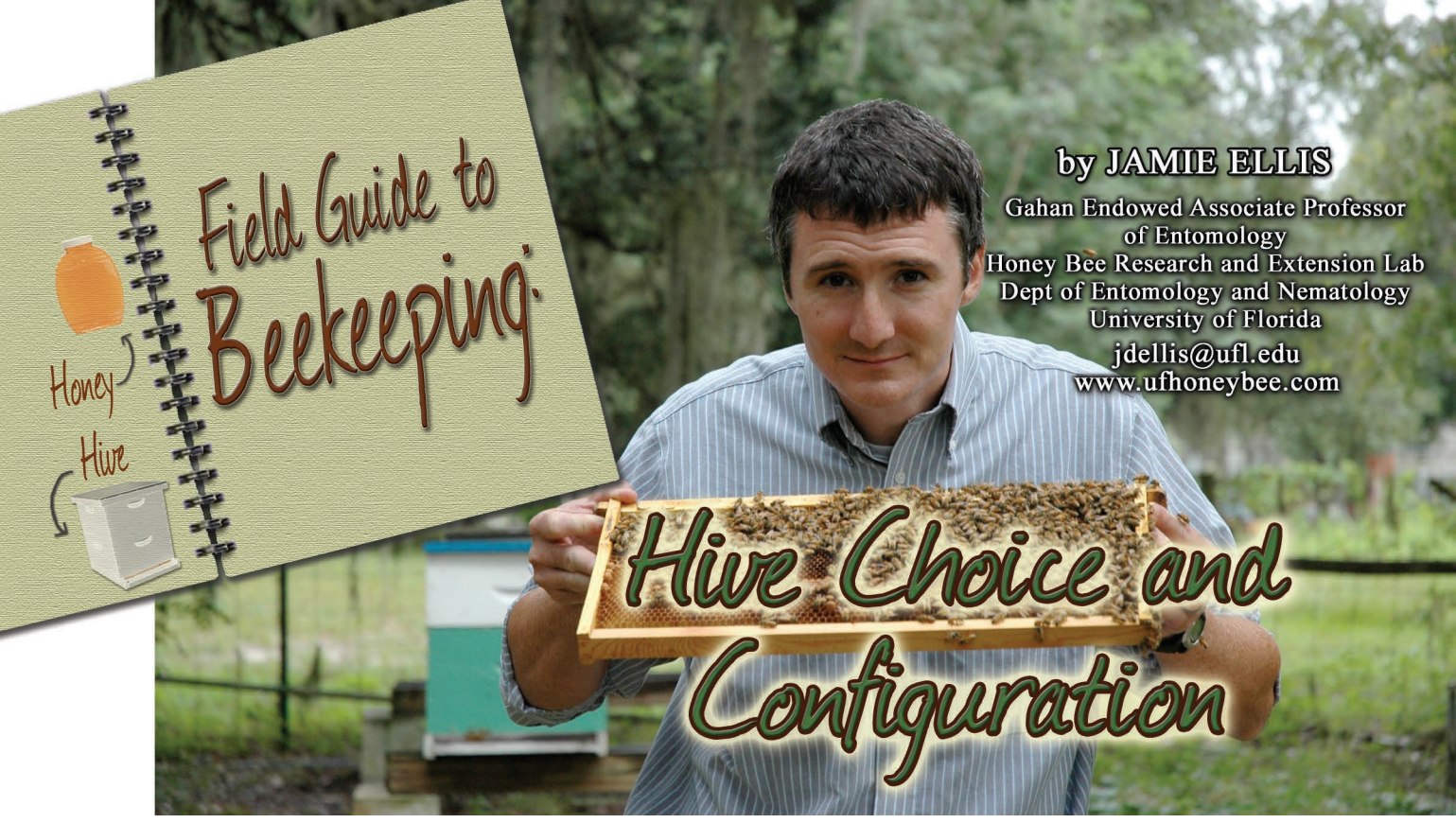

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Open any beekeeping equipment catalogue and you will be inundated with all types of hive types and configurations. The overwhelming number of options is compounded further when you ask another beekeeper what hive configuration you should use. Are you going to use double deeps, single deeps with excluders, multiple shallow or medium supers, Langstroth hives, top bar hives, etc.? Beekeepers have many options when deciding what type of hive and hive components should form the basis of their beekeeping operations. You are, of course, free to choose the hive style configuration you like. *You should remember to choose the design that <u>you</u> want, a design that will complement your beekeeping style and goals.* I hope this article will help you make an informed decision.

In general, there are eight major decisions you will need to make when determining what type of colony you wish to manage. These decisions are: (1) type of hive, (2) hive configuration, (3) hive construction materials, (4) number of frames to use in the equipment, (5) the type of foundation to use in the frames, (6) whether or not to use queen excluders, (7) the type of bottom board you will use, and (8) the type of hive lid you will use.

(1) Type of hive

There are a number of hive types used by beekeepers in the U.S. and around the world. I will limit my discussion to only a few of the available types, namely the Langstroth colony, top bar hives, Warré hives, and other, miscellaneous, hive types.

A) Langstroth hives - I discussed Langstroth hives (Figure 1) in detail in my March 2014 ABJ article so I will not review these hives in any great depth here. This hive is the U.S.-standard hive that beekeepers use; its basic design is used around the world. It is not the only hive design used around the world, but it possibly is the most popular design.

The basic premise of the Langstroth hive is that a single box contains movable frames and that multiple boxes (supers) can be added to the single box as the colony population grows. The frames and other parts of the hive are movable because the internal components of the colony are constructed to take advantage of "bee space." Bee space is a gap size (3/8 inch) in which bees will not build comb or place propolis. This, then, keeps bees from fastening all of the hive components together with wax and/or propolis. Thus, the frames can be removed from the colony and the supers pried apart easily.

Figure 1: The standard Langstroth hive. This hive is composed of a single deep brood box and has a single medium super that serves as its food super. It sits on a screened bottom board and is protected from the weather by a telescoping hive cover.

Langstroth hives are easy to find, purchase, assemble, and support, largely because of their popularity and widespread use. Furthermore, the standardized size of Langstroth colonies generally allows beekeepers to purchase hive equipment from multiple equipment manufacturers with reasonable assurances that the hive components will fit together as if they were manufactured by the same vendor. Finally, and with no disrespect to the other hive designs, Langstroth hives have been used by hobbyist and commercial beekeepers alike. The hive's design has been tested under all conditions and vetted by scores of beekeepers. I, personally, do not think that any other hive design rivals the general use and functionality of the Langstroth hive, though I know many people would argue that point. Regardless, my discussion of the points associated with one's choice of a hive style will proceed under the assumption that most beekeepers will elect to use Langstroth hives.

B) Warré and top bar hives – I grouped these two hive designs because they share some similarities and because they probably are the second most popular hive types in

the U.S. Do not hear me wrong; far more people in the U.S. use Langstroth colonies than any other hive type. Top bar and Warré hives are a distant second and third, respectively, hive type used by beekeepers. Both hive types are based on the top bar approach. Top bar colonies do not use the traditional frames that are present in Langstroth hives and their relatives. Rather, the bees are placed in the hives and given only a series of top bars from which the bees suspend their combs. These hives typically do not contain foundation so the beekeepers have to use management techniques to encourage the bees to suspend one comb per top bar rather than across many.

Top bar, or Kenyan, hives are oriented horizontally. Thus, colonies expand backwards from the colony entrance, this facilitated by the addition of more top bars behind the existing top bars. These hives are popular among some hobbyists, but rarely among commercial beekeepers, though I do know a couple of commercial beekeepers who prefer to use these hives. In contrast to top bar hives, Warré hives are oriented vertically. Consequently, supers can be added as the colony grows, though these supers usually are added *below* the brood nest rather than *above* it as in Langstroth hives. I was made aware of Warré hives only a few years ago. However, I regularly get questions regarding this hive type when I travel to and speak at various beekeeper meetings. Therefore, it seems to be gaining in popularity.

The proponents of both hive types report countless benefits using one hive or the other, including that these hives are cheaper to build and manage. Most of the purported benefits center on the idea that keeping bees in these hives is more "natural" than keeping bees in Langstroth style hives. I submit to you that beekeeping ceases to be natural the moment one takes a colony out of a tree and inserts it into any manmade box. Be that as it may, there is not much data to support the claims made by users of top bar and Warré hives. This does not mean that the colonies do not live up to the hype. It only means that there are not much data available to support the hype. Perhaps one day, rigorous studies will be conducted on the hive types and the data compared to like data from Langstroth colonies. Regardless, those interested in keeping bees with top bar or Warré hives might consider purchasing and reading the following two guides.

- Mangum, W. 2012. *Top-Bar Hive Beekeeping: Wisdom & Pleasure Combined*. Stinging Drone Publications, Bowling Green, Virginia, USA. 411 pp.
- Heaf, D. 2013. *Natural Beekeeping with the Warré Hive*. Northern Bee Books, Mytholmroyd, West Yorkshire, UK. 106 pp.

C) Miscellaneous hive types – This is the catch-all category of hive designs. There are two basic categories: (1) moveable frame hives and (2) fixed comb hives. To be honest, almost every country and/or region has its own unique hive type. For example, the British Standard National hive is popular in the United Kingdom, but is virtually unused in the U.S. Thus, it would be hard to purchase and maintain with additional equipment since the hive and its components are largely unobtainable in the U.S. Then, there are the WBC hives, Long Box Hive, etc. Many of these are based on the movable frame concept, but they would be impossible to support unless one made their own equipment.

There are two main types of fixed comb hives. These include log hives (or "gums") and skeps. I group these hive styles together, not because they are similar in design, but rather because my comments about both are similar. Log hives are basically hollowed tree trunks that are fixed on the ground or in another accessible location. Skeps, one of the oldest manmade hive designs, are woven hives that resemble upside-down baskets with a hole at the base. The premise of both log hives and skeps is that you dump in a swarm of bees and away they go. The bees fix their comb to the top and walls of the hives. The combs are not removable and the colonies are not managed easily. For these reasons, the ownership and maintenance of log hives and/or skeps is *illegal* in many states. Both are novelties and cannot be used in management-intensive situations.

Many of you have chosen or will choose to use Langstroth-style hives. This is, after all, the popular choice. A smaller subset will choose top bar or Warré hives. I, personally, believe that you can use what you want to use. I am biased toward Langstroth hives, largely due to their ease-of-use and general availability. That said, I respect the approach of beekeepers who use the lesser known hive styles. If you are on the fence with what style to choose, I recommend that you get one or two of a couple of types of hives and try them for yourself. No one knows what you will like better than you do! Nevertheless, I will progress through the rest of this article assuming that you chose Langstroth hives; after all, most of you will.

(2) Hive configuration

My definition of "hive configuration" is the approach you take with the boxes when developing the hive you manage. For example, many beekeepers run (a beekeeper term for "use") single deeps. This simply means that they have a single deep brood chamber serving as the core structure of their colonies. On the other hand, many beekeepers run double deeps, meaning that their standard hive never shrinks below two deep brood chambers. Considering the number of box sizes (deeps, mediums, and shallows) and the near-limitless configuration of these boxes, a lot of new beekeepers live in perpetual fear that they are not using the correct hive configuration. I will spend a little time discussing the common hive configu-

Figure 2: Different hive configurations. (a) A single deep Langstroth hive. (b) A double deep Langstroth hive. (c) A Langstroth hive composed exclusively of medium supers. There is a queen excluder between the second and third supers from the bottom.

rations and a few pros and cons associated with each.

A) Single deeps (Figure 2a) – As noted, this hive configuration utilizes a single deep brood chamber for the core colony, with additional supers being added above as the colony grows. The queen may/many not be confined to the single deep using a queen excluder (see point 6). Usually, these hives are provided a single medium or shallow super in which the bees can store their own food. The idea is that bees always need access to a shallow or medium super's worth of honey so these supers (sometimes called "food" or "winter" supers) are never removed and the honey they contain never harvested. Beekeepers ensure that these supers are full of honey as the colony enters winter. All supers placed above the food super are available for removal and their honey harvested for human consumption. Opponents of single deeps will tell you that they restrict queen ability to lay eggs and produce strong colonies, though I doubt data exist to support this assertion.

B) Double deeps (Figure 2b) – Beekeepers using this hive configuration use two deep hive bodies as brood boxes. A queen excluder may/may not be used above the uppermost brood box. The logic is that queen bees need this much space to lay eggs, under the presumption that a single deep is not enough space for the queen to achieve maximum egg production. Furthermore, the second deep provides the same function as that of the medium or shallow food supers on a single deep design. Thus, the bees are given sufficient space to store enough honey to survive winter. I certainly understand the logic behind using double deeps as the core colony, but I am not convinced that double deep colonies are stronger than single deep colonies. Of course, it takes twice the effort to find a queen in double deep colonies than it does in single deep colonies since one has to look on twice as many frames.

C) Using shallows and/or mediums as brood chambers (Figure 2c) – In this configuration, the beekeeper uses 2-4 shallow supers or 2-3 medium supers as the colony's brood chamber. Additional supers can be added as the nectar flow necessitates. The advantage of this configuration is that all of the hive boxes are lighter since they are smaller than the deep hive boxes. Thus, they tend to appeal to individuals who may otherwise have difficulty lifting heavy, deep brood boxes. Furthermore, beekeepers using this design can invest in a single box size, thus standardizing the equipment in their apiary. Queen excluders may/may not be used. My only negative comment about using shallow or medium supers as brood chambers is that it can take a lot of effort to find a queen. A single deep has 10 frames. A double deep has 20 frames. Three – five medium/shallow supers have 30 – 50 frames. Queen management can be an issue when you have to work much harder to find her.

Which hive configuration should you use? I honestly can say that I have worked with thousands of beekeepers who have used the various hive configurations. At the end of the day, a good beekeeper can take any of these hive configurations and accomplish his/her goals with their bees. I am confident that all of these designs work so the decision is left up to the individual. I recommend that beekeepers experiment with a few of the designs and decide what they like best.

(3) Hive construction material

Hives can be made out of three main materials. These include wood (Figure 3), polystyrene, and plastic. Wood is the more traditional material used to construct hive parts and is the most favored by beekeepers. Of course, hives can be made out of many types of wood: pine, cypress, cedar, spruce, etc. Wood is a decent colony insulator and it helps mitigate colony moisture issues. Wood is fairly cheap to use, can be painted, and is considered a natural product. Some drawbacks include the facts that wood rots, molds, and must be assembled. Because it rots and molds, the wood must be painted and otherwise protected from the elements. Many of these issues are mitigated somewhat if the colonies are made out of rot-resistant wood, such as cypress.

Plastic and polystyrene hives are becoming increasingly popular. They generally are easy to maintain, with no painting and, often, no assembly required. Therefore, they may have a longer field life than hives made out of wood. On the other hand, these types of colonies tend to be more expensive than wooden hives and some note that colonies in these hive types have some trouble managing colony moisture levels.

Figure 3: Most beekeepers use hive boxes constructed of wood. Polystyrene and plastic also are popular hive construction materials.

(4) Number of frames to use in the hive boxes

You must decide your approach to frame management; by this I mean how many frames you plan to use in your colonies (Figure 4). Standard Langstroth hives hold 10 frames. This number can vary in two ways. First, and simplest, you can put fewer frames in a 10-frame box. For example, you can choose to use 10-frame equipment, but with the boxes, hive bodies and/or supers, containing only eight or nine frames. Many beekeepers use nine frames in 10-frame equipment. Fewer use eight frames in 10-frame equipment, and then mostly in the honey supers.

Why use fewer frames in a box? Bees will build the combs on the frames thicker when one of the frames is removed and the remaining frames spaced evenly. This is advantageous when producing honey as it is easier to uncap frames whose combs stick out further than the wooden frame in which they are contained. Also, I find that it is easier to work boxes having only nine frames. The extra space makes it easier to remove frames from the boxes, thus minimizing damage to combs and bees.

Figure 4: Two medium supers containing different numbers of frames. There are nine frames in the uppermost super and 10 frames in the lowermost super.

The second way to use boxes with fewer than ten frames is to buy equipment that only accommodates a reduced number of frames. For example, eight-frame equipment is becoming increasingly popular. It is being marketed mainly to those individuals who do not want to lift heavy, 10-frame equipment. Despite anecdotal reports, I do not believe bees prefer the narrower boxes, but I know many beekeepers who do!

In conclusion, you will need to determine your approach to frame management. Will you use standard, 10-frame equipment? Or, will you use 10-frame equipment in which you put a reduced number of frames? Will you forgo both options and use eight-frame equipment? It does not really matter. It is, however, important that you make a choice and build your operation around that decision. The good news is that both options are supported in today's beekeeping climate, i.e. you can purchase a diversity of equipment to maintain both colony styles. If I had to make a recommendation, I would still recommend that one use 10-frame equipment. You can lighten the weight of the boxes by (1) using fewer frames in the boxes and (2) using only smaller-size boxes (see point 2 above).

(5) Types of foundation

What type of foundation will you use in your frames? This is another decision that is a matter of individual taste. There are

Figure 5: Types of foundation. Plastic foundation comes in many colors, in this case white, black, and yellow. There is a piece of pure beeswax foundation on top. This happens to be crimp-wired foundation, so named because of the crimped wires running through the wax.

three basic foundation types: (a) pure beeswax foundation, (b) beeswax-coated, plastic foundation (Figure 5), and (c) full plastic combs. Of course, a fourth option includes using no or little foundation at all and allowing the bees to develop their comb with minimal beekeeper input. In this instance, a small strip of foundation, usually pure beeswax foundation, is affixed to the top bar of a frame. The bees, in theory, continue building the comb straight down from that strip.

The first type of foundation developed was made of pure beeswax. The beeswax was milled into sheets and run through foundation presses to imprint the hexagonal shape on the beeswax. Arguably, bees likely prefer pure beeswax foundation. After all, they construct their own combs out of pure beeswax. I much prefer to use pure beeswax foundation in my frames, with the caveat that I *rarely* use pure beeswax foundation in my frames. This is due to a very simple truth. Beeswax foundation takes time to install into frames. Time is money so most sideliner and commercial beekeepers no longer use pure beeswax foundation.

Many beekeepers use foundation made of hard plastic. Plastic foundation often is coated with a thin layer of beeswax to make the foundation more palatable to bees. Earlier iterations of this type of foundation contained thin, clear plastic (Duragilt foundation for example). However, I do not like this type of foundation too much because bees will not built comb on sections of the foundation from which all of the wax has been removed, i.e. once you get down to the plastic. Many proponents of natural beekeeping argue that plastic foundation just is not, well, natural. However, the bees do not seem to mind and they construct wax comb on plastic foundation indiscriminately, especially during good nectar flows or while being fed. Though my heart tells me to use beeswax foundation, practicality tells me that plastic foundation is the way to go. It is easy to install since it does not need to be wired into the frame. Furthermore, it is sturdier, making it preferable to use when extracting honey. It even can be recoated with beeswax if the comb is ever damaged, though I think it is cheaper just to purchase and install new foundation in this instance. I know the purists will cringe when I say this, but plastic foundation was a major advancement in beekeeping – as much as I hate to say it.

The final type of foundation is not really foundation at all but rather is an entire comb made of hard plastic. Usually, the comb and frame a molded as a solid piece. I have no personal experience using this type of comb, but I do know individuals who use it. Most people seem quite happy with their experience using plastic combs, thus further demonstrating that such comb has value and may be worth using. At the end of the day, bees ultimately will use anything you force them to use, though they may be slow to optimize their use of the product.

(6) Queen excluders

This is a *very* polarizing subject in beekeeping. I have seen many a beekeeper's temperature rise as they advocated for or against the use of queen excluders. You might be surprised to find out that it does not really matter which approach you take.

Arguments *for* using queen excluders (Figure 6a) include keeping queens (and brood) out of your honey supers and limiting the queen's movement to one or only a few boxes, thus being able to find her easier. Both arguments are legitimate. You should use queen excluders if these issues matter to you.

Arguments *against* using queen excluders (Figure 6b) include allowing the queen to lay anywhere she wants and maximizing honey production. I must say that I find both arguments to be built on shaky ground. Many beekeepers state that queens should be allowed to lay eggs over multiple boxes so that colonies can grow to their full potential. I am not aware of any research studies that show excluder-less colonies are stronger than colonies fitted with excluders. My general belief is that queens produce about the amount of brood that can fit into a single brood box. It only *looks* like more if it is spread out over multiple boxes. Similarly, there is no evidence, to my knowledge, that queen excluders decrease honey production in a colony. Some beekeepers call queen excluders "honey excluders" under the supposition that bees store less honey in the upper supers when they have to travel through excluders. The merit of this statement is suspect.

I can think of only one good reason not to use an excluder. They cost money. Beekeepers who see no need for excluders get the added benefit that they can save a little money since they do not have to purchase excluders. So the decision to use/not to use excluders boils down to a simple question. Do you want to limit your queen's movement and/or keep brood out of your honey supers *or* do you want to save a little money? If the former, use excluders. If the latter, do not.

(7) Bottom boards

This decision is easier to make, mainly because there are only two types of bottom boards, but also because one seems to have clear advantages over the other. The two types are solid bottom boards and screened bottom boards (Figure 7). Solid bottom boards, like the name implies, are solid pieces of wood, fitted with a raised rim on the top side of three of its edges. This is the traditional bottom board and still probably the most widely used today. The screened bottom board has screen mesh in place of the solid piece of wood. In this design, the underside of the colony is open to the outside world.

I recommend that beekeepers use screen bottom boards. They gained quick notoriety because of their reported impacts on colony *Varroa* populations. In short, colonies with screen bottom boards tend to have fewer *Varroa* than colonies with solid bottom boards. The research on screened bottom boards also revealed that colonies with screen bottom boards tend to have more brood. Screened bottom boards may help keep colonies from overheating as they are being transported. I am not aware of any negative effects of screened bottom boards on colonies. So, my reasoning is that you might as well use them since there seem to be some documented benefits.

It is worth mentioning that some beekeepers in northern states tend to be hesitant to use screened bottom boards, usually based on the assumption that this open bottom hinders a colony's ability to thermoregulate during winter. It is worth noting that bees

Figure 6: Queen excluders are a hotly debated hive component. The colony of the left (a) has a metal bound excluder between the deep (red) brood box and the upper (white) medium super. The colony on the right (b) does not contain a queen excluder.

Figure 7: Bottom boards are important pieces of equipment. They support the entire colony. There are two bottom board options shown, the screened bottom board (left) and the solid bottom board (right).

keep their cluster warm, not the entire hive body. Thus, biologically, an open bottom may not compromise colony thermoregulation ability too much. I know some northern beekeepers who use screened bottom boards during winter. You can always close the screened bottom board during winter if you worry about the cold. This can be accomplished by sliding a thin piece of wood or plastic in the colony entrance, thus covering the screen.

(8) Hive lids

The decision of which hive lid to use also does not matter so I would not stress too much about it. Read what I have to say and make your choice unapologetically. There are two main types of colony lids, the telescoping cover and the migratory cover (Figure 8). Telescoping covers are more traditional, usually constructed more solidly than are migratory covers, and are more aesthetically pleasing. However, they also are more expensive and require the use of a second, inner cover. Many hobbyists default to telescoping covers.

Migratory covers are made for the high-input beekeeper. They are designed to fit flush to the uppermost super of a hive. This facilitates the packing and stacking of hives on a truck when moving them to other apiaries. Most migratory covers have a hole in the middle, this being made to accommodate a jar feeder. This design makes is much easier to get food to bees when they need it, another reason this cover appeals to the professional beekeeper.

Figure 8: What is on top of your hives? The hive on the left is covered by telescoping lid while the colony on the right holds a migratory cover. Note the feeder hole in the center of the migratory cover.

What I use

I thought long and hard about ending this article with a brief overview of how I approach the questions I addressed herein. I do *not* want to influence your decisions regarding what type of hives you ultimately will manage. I hope, in fact, that I have convinced you that *your* reasons for using/not using certain types of hive equipment are what actually matter. I encourage you to get the advice of many beekeepers, but try not to be persuaded by their strong opinions. You need to begin your quest in beekeeping by engaging in a fact-finding mission. Read as much as you can about the various hive configurations, talk to seasoned beekeepers, try a few styles in your apiary, etc. Do all of this *before* you decide what type of hive you ultimately want to manage. Rest assured that you can take almost any hive design and conform it to your management practices and goals.

Notwithstanding, beekeepers regularly ask me what hive type and configuration I use. My approach is neither better nor worse than yours. It simply is born out of my experience and the development of my personal preferences. With that introduction, I will share with you my basic approach to hive design with my principal reason(s) for taking a given stance on each approach.

- I use Langstroth hives. They are functional, easy to support, and vetted internationally. I will, someday, try a top bar hive and maybe even a Warré hive; but, they will be novelties and not the main hive types I will use.

- My core colony consists of a single deep hive body outfitted with a single medium super to which I allow the bees to have exclusive access (Figure 9). I like the single brood chamber because it is easier for me to manage. I place a medium super on top so that the bees can have space to store honey for their use. I never extract the honey in the medium super.

- My hives are made of wood, cypress in fact. I like wood because I am old-fashioned. I would use plastic or polystyrene colonies…at least I would try them. I have nothing innately against them.

- I use nine frames in my honey supers *and* my brood chambers. I like the benefit of uncapping and extracting fuller (i.e. thicker) frames. I use nine frames in my brood chambers because it gives me more space to work. I see no evidence that my colonies have 10% fewer bees since my queens have 10% less space to lay.

Figure 9: My hives. I use single deep brood boxes topped by metal bound queen excluders. I place a single medium food super on my hives, above the excluder. I then add additional medium supers as the colony population grows. The second colony from the left contains a deep hive body on top. These get heavy when full of honey.

- I use plastic foundation in wooden frames, but I prefer pure beeswax foundation. Go figure. I find the plastic foundation to be very user friendly.

- I separate my brood chamber (single deep hive body) from the medium food super using a metal bound queen excluder. I do not like looking for queens in multiple boxes, hence my use of an excluder to limit her only to my single brood chamber.

- I use screened bottom boards, principally for assistance with *Varroa* control.

- I use telescoping lids with inner covers. I do this purely for aesthetics: it looks better. I would use migratory lids if I were a commercial beekeeper. They simply are too functional to ignore.

There you have it. I really hope this article helps you as you navigate your way through the various recommendations related to hive configuration. Part of the fun of beekeeping is discovering for yourself what you most like to use. Just remember to hold your opinions loosely. Honey bees tend to be very forgiving. So, allow your approach to beekeeping to be flexible. You will enjoy the diversity in management practices.