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Know Why You Are Keeping Bees

In my February 2014 article, I discussed why people keep bees. I outlined a number of reasons that people pursue a relationship with colonies of insects known for their pointed stingers and sweet honey. Practically speaking, however, honey bees can be used to generate income. Of course, many people keep bees as a hobby for reasons other than generating income. Yet, honey bees can be an expensive hobby if they fail to pay for themselves. With that in mind, I note that it is important to understand what you want to accomplish with your bees if beekeeping is not simply an artistic/spiritual pursuit for you. Your goals with your bees will shape your approach to managing them.

Generally, there are three recognized sizes of beekeeping operations and any size beekeeping operation can be used to generate income a number of ways. Regarding operation sizes, the Florida Department of Agriculture and Consumer Services – Division of Plant Industry, Apiary Inspection Section recognizes the following three groups: (1) niche pollinators (formerly “hobby beekeepers”), 1-10 colonies, (2) sideline/part time beekeepers, 11-200 colonies, and (3) commercial/full time beekeepers, 200+ colonies. This grouping is similar to that used by most other states, though the category names and number of colonies can differ slightly.

Regardless of operation size, beekeepers in the three groups can make money with bees the following ways: (1) honey production, (2) providers of pollination services, (3) production of alternative hive products, (4) queen and package bee production, (5) nuc/split production, (6) make and sell beekeeping equipment, and (7) honey packers. There are, of course, subcategories within each en-

deavor and most beekeepers use their bees to make money in more than one way.

Understanding what you want to accomplish with your bees is of primary importance since it will dictate how you develop and structure your beekeeping operation. It determines what equipment you should purchase, where your bees should be located and even what type of bee you should use. Most importantly, your production goals as a beekeeper necessitate certain management practices. There is no “one size fits all” when discussing bee management. You must know what you want to accomplish (i.e. why you keep bees) in order to make the most informed decision regarding appropriate management practices. What follows is a discussion of the principal ways beekeepers can generate income using bees. I briefly discuss some important considerations for each category and will expand this discussion in subsequent articles.

Some considerations apply across multiple strategies for generating income with bees. Perhaps the most universal of all of the rules concerns business experience. It is helpful, or essential, to have some business training or to contract with a business consultant or accountant in order to make informed business decisions. Otherwise, you are not likely to maximize your profit, or worse yet, you may actually lose money in the endeavor. Furthermore, there may be local, state or national laws that govern the industry in which you are engaged. It is important to note these when developing responsible business and management plans.

1) Honey production – Many new beekeepers get into the craft because they want

to make honey with their colonies (Fig 1). Of course, there are a number of beekeepers who are only interested in producing honey for consumption at home or for sharing with friends, family, and neighbors. Yet, many (perhaps most) beekeepers want to produce honey, package it, and sell it to generate a steady stream of income. There really is nothing like producing honey where you live and seeing it for sale in local markets, on the tables of community restaurants, and in the homes of citizens around town.

Many people erroneously believe that they can purchase a colony, put it in the backyard, and produce copious amounts of honey all year. Nothing could be further from the truth. Honey production take focus and work, especially if you want a predictable, yearly supply of honey that is of sufficient quality to sell. If honey production/sale is your goal, you must keep the following pointers in mind.

- Not all land is conducive to honey production. Bees cannot make honey if nectariferous plants are scarce or absent. My own bees are a good example. I am surrounded by oak and pine trees. I have yet to make a drop of oak or pine tree honey (or any other honey for that matter).

- Beekeepers interested in producing honey have to be willing to move their bees to areas where important honey plants are located. Depending on the size of your operation, you will need equipment to move colonies: trucks, trailers, forklifts, pallets, etc.

- Queen management (especially swarm control) and disease/pest control are the two principal management techniques that must be undertaken if honey production is your goal.



Figure 1: An apiary established for honey production. This apiary is located where bears are present so it was necessary to build a bear fence to protect the bees. Saw palmetto and gallberry are blooming in the pine forests surrounding the apiary, making this a good location for honey production. Photo: University of Florida.

- Other management issues are worth considering. How many colonies can an apiary support? Is your production area home to plants that produce prized honeys (sourwood, tupelo, citrus, etc.)? How many colonies are too many for one person to manage when producing honey (that number seems to hover around 700-800 colonies)? Are you in an area where bears live (see figure 1)?

- Not all bees work equally well in all areas. So, it is important to network with local beekeepers to determine which bees are the most prolific honey producers where you plan to have your operation.

- Honey production is a lot like growing crops. To be successful, you are at the mercy

of a lot of factors that you cannot control. This includes rainfall, soil type (which influences plant productivity), heat, available floral resources, market prices, etc.

- Bees used for honey production typically are not under the same threat from pesticides that are bees used for crop pollination purposes. This is because most, though not all, named honeys are produced from wild plants that are not treated (usually) and not from crops that typically are treated.

- There is a unique set of equipment and space requirements for honey producers. Producers typically have honey extraction and bottling facilities and all the miscellaneous equipment that accompanies those practices.

- States have specific laws regarding safe handling and bottling of honey that must be noted and followed. Food safety is of up-most importance so these laws must be followed closely.

- States also typically have rules about selling honey. It must be of certain quality, have no adulterations, be sold under a business license, etc. It is important to check your state and local laws about establishing a business and selling goods.

- Beekeepers must decide if they plan to sell honey wholesale or directly to consumers. There is a big difference in the equipment and expertise needed to do one over the other.

- Interestingly, some beekeepers become so good at selling honey that they convert to being honey packers, a business where they purchase, bottle, and sell other beekeepers' honey under their own label.

2) Providers of pollination services – This is likely the primary way most commercial beekeepers generate income with their bees. Beekeepers who use their bees to provide pollination services essentially rent their colonies to growers who need the bees to pollinate their fruit, vegetable, nut, or cattle fodder crops. This rent can vary based on the crop and the availability of colonies. For example, blueberry growers in my area pay about \$45/colony, while almond growers in California may pay \$150/colony or more (Fig 2). Both bloom at the same time; so, where are beekeepers likely to go?

- Beekeepers engaged in this facet of beekeeping must understand pollination, plant biology, bloom cycles, and colony stocking requirements.

- Beekeepers who use their bees to provide pollination services must know growers whose crops need to be pollinated by bees.

- Like for honey production, beekeepers interested in providing pollination services must be willing to move their bees to areas where bee-pollinated crops are located. Depending on the size of your operation, you will need equipment to move colonies: trucks, trailers, forklifts, pallets, etc.

- Queen management and disease/pest control are the two principal management techniques that must be undertaken if crop pollination is your goal. Specifically, colonies need to be healthy and full of brood if they are to be good pollinating units. Brood creates the demand for pollen.

- Bees used for pollination often need to be fed sugar and pollen supplements/substitutes. This is because most, though not all, crops that need bee-provided pollination services do not produce copious amounts of quality pollen and/or nectar. So, the beekeeper has to provide it to the colonies in other ways.

- Other management issues are worth considering. How many colonies per acre are needed to pollinate the crop adequately? How far are you willing to travel to pollinate crops? Are you willing to work bees at night, assume the risk of moving them on the highways, and expose your bees to crop protection products?



Figure 2: Pallets of bees placed on almonds in California. Almonds have the nation's greatest demand for honey bee pollination services. Photo: Liana Teigen, University of Florida.

- Pesticide exposure can be a significant threat to bees used to pollinate crops. Beekeepers must work with growers to understand the crop treatment needs, the products used, and the products' toxicities to bees.

- Beekeepers should develop and use a pollination contract when providing pollination services to growers. There are numerous examples of such contracts online. They outline responsibilities of the growers and beekeepers and, if developed appropriately, protect the beekeepers from multiple threats related to pollinating crops.

- Beekeepers need *strong* colonies to produce honey, but they need *a lot* of colonies if they intended to pollinate crops, since they are paid by the colony. So, management systems tend to focus on increasing the number of colonies rather than making them abnormally strong.

- Bees used to pollinate crops need staging apiaries when they are not located at the crop. This is especially true in fall and winter when there are no crops blooming that need bee pollination services.

3) Production of alternative hive products

– Bees can be used to make more than just honey. Many beekeepers find joy in harvesting/selling alternative hive products. These products include royal jelly, wax, pollen, propolis, and bee venom. Although not a “hive product,” mead is loosely placed in this category as well, though you must produce honey in order to make mead.

These products are called “alternative” hive products because the demand is not as high or their production deviates from that with which we are more familiar (honey production and providers of pollination services). Though I do not know with absolute certainty, I suspect the alternative hive products can be ranked based on popularity in production in the U.S. as follows: wax, pollen, propolis, royal jelly, and bee venom.

- It does not take a lot of colonies to produce these products. However, it often takes very specialized equipment to produce and process the products. For example, one collects pollen with a pollen trap (Fig 3) and propolis with a propolis trap. Bee venom collection is facilitated with a special device

while wax is a routine byproduct of having bees and extracting honey. Wax must be melted, strained, and cooled slowly before it can be used to make candles, foundation, or as an ingredient in other products.

- Beekeepers engaged in this branch of beekeeping must really understand bee biology, yearly colony life cycles, and specific traits unique to the various bee races. For example, you must know that queenless colonies produce new queens, hence royal jelly. You must appreciate that some races of honey bees produce more propolis than others. This type of knowledge will dictate how you approach your management strategies to produce one or more of the alternative hive products.

- Obviously, strong colonies produce and use more wax, propolis, etc. So, beekeepers wanting to produce alternative hive products must be versed in typical bee management strategies.

- Finally, there is little regulation governing the production and selling of alternative hive products. Beekeepers engaged in the production and selling of these products should be careful not to make unwarranted, unsupported claims and work hard to follow all applicable rules and laws regarding the products' production.

4) Queens and package bee production –

There is a subgroup of beekeepers whose primary income centers around producing and selling queen and package bees. The production of queens and packages does not have to go hand-in-hand. Many queen producers do not produce package bees. However, most package bee producers have to produce queens. Obviously, this part of the industry is somewhat limited by the number of people in the U.S. who want to purchase more colonies. Every beekeeper in the U.S. can produce/sell honey and the demand for honey would remain. Not every beekeeper could produce and sell queens/package bees – the demand simply is not there.

- Beekeepers engaged in this branch of beekeeping must really understand bee biology, genetics, breeding, and yearly colony life cycles.

- The beekeepers must be able to recognize objectively and quantitatively what

qualities make a colony “good”, and determine which queens or drone source colonies are worth using in breeding programs. Queen producers are not only selecting breeder queens to use to produce production queens. They are also selecting breeder drones, i.e. drones from colonies headed by queens who, themselves, are good enough to be breeder queens. Drones are the “other” bees that are responsible for producing good, productive colonies.

- Queen production should be attempted with an absolute minimum of 10 colonies to minimize inbreeding and to provide sufficient stock from which one can make a selection. To be honest, most queen producers would not consider selecting breeder queens from fewer than 50 or more colonies.

- Queen producers must purchase and use equipment that is somewhat unique to the craft. For example, colonies used for pollination and/or honey production use mostly the same equipment. Queen producers, on the other hand, must invest heavily in nucs or baby nucs (Fig 4) and less so in the traditional equipment. Package producers also have a unique set of equipment they must use (packages, funnels, etc.) (Fig 5).

- Package producers must have a large number (perhaps 100+) of strong colonies from which they can shake packages. Consequently, the producers must be good at controlling pests and diseases in colonies.

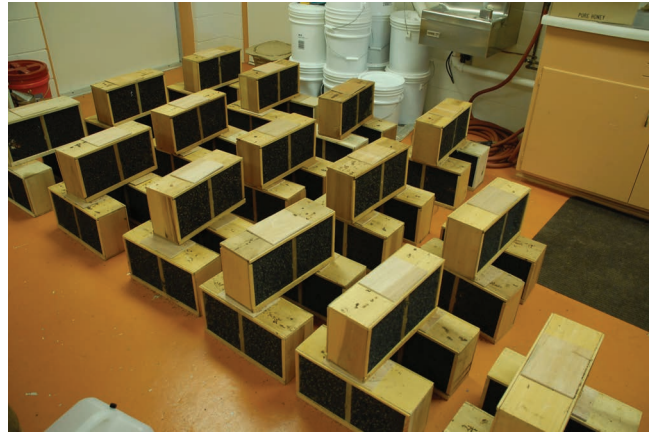
- Typically, professional queen and package bee producers need access to large areas of land for mating yards. This land can be owned or rented.

- Queen and package bee production is regulated in some states. Therefore, the business usually needs to be inspected by apiary inspectors to ensure that the bees are free of any communicable diseases such as American foulbrood.

- Finally, queen and package bee producers have to assume some level of customer dissatisfaction in the product. Perhaps the packages absconded or the queen died upon release. The producer will have to develop a set of rules for how to handle these types of issues.



Figure 3: (a) Fitting colonies with pollen traps to collect pollen. The trap goes between the brood chamber and the bottom board. In this photo, the pollen trap is sitting on the bottom board and the brood chamber is being placed on top. (b) Pollen can be collected and sold as an alternative hive product. Photos: University of Florida.



(l) Figure 4: Mating nucs are needed for the production of large numbers of queens. *Photo: Jamie Ellis* (r) Figure 5: Strong colonies are needed if one wants to produce healthy packages. *Photo: University of Florida.*

5) Nuc/split production (Figs 6 and 7) – This way of generating income is similar to that of making packages in that bees are sold to other beekeepers who use them to make new colonies. This differs from making packages in one notable way: nucs/splits are functioning colonies, complete with queens, wax comb, brood, and honey/pollen stores. In my opinion, which is strictly an opinion, this is one of the best, most economical ways of generating an income with bees. I say this because (1) the demand for bee colonies is at an all-time high, (2) you are not at the mercy of fluctuating honey and pollination prices, (3) you can make nucs/splits just about anywhere you can place a hive, and (4) nucs/splits are selling for prices that are nearly as high as the going rate for full size colonies. If that is not enough to convince you to consider making/selling nucs/splits, with proper management, the average colony can produce more value in nucs than it can from just about any other way of making money with bees. For example, the average colony in Florida produces about 60 lbs honey/year. If you sell that direct to consumer, thus com-

manding the best price, you can make about \$7/lb, thus giving you a gross income of \$420/colony. With proper management, you can make 4+, five-frame nucs/colony. Nucs sell for \$25 - 50 per frame. Thus, a colony producing 4 nucs yields a gross profit of \$500 - 1,000/colony.

- Bees make bees. Remembering this will maximize the number of nucs/splits one can make. Because of this, colonies must be kept strong and healthy if they are to be populous. They must be headed by quality, laying queens and any diseases/pests present in the colonies must be kept under control.

- There is not much specialized equipment needed to produce nucs/splits but there typically is significant equipment turnover. For example, beekeepers making nucs/splits are always selling frames, nuc boxes, etc. So, nuc/split sellers are constantly ordering/making new equipment to replace what is being sold.

- Colonies being split regularly are somewhat resource-stressed. So, beekeepers undertaking this endeavor often have to provide supplemental sugar/pollen resources to

the bees. This is true both for the parent colony (the one being split) and the split or nuc. Of course, you could be fortunate enough to live in an area where nectar/pollen resource abound. Yet, given that this is the exception rather than the rule, beekeepers making nucs/splits spend a lot of time feeding bees.

- Beekeepers engaged in this branch of beekeeping must really understand bee biology, genetics, breeding, and yearly colony life cycles. All of this dictates when to split a colony, when they need food, etc. Furthermore, people producing nucs/splits often have to produce their own queens to place into the nucs/splits or be prepared to purchase queens from other breeders.

- To my knowledge, this branch of beekeeping is not heavily-regulated, though beekeepers undertaking this endeavor need to follow local and state laws governing the industry in general.

6) Make/sell beekeeping equipment – One does not have to be a beekeeper to make or sell beekeeping equipment. However, most people get into this branch of the beekeep-



(l) Figure 6: Making splits is hard but rewarding work. These hive bodies are ready to receive frames of honey, pollen, and brood from strong, parent colonies. *Photo: University of Florida.* (r) Figure 7: An apiary of newly made nucs. These nucs are ready for sale. *Photo: University of Florida.*



Figure 8: A beekeeper removing a honey super in order to inspect the brood chamber below. Beekeeping is a rewarding endeavor. It is important to know your goals in order to maximize your productivity and your colonies' potential. Photo: University of Florida.

ing industry after they have spent some time as a beekeeper. Thus, I felt it was worth discussing here.

Being a beekeeper before or while making/selling beekeeping equipment certainly is advantageous since one can maintain a “feel” for what beekeepers want and know if new products are likely to work. I know a lot of beekeepers in rural areas who get into the business of selling equipment just to make it available to beekeepers who have a hard time getting it otherwise. Most equipment providers I know work long hours to meet the ever-growing demand of the bulging beekeeping industry.

- To make equipment to sell means one must have good general knowledge of tools and their use. That said, one does not have to make the equipment that one sells as the bigger equipment manufacturers often sell their products to smaller distributors for resale purposes.

- To make equipment, you must have a shop and all of the necessary tools and equipment.

- There are a number of business-associated regulations and laws one must follow.

- You will need a warehouse and showroom of sufficient size to maintain an adequate stock of equipment.

- Equipment providers must have a good general knowledge of bees and beekeeping. They are often the first people beekeepers call when they want the latest bee news, need to know how to find a queen, and want to know why their colonies failed. Many equipment producers/sellers I know spend significant amounts of time answering bee calls.

7) Honey packer – Like those who make and sell beekeeping equipment, one does not have to be a beekeeper to be a honey packer. In fact, many full-time honey packers are not beekeepers with some never having been beekeepers. Regardless, packing and selling honey is another way that people associated with bees generate an income and the business is worth discussing here.

- Honey packers purchase honey from beekeepers, package it, and sell it under a unifying label. A lot of honey-producing beekeepers become packers to keep up with the public demand for their honey.

- Honey packing is regulated and must be done under certain conditions and by meeting certain rules/qualifications. It is important to know and follow all appropriate laws and regulations.

As noted, many beekeepers generate income from their bees in two or more of the described ways. This seems logical since diversification in business is an appropriate method of minimizing risk. I hope that you critically consider why you keep bees since your motivation for keeping bees affects everything that you do with them. Above all else, it is important that you enjoy your interaction with bees (Fig 8); but it does not hurt if they can help you pay the bills.

Honey Bees 101: The Order Hymenoptera

Honey bees belong to the insect order Hymenoptera, an order that includes wasps, bees, and ants. This is the insect order in which sociality has arisen most. Of course, termites are the other well-known social insect, but they are not hymenopterans. Before progressing, it is important to note that taxonomy is an ever-changing subject, with organisms being classified and reclassified regularly. Hopefully, what I share below represents the most current state of knowledge of the order Hymenoptera.

The word “hymenoptera” translates to membranous wing. Many people do not often associate “wing” with ants but you will note that most reproductive ants have wings at some stage in their lives. Hamuli are little hooks located on the hind wings of hymenopterans. These hooks connect to a small fold in the back of the forewing, thus joining the two wings together during flight.

All hymenopterans are holometabolous, meaning that they undergo complete metamorphosis. For honey bees and other hymenopterans, this means that they have 4 principal life stages: egg, larva, pupa, and adult.

Female hymenopterans have ovipositors, many of which are modified to sting. An ovipositor is an apparatus that lays eggs. Of course, worker bees and queens do not use their ovipositor to lay eggs, thus it is more appropriately-called a modified ovipositor. Other hymenopterans do, in fact, use their ovipositor to lay eggs. Some parasitoid wasps, for example, will “sting” their prey and deposit an egg inside the prey’s body, this done using their ovipositor. But, we know the bee’s ovipositor as the sting and we recognize its function.

Hymenopterans also have a haplo-diploid reproductive sys-

tem. This simply means that males (drones) result from unfertilized (haploid) eggs while females (workers or queens) result from fertilized (diploid) eggs.

The order Hymenoptera is split into two suborders: Symphyta and Apocrita. Symphyta includes sawflies, horntails and parasitic wood wasps. These are interesting hymenopterans because they do not have the “wasp waist”, or restricted waist for which bees, wasps and ants are known. Bees, wasps, and ants belong to the suborder Apocrita. In addition to having the wasp waist, their first abdominal segment is fused to the thorax and their larvae do not have legs, prolegs, or ocelli (unlike the Symphyta).

Most members of the suborder Apocrita are parasitoids. These include the parasitic wasps, many of which are so small that they are mistaken for flies. Hymenopterans in this branch of Apocrita (sometimes called “Parasitica”) have ovipositors used for laying eggs in/on prey. The rest of the members of Apocrita (sometimes in a branch called “Aculeata”) usually have ovipositors that are used as stingers that inject venom, though not all do. Ants, bees, predatory and some parasitic wasps fall into this division of Apocrita.

There are three superfamilies in the Aculeata division: Apoidea (bees and sphecoid wasps), Chrysoidea (parasitoid or cleptoparasitic wasps), and Vespoidea (wasps and ants). Each superfamily contains a number of families, which, in turn contain numerous genera and species. If you spend any time studying hymenopterans, you will be fascinated by their diversity, both morphologically and biologically. They truly do have remarkable life histories.