results showing high colony mortality, reduced bee viability, and some tantalizing data that indicates that beekeeping globally is undergoing tremendous change. Beekeepers report that fewer of their colonies are able to survive the many insults they face from modern agriculture in terms of monoculture and new pesticide utilization, as well as from climate changes and increasingly unpredictability of the ability of colonies to produce surplus honey and survive to the next reproductive cycle. Will their colonies be alive next spring? Too often this is the primary question beekeepers ask, regardless of their years of experience or size of operation. To sustain both the bees and the beekeeper, bees must survive in larger numbers.

Sustainable apiculture, that which is able to maintain itself at its certain rate or level, clearly depends on our ability to manage population levels. In the revised edition of *Honey Bee Biology and Beekeeping*, Caron and Connor describe the Essence of Beekeeping as "the relationship between time of the season and the number of bees" (Chapter 1, Figure 1-2). They go on to state that the goal of all beekeepers is to reach the peak population of bees with the peak availability of nectar and pollen needed to make a honey crop and sustain bee populations for the rest of the season.

While this seems to be a simple concept, it is harder and harder for beekeepers to achieve. Beekeepers report that their colonies fail to build up in time to be productive. Colony populations do not reach their peak until AFTER the primary nectar flow is over for their area, if they grow at all. This may be a combination of a variety of factors—a shift in the genetic composition of the bees due to heavy varroa mite predation—earlier blooming times for plants as impacted by global climate change/global warming—and sharply reduced new colony viability. Especially with package bees, in 2013 some beekeepers report failure rates approaching 100% due to queen problems and a general failure to grow, combining to result in some pretty pathetic colonies. Or dead hives.

Beekeepers who have success with new colonies tend to be those who are using locally produced queen bees installed into colonies that were produced from local bees, those that survived winter or periods of extreme stress. Any step toward localization of genetic stock and bees tends to move the beekeeper to a higher level of success. Various state programs have clearly shown the value of local bees, local queens, and local training as a method of ensuring better results in the colony.

This leads me to consider the sustainability concept and show how many beekeepers are surviving while others are failing. For the point of generating a label on these practices, I will refer to them as the **New Sustainability Practices**.

**New Sustainability Practices**

The sustainable beekeeper is one who keeps *extra bee colonies* in production at all times, usually as growing nuclei colonies established during the peak of bee population, from swarm prevention practices (making nuclei) or by catching swarms and removing bees from buildings. Some sustainable beekeepers consider only the third concept as the limit of their operation, and I disagree. Making and using nuclei (call them what you want, a nucleus is a miniaturized version of a full-sized hive) has become a dominant change in many beekeeping operations over the past decade or two, with beekeepers attempting to overwinter one or more nuclei hives for every full-sized colony in the operation. This maintains colony numbers when some of these colonies die, or are killed by a multitude of factors but concentrated on queen failure and pesticide-disease interactions. Progressive northern beekeepers are keeping nuclei alive during the winter, and using them as brood and bee banks to strengthen full sized colonies during colony buildup and just before honey production, and to make further increase to replace colony losses or make new colonies for sale to area beekeepers in line with the local bees' attributes.

This requires the *overwintering of nuclei* in cold areas where bees are not moved to a warmer climate. This is introduced in *Increase Essentials*, but many new ideas have been developed into fully functioning beekeeping management plans since its publication. In migratory operations, the return south or to California provides for an extensive practice of *renewing travel-weary pollination units in the fall* in anticipation of a fall flow or heavy feeding, supplied with fresh, new, locally produced queens, new combs and extensive nutritional programs. If there is not enough stored food, the colonies must be fed with protein patties, sugar patties or syrup. The goal of most migratory colonies is to score a high bee population level when evaluated in the almond groves, as this sets the level of payment they receive for their bees' work.

Nearly every beekeeper who practices a nucleus program will argue that this provides for a break in the brood cycle, which in turn provides for lower mite numbers. Certainly the process of removing brood and bees from a strong hive will benefit the new colony with the combination of a brood cycle interruption and rebalancing of the bee population to larger numbers of nurse bees. Using mite-tolerant queens ultimately solves the mite issue only when all queens share these genetic traits.

**Since spring the author has been working with a group of students from the Students for a Sustainable Earth from the Western Michigan University. Students are using traditional hives, painted in school colors, nucleus hives, and have been successful in making honey and several nucleus hives. They hope to grow the program to establish a sustainable apiary program at the University. (*Celia Kubiak photo*)**

Sustainability avoids the depletion of natural resources; so feeding must be part of an overall nutritional program that will pay benefits to the bees and to the beekeeper. The trend is generally away from high fructose corn syrup and to use sucrose found in cane sugar (some avoid beet sugar due the its GMO origins, but I have not seen data supporting this objection). A few beekeepers, usually smaller operators, feed bees by using their own surplus honey combs as a quick and easy method of supporting the nutritional needs of smaller colony numbers. Larger beekeeping operations are using custom-made carbohydrate-protein patties that fill the needs of their bees for the phase of their season. A wide variety of additives are being used to customize bee feed.

The new sustainability has a much better focus on new comb production and removal of old tired brood comb on a two- to five-year rotation. As a business model many commercial nucleus producers clear out older brood comb by selling them in the nuclei they produce, forcing the new beekeeper to consider comb replacement at a faster rate than if the combs were from the previous season.

Monoculture is a growing problem for beekeepers. While it is not new, monoculture has been increased as certain areas of the country are being maximized for field crop production, especially for corn. Single crops of almonds are of high value to beekeepers because of the need for pollination, but the system is enormously unbalanced the rest of the season because other plants are not in existence that support bee colonies. Various government programs that took acreage out of crop production and put them into prairie type ecosystems (which included bee forage), are seeing a reduction in acreage as farmers move to solid planting plans for field crops. In areas of the country where brush country still exists, like in south Texas, the removal of the bee-forage rich, but relatively unproductive agricultural land and converting it to pasturage eliminates a variety of nectar important flows, leaving a few minor legumes to produce nectar a few days per year. It is of note that the hunting refuges of the millionaire/billionaire landowners that set tens of thousands of acres in fenced areas maintain the natural plant diversity and nectar production, and are sought after regions for apiary locations.

Pesticide damage to bees has been reported since the 1870's according to C. Johansen and D. Mayer in *Pollinator Protection: A Bee and Pesticide Handbook*. There have been periodic problems with heavy pesticide losses and a continuous threat to keeping bees in certain areas or crops in certain areas. My first experiences were with emergency mosquito sprays in Ohio after the ruminants of a hurricane lead to widespread flooding and public health mosquito population control measures by airplane; the use of microencapsulated materials of the 1980s that caused colony devastation in apples and corn; and the use of carbaryl in gypsy moth control in the eastern U.S.

Now the use of neonicotinoids and especially Imidacloprid systemic insecticide has created the latest storm over pesticide and bees. The key here is that the insecticide does not seem to kill bees directly, but indirectly through its systemic action. This class of insecticides acts on the central nervous system and has a much lower toxicity to mammals. Imidacloprid is the most widely used insecticide in the world, and is used in soil injection, tree injection, application to the plant, as a ground application and as a seed treatment. It is widely used in agriculture, in termite control, gardens and to control lawn pests, as well as to control fleas on pets. It is used to protect trees from boring insects. The systemic effects are linked to colony collapse disorder and have lead to the decline of honey bee colonies in North America and Europe since 2006, associated with the translocation of the material into bee-collected nectar. Several countries have banned the use of the material with statements that Imidacloprid is not part of sustainable agriculture. Further studies show that bees that are exposed to the compound and a range of other stress factors, including viruses and diseases, lead to colony mortality, in part, through bee behavioral changes associated with learning.

For New Sustainable Practices beekeepers must avoid the areas and crops where neonics are used, which is very difficult to do. Beekeepers have become part of the protest in areas where the compound is in use, and have caused the ban in Europe and the reduction of seed treatment in Canada, but not yet in the U.S.

We have long known that areas of general agriculture are hard on bees. These areas eliminate habitat and negatively impact, through insecticide and herbicide use, native pollinator populations. Part of my doctoral research included a simple observation that strawberry fields in Michigan that were surrounded with forests and pastures had a much larger diversity of bee species than did areas where the fields were surrounded by other agricultural crops, especially fruit and vegetable crops. In the latter area, it was hard to find more than honey bees, bumble bees, and a few Dipteran pollinators. This may be considered a form of environmental sterilization by eliminating plants and other animals found there, and creating a challenging zone of life.

The sustainable beekeeper needs to have refuges of low pesticide use and exposure to intensive agriculture—both because of pesticides and also from the loss of nectar and pollen diversity. This is directly linked to important issues of colony nutrition. Beekeepers must focus on protein feeding programs that incorporate carbohydrates and protein into one mixture. This is an area where some local bee clubs are cooperating to fulfill the local nutritional needs of their bees. Specialized feeding is needed for pollinator hives, queen and drone production hives, hives kept by small beekeepers in marginal areas and more. The production of sugar-protein patties, candy boards, and other products should be encouraged.

Sustainability is not new to beekeeping. It was the basis of skep beekeeping in the Middle Ages. Then, the common practice was to kill the strongest and the weakest colonies by burning sulfur, and keep the medium-sized colonies for the winter season. Swarms were captured the next season and placed into the vacant skeps where they built new comb. Elimination of the weak hives, which may have had queen problems or disease, was a form of culling inferior hives, and probably selected for the best bee stocks. Elimination of the largest hives, and harvesting the honey and wax, sustained the beekeeper without doing damage to gene pool of the bees (and may have ensured wintering success, as the larger hives may have eaten all their stores and starved to death over winter). There are some useful concepts to be learned from this practice that we should all consider in selecting which colonies enter the winter season.

A final thought. Our New Beekeeping Sustainability in the United States needs to focus on the role of African bees in our country. I do not advocate the spread of these genes into non-African areas, but in southern Texas, Florida, and the Southwest, there needs to be an intentional and sustainable selection program for the African stocks that are both productive and manageable. We need only look at the excellent work done in Mexico by Dr. Ernesto Guzman, now in Guelph, Ontario, for a plan of work.