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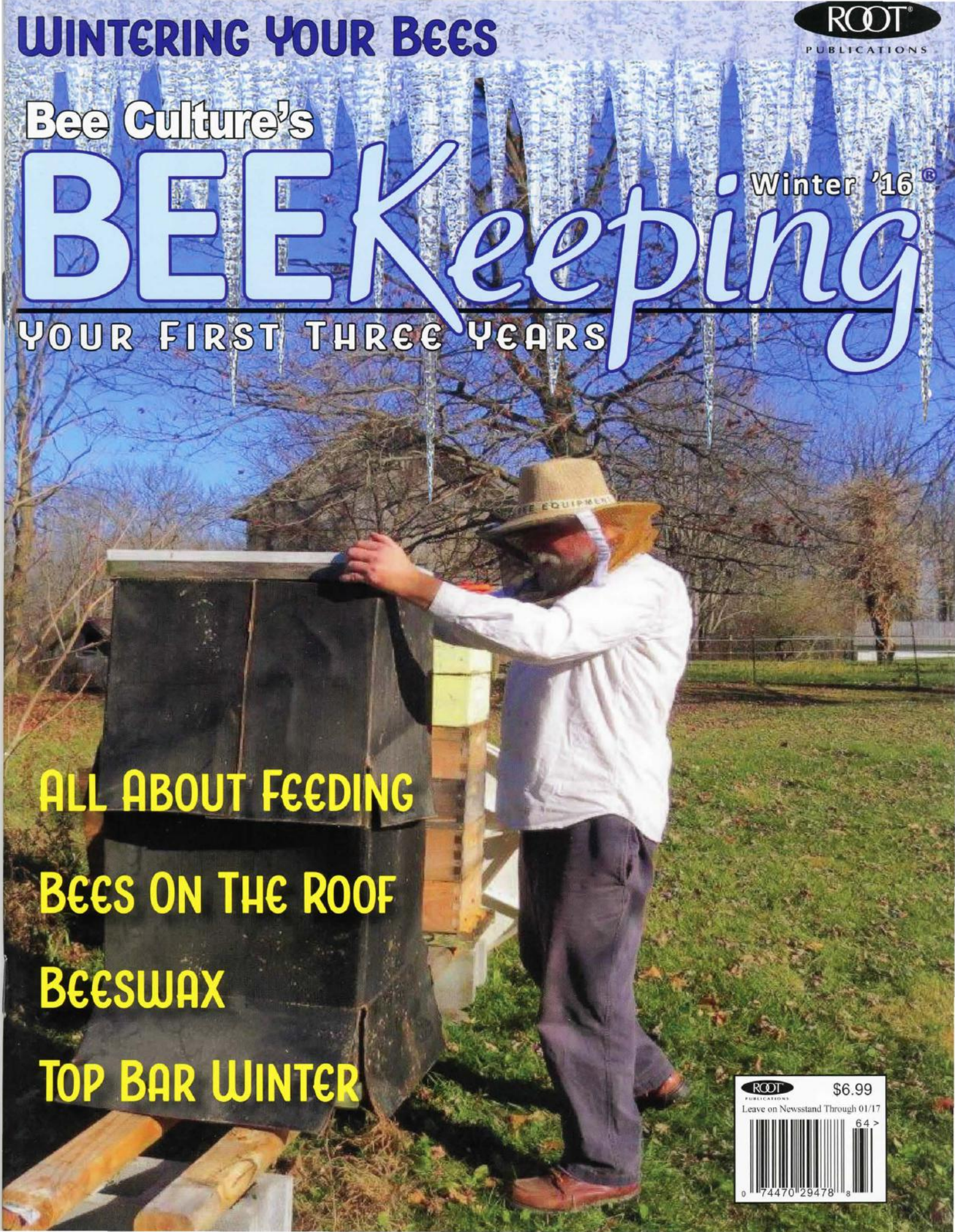

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BEEKeeping

We All Make Mistakes!
In the Autumn 2016 Issue we listed an author wrong on the contents page!

20 Facts about Honey Bees is by Gail Damerow

Hive Tasks

October, November, December

~ Ann Harman

- Make October first "Put Mouse Guards On Day"
- Queen is decreasing egg-laying—don't panic!
- Broodless period suitable for *Varroa* intervention until day temperatures are below 57°F.
- Keep up small hive beetle controls until weather cools.
- Your goal: adequate winter stores:
  - Warm climate 40 pounds
  - Temperate climate 60 pounds
  - Cold climate 90 pounds
- Frames of honey can be moved from one hive to another provided colonies are free of disease. Do not move the queen!
- Syrup for winter storage is 2 parts sugar to 1 part water.
- Stop feeding sugar syrup when temperatures are below 57°F.
- Be certain that queen excluders are off the hives. Set excluders aside for a cold day to snap off propolis and wax.
- Inspect queen excluders for damage. Queens will find any damaged place.
- Protect plastic queen excluders from mice.
- Set aside damaged equipment for repair. Get ahead—fix it now!
- Protect all stored equipment from mice.
- Any stored brood comb must be free of wax moth eggs and protected from damage.
- Inspect any stored comb for damage, lumps of cross-comb and excessive drone comb.
- Clean up beeyard. Do not leave bits and pieces of equipment lying around.
- Mow any grass or weeds so bees have flight on warm winter days.
- If you live in bear country, check bear fence.
- Wash all your bee clothing—veils, jackets, coveralls and gloves. If you use household gloves, discard old ones and buy a new supply.
- Clean up your smoker. Make sure it is free of ashes under the grid.
- Plan to check your hives at least once a month. Do not break the cluster.
- Use honey in Thanksgiving pumpkin pie and during the holiday season.
- Tell Santa Claus which bee book you would like for your library.

Good Stuff From Ann

Ready, Set, Go!

During October, November and December you should have noticed that your queens are starting to take a vacation—a short rest from laying so many eggs. This is normal behavior for our bees of European origin. Does this mean you can also take a rest? Well, in a sense yes—meaning you will not be as busy with your bees as you were during the spring and summer months.

Depending on your onset of winter weather, you can consider October as the end of preparing your hives for winter. All should be well until Spring arrives. Now you have a few months to get ready for your coming Beekeeping Year. (Remember, the bees' New Year started in August.) You have some time to review your records for this year. I hope you did keep some sort of records! How satisfied were you with your bees throughout the spring and summer? Did you requeen? For what reason? If you did requeen are you satisfied with the new one? How about equipment—did you have to order something necessary in a panic? Use your records to plan your coming Beekeeping Year.

One important beekeeping activity will be a quick inspection at least once a month during the winter months in your area. You must not disturb the cluster. You can choose a day with sun, low wind and remove the covers. You need to know if the bees are alive and if they have enough food to last until early plants with nectar and pollen are available. Bees, in a Langstroth type hive, work their way up through stored food. In a top bar hive they will work back into where their food is stored. If, for some reason the colony is dead, block all entrances until you can determine they did not die from American foulbrood.

In your beekeeping library, no matter how small, you should have a collection of catalogs. If not, it's time to start. Although it would be nice to have 2017 catalogs with their new items when January begins, you might have to do those new items search on the internet. The new printed catalogs sometimes do not arrive promptly but the 2016 catalogs will be useful. Having a library of catalogs is convenient because you can open several at once making it easy for comparisons such as price and shipping costs. Look through the equipment suppliers' advertisements in this magazine and contact them to be put on their mailing list.

This is the time to look forward to your equipment needs for the coming bee season. Bee equipment suppliers usually have sale prices on many items in January. Since the 2017 catalogs will probably not be available, look online. If you have finished your first year and preparing to harvest honey next season, now is the time to order honey supers and foundation for the start of the nectar flow. Waiting to order until you suddenly need honey supers can mean you will miss your best nectar flow. In general try to buy woodenware from the same manufacturer to assure a smooth fit.

You may be tempted to buy some used equipment. Because of the possibility of American foulbrood contamination buying used boxes and comb could turn out to be very costly if you have to destroy bees and burn hives. You may have found someone nearby making beehives and the price seems cheap. Think twice—cheap could mean poor wood and slight mismeasurements. A well-made hive should last many years and be a pleasure to use.

While the weather is still warm you can give your hives a thorough check from top to bottom board. Remember to keep the bee's organization of their home intact. Make sure the bottom is clean, even a screen one. Odd bits of wax and propolis can be scraped off and removed from the beeyard. Such debris left lying around is an attractant for small hive beetle, skunks, racoons, and even bears.

Equipment, such as empty boxes, queen excluders, frames, foundation, and drawn comb should be reviewed and cleaned up. A chilly day, about 35 to 40°F, is ideal for snapping off propolis and wax. If you live in a warm climate you may be scraping instead of snapping. If any woodenware needs repair set it aside and don't forget about it. You may need that in a hurry next Spring.

If you used queen excluders, they may need cleaning but be careful not to damage them. You can flex the plastic ones to look for places with a small rip. To inspect

metal ones, hold the short end and tip the excluder down away from you. In that way you can see if any of the rods are bent. Yes, the queen will find a damaged place in an excluder so take good care of them.

All stored equipment should be protected from mice. They can ruin a plastic queen excluder, gnaw at woodenware and make a fluffy nest out of your protective clothing and gloves. In addition to mice, beekeepers need to protect stored comb, especially brood comb, from wax moth. Yes, you can use the Para-Moth® from equipment suppliers. It is paradichlorobenzene.

It will be absorbed into the wax permanently even if you cannot smell it. But you must renew the treatment each year. If you purchase and use 'moth balls' and the container says 'naphalene' you will kill your bees! That equipment is ruined even if you do not smell it and must be destroyed. You cannot tell the difference in the two chemicals by the odor.

Two other ways to protect equipment from wax moth are freezing and light. Brood combs and even hive bodies containing brood comb can be put into a freezer for a week. Wrap combs or hive bodies containing combs in heavy plastic trash bags and seal with tape. Leave sealed up after removing from freezer but protect from mice—they can easily chew through a plastic bag. If you live in a cold climate the comb can be stored in a shed or outdoors but should be protected from rain and snow. Wax moth cannot lay eggs if light is present. So hive bodies with combs can be stacked in alternate directions, each box 90° from the one below it to admit light but the light must be on 24 hours a day. It does not need to be a bright light.

Although you now have your unused equipment protected from mice, did you put mouse guards at the entrance to your hives? As the days grow shorter and nights become frosty, mice are shopping for a protected warm dry place to establish a nest. Your beehive provides that. Mice destroy comb to make their nest area and their smelly urine keeps the bees far away. You can buy mouse guards or make your own with a piece of ½ inch hardware cloth fastened firmly across the entrance.

Bees will fly on warmer days in winter so mow grass and weeds to give them free flight. (You might find that hive tool you lost back in June.) In moderate winter weather bears may not completely hibernate. If you live in bear country make certain your bear fence is working. In areas of high winter winds put a heavy weight on top of flat telescoping covers. If you live in an area that could have a snowstorm you really do not have to clear the snow away from the hive entrance unless you want to. You will soon find an opening along the entrance. Snow surrounding the hives acts as insulation so there is no need to shovel the beeyard.

Clean up your smoker. Creosote can build up and make the top difficult to open and close. Check the bellows for any damage. If so, you can buy bellows from the bee supply company you bought your smoker from. However, if you, as so many other beekeepers have done, drove over your smoker and flattened it, replace it now.

Hive tools can have a buildup of propolis and wax. Scrape any buildup off. Sticking the dirty end inside a lit smoker does a good job of cleaning it. So does a trip through the dishwasher after being scraped.

You need to wash all of your bee clothing—veil, jacket, coveralls. If bees stung the clothing the venom has dried in the cloth. A buildup of dried venom can trigger a venom allergy so plan to wash your protective clothing frequently. Cleaning your gloves can be a problem if they are leather. Propolis and wax can make then very sticky. Rubbing alcohol will dissolve most of the propolis. Using household dishwashing gloves means no stings and you can feel the bees and what you are doing in the hive. When these gloves become sticky they can be discarded for a new pair. Check your veil for any holes before the bees find them and crawl inside. Repair, or if a serious problem, replace.

If you do not belong to your local bee club you are missing a lot. Clubs will have speakers on a variety of topics. You may feel that not all of the presentations are interesting but they may give you some ideas for your future in beekeeping. State beekeeping associations frequently bring in bee scientists with up-to-date information on some of our beekeeping problems. So attending a state meeting is very worthwhile. If you are not aware of a local association in your area, the state association can give you that information. Here is where the internet is a big help. Just Google your state beekeeping association and take advantage of the information.

Is the internet a good source for finding answers to your bee questions? Probably not if you are just cruising around. Experienced beekeepers are able to sift the correct and useful from opinions and guesses and completely wrong information. If you wish to find accurate beekeeping information you can try these sites: www.eXtension.org and put beekeeping into the Search block. One site that is specialized for the Mid-Atlantic region but also has excellent general beekeeping information is the Mid-Atlantic Apiculture Research & Extension Consortium, MAAREC, at agdev.anr.udel.edu/maarec. An excellent newsletter can be found at the University of California Davis site: elninobeelab.ucdavis.edu/apiculture_newsletter.html. Some state and local bee associations have newsletters. And check out your state University webpages for the Extension on Beekeeping.Choose club newsletters in your area because the information usually will be more pertinent. You can subscribe (free) to two interesting newsletters, one is called *CATCH THE BUZZ*, information available on the *Bee Culture* website. The other is Malcom Sanford's APIS newsletter: beekeep.info/apis-newsletter.

If you are one of the lucky ones who took beginning beekeeper classes in your area, you could ask to sit in again to refresh your memory on points that you may have missed the first time. If you did not take classes then sign up for them! Some associations offer mentors to guide you through the first year or two of beekeeping.

Tell Santa that a Christmas present of a beekeeping book would be nice. Unfortunately many are on the market and some of those are rubbish. Two websites offer excellent books for all levels of beekeeping: beeculture.com/books and wicwas.com. As your beekeeping year draws to a close you can still have 'bee time' with a good book.

~Ann Harman

Evolution has provided honey bees with an extraordinary ability to thermoregulate and survive in a cold climate. [1] During winter, bees cluster in a configuration that has a dense outer layer of older bees, sometimes referred to as a mantle, covering an inner core of more loosely packed younger bees (Figure 1). The cluster responds to changes in temperature by expanding to dissipate heat and contracting to conserve heat. Bees can precisely position their bodies in layers so their thoracic hairs interlace. Since a bee's hair has similar properties to down, bees resist heat loss, and their layered bodies close off ventilation through the cluster and between combs. [2] As an interlaced cluster they form a naturally efficient insulation cooperative.

Figure 1 *An infrared photo reveals a tightly packed winter cluster. The bright yellow indicates the warmest part or the center of the cluster. Away from the center the color darkens, as the temperature is lower.*

As the body temperatures of the mantel bees fall, they generate heat by using their indirect flight muscles to shiver. While shivering, bees are using fuel, oxygen, and exhaling carbon dioxide. Their respiration, in combination with reduced ventilation, creates an environment with increased carbon dioxide and reduced levels of oxygen. Both these conditions would be toxic to humans, but to bees these alterations are intentional. The changed environment around the cluster induces the bees into an "ultra low metabolic rate" which conserves energy and traps some needed humidity. There is also some research indicating that a higher level of carbon dioxide increases the mortality of wintering *Varroa*. [3]

The temperature of bees in a cluster are regulated in three different ways, first by conduction because they are touching, then by radiant heat from bees nearby, and finally, with convection via air movement. When bees cluster tight and shiver, the heat they generate reaches down to the core. At the core, the temperature would continue to increase until the cluster overheats, but instead, the younger bees at the center expand and loosen the core allowing excess heat to flow back to the outer layers of the mantel. In this way, the heat being generated in the mantle layers is equalized and distributed by the action of younger bees at the core.

Ultimately, the heat dissipates from the mantle's surface into the convective airflow around the cluster. Heat dissipation plays an important role in understanding how the size of a cluster matters to heat loss and winter survival. The larger the cluster, the less the surface area represents the total mass of the cluster. The opposite is also true, and in a small cluster, the surface bees represent more of the cluster's mass.

To understand this better, visualize a cluster of just one bee. In a one-bee cluster, 100% of the surface area and 100% of the cluster's mass is represented in the single bee. Convective flow around that one bee will also cool the entire mass of the cluster because they are one in the same. If we add another a bee, the cluster's mass is doubled, but the surface area is not increased by the same amount. As we continue to add bees, the surface area becomes less and less representative of the total mass of the cluster. The surface area is critical because that's where heat dissipates and if that surface represents less of the cluster's mass, the cluster can retain more heat and stay warmer. It's why a dog or a cat curls in a ball to sleep; they're protecting their core temperature by reducing the surface area exposed to cooling. Maintaining core temperature is the key to winter survival and is also where insulation can make a critical difference.

How Insulation Works

As beekeepers, we can't control thermoregulation, but we can influence heat loss in two significant ways. We can manage the convective flow by keeping the air as still as possible around the cluster, and we can add insulation to the hive body to help conserve some of the heat.

To aid in understanding how insulation and air temperature play a role in over-wintering colonies, it may help to visualize the cluster as if it were a stand-alone hot-water tank. Water inside is maintained at a steady temperature, and the amount of fuel used to heat that water depends on both heat lost to the surrounding environment and the insulation quality of the tank. If you want to save money on heating fuel, the first thing you are advised to do is insulate the tank. The reason insulation conserves fuel is because it resists the natural movement of heat to cold and therefore, the heat that's generated takes longer to migrate away. The same thermal transfer takes place in a bee cluster, and the same conservation of heat applies when you add insulation around a hive.

In a natural bee cavity, insulation is provided by the surrounding mass of the tree. Above and below the colony is an almost infinite amount of insulation and the outside walls can be virtually any thickness, but more typically range from 3 to 5 inches. According to universally accepted standards, soft pine offers an R-value of about 1.12 per inch. [4] Therefore, the ¾ inch pine boxes we typically use provide an R-value of about 0.84. Conversely, a colony surrounded by 5 inches of wood in a natural softwood tree benefits from an R-value of about 5.6 or about six times the insulation quality of a typical bee box and that's just the outside walls.

The real contrast in R-values is evident when you compare the insulation quality of what a tree provides above and below the cluster (Fig-

Figure 2
With the physical comparison between a single deep box and a bee tree, it's easy to see that there's little insulation value in a thin box compared to the mass of a tree.

Winter Management

Using Insulation and Ventilation in Temperate Climates

~William Hesbach

ure 2). A typical commercial box sits on an open bottom board, which offers little to no insulation value below the cluster. Above, the combination of an inner cover and telescoping cover provides some insulation, but not much. Also, if the inner cover has a bee escape hole, with a notch on the outside rim, the insulation value is near zero. That's a problem and especially on top where warm moist air will accumulate. If that warm moist air meets a thin cold surface or an open bee escape hole, it will condense and dump cold liquid water back onto the cluster. Bees can tolerate extremely low temperatures while dry, but if you wet them in cold temperatures, they will die.

In a recent study, researcher Derek Mitchell went beyond simple R-value calculations and used his physics background to apply known thermal mass calculations to compare the heat transfer (loss) of a tree to that of man-made hives. His research indicates that a thin man-made box will lose 4 to 7 times more heat than a typical tree colony and that some behaviors may be driven by that fact.

"Many honeybee behaviours previously thought to be intrinsic may only be a coping mechanism for human intervention; for example clustering in a tree enclosure may be an optional, rare, heat conservation behaviour for established colonies, rather than the compulsory, frequent, life-saving behaviour that is in the hives in common use. The implied improved survival in hives with thermal properties of tree nests may help to solve some of the problems honey bees are currently facing in apiculture."[5]

Mitchell makes a strong case for adding insulation to an overwintering colony, but he also makes a case for more year-round insulation. Mitchell is hardly the first to consider the difference between trees and thin pine boxes. Langstroth's first hive was double -walled and he advocated filling the dead-air space between with a non-conductive material like charcoal or sawdust, "to enable the bees to preserve with, the least waste, their animal heat". [6]

Some manufactures recognize the need for more insulation and today we're seeing hive bodies offered in lightweight insulating materials like high-density polystyrene. Polystyrene boxes have been used in Europe for many decades, and the characteristics are well documented. But in the US, wooden boxes dominate, and there still seems to be a lingering discussion about the need for adding insulation.

Arguments Against Insulation

There are a few standard arguments often advanced against insulating. The first being that insulation will make bees more active at times and use more stores while they're moving around and that's true. An important thermology study of wintering bees [7] concluded that colonies with insulation have more relaxed clusters, and, therefore, bees have the ability to move around more when compared to uninsulated colonies. But that only allows bees to have greater access to stores and avoid starvation. To the contrary, it's not uncommon to observe that a starved colony left behind plenty of honey because it was just too cold for the cluster to move and consume them.

Another common objection is that insulation will cause the colony to remain cold as the outside temperature warms, and the bees will miss opportunities for cleansing flights on warm winter days. But as the thermology study documented, bees in insulated colonies reacted to changes in outside temperature at basically the same rate as uninsulated colonies.

Bees break cluster based on the temperature of outside air drawn directly into the cluster, not the temperature of the hive body or the surrounding honeycombs.

Contrary to the belief of some, insulation does not add heat - it can only help contain heat already generated. As such, insulation will not provoke bees to fly when it's too cold causing them to die as they exit the colony - they do that with or without added insulation. When considering arguments that advance the notion that added insulation will harm your bees, it's important to remember that bees have lived in well-insulated natural cavities for thousands of years.

Finally, during a winter when a colony will need almost all the honey it has for survival, insulation can make a critical difference. Even in winters when insulation may not play a significant role in survival, the bees can benefit from less cold stress and emerge in spring healthier. Improving the insulative quality of the habitat we provide our bees is just moving them closer to life in a more natural enclosure.

Ventilation In a Langstroth Box

Ventilation is both complicated and interesting when wintering bees, and although I've separated the topic from insulation, how you use ventilation will determine the effectiveness of your attempts to insulate. The complicated part is understanding whether it's bees in the cluster that need ventilation, the Langstroth box that's made ventilation necessary, or a combination of both. It's always interesting to

Figure 3 *In this figure, the bees are attempting to close an inner cover bee escape hole, which is an indication that they want control over ventilation.*

observe that bees in fall make every attempt to close all seams and holes in their hive (Figure 3) - are they trying to tell us something? [8]

How Convective Flow and Condensation Work

In a bee enclosure, where bees are the source of heat, there is a natural convective flow. Heated air has the characteristics of being both more buoyant and capable of holding more water vapor than cooler air. As bees breathe and metabolize food, the heat they generate provides a constant upward convective flow of warm moist air. What happens next depends on the type of enclosure.

In a natural tree cavity, which is a tall cylinder, the moist convective flow reaches the top of the cavity and meets a warm surface with a physical vapor barrier. The warm surface is there because the tree offers, as mentioned earlier, an almost unlimited amount of insulation above the cluster which is resisting heat loss. The vapor barrier is there because the bees have placed water-resistant propolis over the entire inner surface of the cavity. Since the top is warm, and heat seeks cold, the warm flow spreads along the top seeking the cooler surfaces of the cylinder walls. Warm moist air and a cold surface will cause condensation. The condensation happens because as the air's temperature is lowered, it loses its ability to hold water vapor. As the water vapor condenses out and turns liquid, the hive's humidity level is lowered, and the process gives back latent heat to the enclosure. It's a perfect balance made better by the fact that the bees select cavities where the entrance is positioned away or lower than the center of the winter cluster [9] so any cold air coming in, falls to the bottom of the cavity mostly avoiding the actual cluster. At the bottom, excess humidity remaining in the falling air condenses out into the compositing detritus on the bottom. [2] Also, since the cylinder is long, the cluster has more surface comb to allow for a winter position farther up into a warmer space as needed.

In a thin wooden man-made enclosure, things are much different. We've already discussed the difference in insulation quality, so what happens in this box follows the same principles of thermodynamics, but with a different outcome. For the purpose of comparison, I'll assume an uninsulated box with a typical inner cover and telescoping outer cover. The warm moist air rises and the first thing encountered is a thin cold inner cover where condensation will occur and in this case, it will occur directly over the cluster. Bees can tolerate cold well below -20°F, but drip cold water on them at 32°F, and they die. It's no mystery that having observed this, beekeepers want to ventilate the moist air before that happens. For many decades, beekeepers have devised ways to use the inner cover's conveniently placed Porter bee escape hole to ventilate all that warm moist air, without regard for the consequences of lost heat.

Figure 4 *This condensation pattern indicates how a warm telescoping cover will redirect hot moist air to condense away from the cluster's center- notice the dry center.*

What Happens When You Add Ventilation

Ventilation provides some level of humidity control by directing the cluster's warm convective flow to the outside, but the consequence is the removal of needed heat. A few important questions come to mind. First, as beekeepers, we know how to keep condensation levels down by adding lots of ventilation, but do we know enough to understand how to balance ventilation with the needs of wintering bees. [10]

The complication arises from the fact that natural humidity levels change in response to many ordinary variables in the daily life of the colony. Therefore, a fixed amount of applied ventilation will not accommodate those natural fluctuations. How much ventilation is required, and when to adjust the amount, is not known. It's not even definitively known if bees' attempt can control humidity, or if they just adapt to naturally occurring levels. [11] What is clear is that bees need some of the condensation they generate to hold heat in the enclosure.

Also, we've known for some time that humidity plays a significant role in varroa reproduction, with optimum humidity for reproduction ranging from 55% to 70% and only limited reproduction taking place at higher humidity. [12] So a real contemporary question is does added ventilation aide varroa reproduction. [13]

The next question is how much of our current practice of provisioning 60- 100lbs of honey per wintering colony, then providing supplemental fondant, and in some cases ending with the need for emergency food, is being driven by removing lots of heat the bees must replace?

E.B. Wedmore calculated the amount of honey required to overwinter a measured population of bees in his influential 1947 book, The Ventilation of Bee-Hives. Wedmore converted the caloric content of honey to watts and then using wattage he calculated that the basic needs are about 3 lbs. per month between mid-October and mid-April. Therefore, if Wedmore is correct, and the primary winter honey requirements of an average population of bees are in the range of ~21 lbs., it seems like our need to provision winter stores at four times that amount, may indicate something about the burden on bees to generate additional heat beyond their basic needs. One obvious reason is the loss of heat by an abundance of added ventilation.

There's no question that ventilation is needed, but I think if we could refine our understanding of how much is needed and when, modify our boxes to direct the convective flows away from the cluster's center (Figure 4), and increase insulation around the winter cluster, we could help our bees live healthier, lessen the burden of winter provisioning, and reduce winter losses.

Insulation options

When the subject of adding insulation comes up, it invariably starts with wrapping a colony with tarpaper. Although tarpaper is not insulation, because it has no R-value, it has historically been used in combination with insulation material as a way to keep them dry. Early use of tarpaper included covering leaves or straw after they

were packed around colonies. If you're not interested in insulation and only require a water shield or windbreak, tarpaper will work, but advances in energy efficient house wrap made of woven polyester, designed specifically as moisture and air infiltration barriers, are another option.

Many commercially available winter wrap systems simplify the process of insulation. These kits offer an inner core of bubble wrap or fiberglass and an outer covering of black plastic. Some with a fiberglass core offer R-8 insulation. They are simple to install, provide adequate insulation, but are only operating on the vertical box surfaces. The vertical sides represent about 25% of the total heat loss with the remaining heat exiting from the top. That means that almost 75% of a colony's winter heat loss is unaddressed unless you use commercial side wraps and add insulation to the telescoping cover.

One product discussed as insulation is Homasote. Homasote is a mixture of recycled sawdust and newsprint in combination with insecticides and microcrystalline wax. When thoroughly dry, ½ inch Homasote has an R-value of 1.20. Beekeepers sometimes put Homasote over their inner covers to act as insulation and as a moisture collector, but those two functions can oppose each other. Homasote's intended use is in dry building cavities where liquid water or excessive water vapor can become a problem. To combat this, Homasote added microcrystalline wax to delay vapor saturation. But since Homasote is paper, it will collect moisture, which is an advantage if you're using it for that purpose, but once Homasote starts to collect moisture, its R-value declines. So, if you decide to use Homasote as insulation or a moisture collector, consider its properties and use it accordingly. The "moisture boards" sold commercially are made of Homasote or a very similar product.

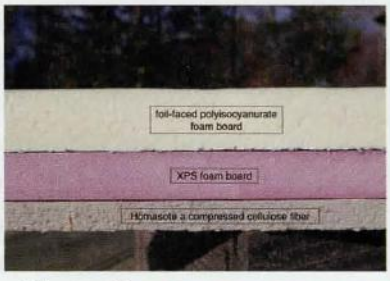

Figure 5 *Foil-faced, polyisocyanurate offers both dense insulation and reflective qualities. Pink XPS board provides insulation, and Homasote a compressed cellulose fiber product, offers lower insulation but good water vapor retention.*

If you want insulation approaching the quantity of a natural tree cavity, the best insulator is sheet foam. Sheet foam comes either as pink extruded polystyrene (XPS) or foil-faced polyisocyanurate (Figure 5). These insulators resist moisture and provide excellent R-value in the range of 5-7.5 per inch. Sheet foam's insulation quality will not degrade in the presence of moisture and, therefore, will provide constant R-value in all conditions. Sheet foams can be fashioned into sleeves that slide over the colony for complete sidewall insulation, and sheet foam's biggest advantage is when it's used for both sidewall and top cover insulation.

Not All Foams Are The Same

XPS is rigid [14] , easily cut, and offers about R-6 per inch. XPS can withstand a short exposure to sunlight, but the manufacturer recommends painting it, or covering it with a house wrap or tar paper. When used in the telescoping cover where bees can access it, they sometimes try to chew it out, but you can stop them by covering it with a thin plywood sheet or a screen.

Foil-faced polyisocyanurate foam, sold under different brand names, is a premium product designed to both insulate and reflect infrared heat. Reflecting infrared heat is a valuable way to conserve heat. To use foil-faced insulation as an infrared reflector, you must provide an air space between the infrared heat source, which is the bees, and the foil surface.

Details For A Winter Cover With A Built-In Winter Feeder

You can use the following construction details with either XPS or foil-faced foam. If you use XPS, the sleeve should fit snug around the box and if your boxes are anything like mine, they're sometimes misaligned or slightly different dimensions so don't make the sleeve fit tightly, or you may find that you can't get it on. With XPS you are also advised to protect the surface from the weather and sunlight. If you use foil-faced poly, you can fit the sleeve snuggly or build in an air space to reflect infrared heat, which will increase the insulation quality of the whole project.

I'll explain the details for using foil-faced poly combined with an air space to reflect infrared heat. If you want a simpler snug fitting sleeve, just eliminate the details concerning the air space.

Figure 6 *When the telescoping cover is in place, this ½ inch space will help reflect infrared heat back to the cluster. Radiant reflection is used for thermal efficiently in the building industry and works equally well when applied in beekeeping.*

With the writing on the foam sheet facing out, construct a sleeve that's the total height of the boxes you're overwintering in, plus the height of an Imirie shim used for feeding, plus an additional ½ inch (Figure 6). The ½ inch air-gap is incorporated into both the sides of the sleeve and the top. When you build the ½ space around the sleeve, it will work even better if you ensure that the space around the sleeve's bottom is sealed to prevent airflow; you want the ½ inch space around the box to be as close to dead air as possible. [15]

For the sleeve's rectangular dimensions, just measure your boxes and add 1 inch to both measurements -remember to measure twice and cut once. When installing the sleeve, it's best if the sleeve rests on a support that's level with the seam between the bottom board and the bottom box. Otherwise, the sleeve can tilt, or slip down, and cover the front entrance. I install a small shelf of wood that supports the foam and keeps everything at the correct height (Figure 7). Next, install screen on the shim (Figure 6). The screen on top of the shim prevents bees from occupying the ½ space above the screen, and the

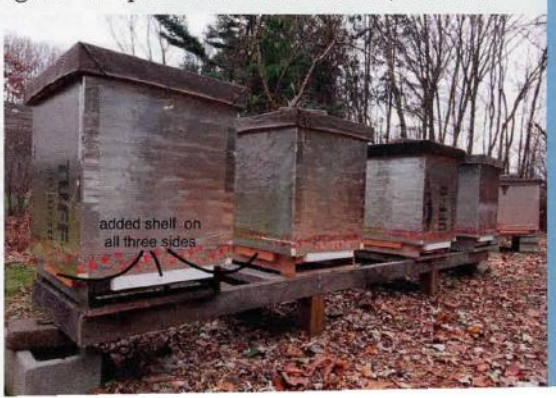

Figure 7 *The foam sleeve slides over the boxes and rests on an added ledge at the junction between the bottom board and the lower box keeping everything at the right height.*

space under the screen is convenient for winter-feeding. If you don't screen the shim, the bees will gather against the under surface of the foam. They like it there because it's warm, but their bodies will conduct heat and partly eliminate the reflection of infrared heat.

The final piece is a rectangle cut the same size as the outside dimensions of the sleeve. You can now place that rectangle on top of the sleeve. I like to then build a telescoping winter cover that fits over the sleeve, and insert that piece into the underside of the cover. I have also used a flat piece of plywood with a stone weight or ratchet strap and there's lots of other ways to add some cover on top.

Lastly, the sleeve and top cover are not intended to be airtight. If you use a screen bottom, you should block it against a sudden cold updraft, but it's not necessary to seal it tight. You may see liquid moisture at the corners around the top and you may also see some in other places indicating air infiltration, and that's OK. Those indications are proof that your system is working, and that condensation is occurring away from the center of the cluster and also that the bees are not sealed in too tight. So, have some fun, keep your bees a little warmer this winter and there may be a few more around to greet you come spring.

~William Hesbach
EAS Certified Master Beekeeper
Sideline beekeeper in Cheshire CT.

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14- Foam sheets are not a structural material, meaning they cannot be used to carry weight. But, they will resist a certain amount of compression, so if you install foam inside an inner cover and then place a weight on top, you will not damage it.

15- It makes assembly a lot easier if you tack any pieces together with a hot glue gun first and then use aluminum tape to reinforce and cover the exposed foam edges.

Don't Worry Bee Happy

~Susan Holliday

I was worried...
about being stung for the first time
on a beautiful last dusk of June.
Herr Ruff, the forester, wore no protection as
he pulled out the hive frames
one by one, explaining who's who—those
large ones those are the drones,
look for the white dot 2016's birthmark
beekeepers give their queen.
There, there she is near the bottom of the
middle frame!
Oh majestic queen tell me the names of each
as you lay your
twelve hundredth egg!

It happened then a sharp prick on the inside
of my left ring finger
not sharp enough to drop the frame, just
sharp enough
to communicate she was mad, and who
wouldn't be
when your door was shut before the last
most efficient workers
returned from foraging, your home
upheaved and
strapped to the back of a jeep as it bumped
along 5 km,
forcing you to hang onto every honey comb
every cell to
protect your eggs, your larvae, your
pupae, your nation
you spent 1/3 of your life building.

Two weeks here with me and you seem
satisfied, if not happy--
are you? Herr Ruff said it would be like a
vacation home
your new hive freshly varnished with natural
linseed oil.
Today I sat and watched several foragers
land at the entrance, legs loaded
with fresh golden pollen, scurry inside. I
imagined their waggle dance.
That made me very happy...

FRAME TIME

All About Feeding Bees

Jennifer Berry

When the hot, sweltering days of summer finally break, we southerners put down our fans and mint juleps, and welcome with open arms, the cool, crisp air of Fall. Not only are AC units starting to get a break but also, more importantly, so are our wallets. The days of sweat soaked shirts, wilting attitudes and heat exhaustion are nothing more than a fading memory. And more importantly for us, working in the bee yard has actually become pleasurable again. 2016 has been a tough year for most of the country with temperatures consistently souring above average and fields parched and cracked (or flooded). But today, the sun has mellowed, the humidity has dropped, and the day's have begun their chilly march towards winter. However, there are still things to do before the frost settles and the greens on the horizons turn brown. We need to make sure our colonies are prepared for their long winter's nap.

There are three key principles (after of course you have lowered *Varroa* populations) that you must pay attention to if you want your colony to survive the winter.

1. Large healthy population headed by a productive queen
2. Sufficient food stores assessable to the winter cluster
3. Protection from the elements (wind and rain)

Let's get to work. The first thing we check during our fall assessments is whether or not there is a queen and second, her performanc. How is she doing? What's her pattern look like? Is she even laying eggs? You want a viable queen, with a solid pattern, that will be ready to kick it into gear by mid winter (in preparation for the spring nectar flow). If she has been limping along all summer, it's time to let her go, otherwise, the colony will suffer. Now remember, if the pattern is spotty, there may be other issues such as disease or mite infestation, so don't just automatically assume it's a poor queen.

Excellent example of a good brood pattern

There are several reasons your queen may no longer be performing well. She may have been reared from an older larva. She may not have been properly mated. Too few drones to choose from or the weather may have kept her from making the required mating flight/s. Other problems could be the queen is too old, not producing adequate pheromones or running out of sperm. Her physical condition may have been compromised due to our manipulations within the hive. Whatever the reason, colonies going into winter with a poorly performing queen is handing them a death sentence. Yet, finding a queen this late in the season will be a challenge. Most operations have shut down for the winter. Plus, if the colony isn't very strong, it is best to just combine with another, preferably one that may need a slight boost. It's better to take your losses in the fall when you can still save the bees, wax and equipment from possible demise!

A quick side note here. Be careful working your hive, especially if you have more than one colony per yard. October especially can be the worst month for robbing. That's when bees from one colony (probably stronger) will "rob" or take the honey from another colony (probably weaker). Opening a hive exposes honey, which wafts in the air, stimulating bees into a frenzy. Plus, with all that dripping honey and exposed surface area, the bees are unable to defend it. If you've ever seen a robbing event, then you understand how horrible it is and will do whatever needs to be done to prevent it from happening again. Even the strongest of colonies left exposed can succumb to a robbing frenzy. Therefore, when conducting your fall inspections, bring several extra lids, covers, or even a towel to cover surfaces. You just need to keep the neighboring bees from gaining access to the supers.

Using entrance reducers help to discourage robbing

And if you can help it, don't pull out frames of honey.

In the upper supers, which should be mostly capped honey, we pull just the center frame and maybe two outer frames to check on amounts. You don't need to inspect each one. If we see it's all or mostly capped, we put the frames back, cover it, and move on to the next super. Each time a frame is removed, you may break the wax coating, exposing even more honey, which attracts even more bees. Also, work at a diligent pace. Don't dally. Put the cell phone down, and press on! If robbing begins, close up the hive immediately and reduce the entrance to a small hole, one just big enough to let one or two bees through.

After we've made sure the queen is healthy, it's time to check on how much honey supplies the colony has. This is a crucial step in any honey bee management plan. Here at the University of Georgia Bee lab, we always assume they don't have enough. That way we don't get caught off guard when conducting our mid-winter inspections and find starving or starved colonies. If colonies are lacking the required amount of honey to survive the winter, you will need to feed. And if your colonies need a substantial amount of food, you must start feeding today! Once the temperatures drop, the bees won't be able to break cluster to collect the food. All the syrup in the world will be useless if the bees can't get to it. Here in the south we can experience a modest golden rod flow this time of year, depending on location. But our experience with the golden rod in the Piedmont region has been minimal to none. Don't rely on it to supply their winter nectar needs here. Now pollen, that's a different story.

So, how much food is enough? For every frame of bees, (in the southeast, NOT Vermont), they will require a frame and a half of capped honey for their winter survival. We used to say, 35-40 pounds of honey for a deep box of bees here in the south, but my experience has proven this is not enough.

Let's back track a bit. The nectar flow, in the Piedmont region of Georgia, is usually completely over by July, and there's not much after that. Oh, there may be a smidge of wildflower here, or a drop of Aster there, but basically, it's done. That means your bees have to survive from July to April with what they have in the cells. That's nine months. If your colony is shy on stores, then you need to start feeding, otherwise they will starve which is one thing we can absolutely, hands down, prevent from happening. And please, don't get caught up in the rhetoric that claims... "if bees are too lazy or don't have the genetic makeup in order to find and store enough food, then they're not worthy of help; therefore don't feed them, let them die, which lets the bad genes die with them"! This is hogwash! I have yet to see a lazy bee, people yes, but bees, NO!

There are many reasons why bees don't have enough to eat, most of which have nothing to do with the bees, their genetics or otherwise. It has everything to do with the fact that the location that **we** choose for them may be poor, **we** extracted too much honey, badly timed swarms, **we** didn't properly manage, it was a rotten year weather wise - it rained too much, or didn't rain at all. All of these have nothing to do with bees being "lazy". Bees have always needed attention to survive, so if they are light on stores, start feeding today.

There are many feeder options and over the years we have tried practically every type of feeder available on the market. And after years of trial and error, we have settled on a favorite. But before I reveal what we use, let me explain why the others have lost favor. The first feeders I was ever exposed to were entrance feeders. This may be your experience as well, since most starter kits come with an entrance feeder. However, these are my least favorite type of feeder even though they are very convenient to use. All you do is fill a quart jar, screw on the feeder lid, push the holder into the entrance, plop the jar on and walk away. And with it being in the entrance, you can see when it is time to re-fill the jar, never once having to open the hive. However, you are feeding only one quart at a time. This method could take months before you have any substantial amount of stores built up.

Another problem is robbing which I've mentioned before. The odor of the syrup will draw unwanted neighbors right to the front entrance. If conditions are right, the "robbers" can overwhelm the colony leaving them with nothing to eat and in a weakened state or worse, dead. Even if you only have a few colonies, take caution because there may be a neighbor down the street that has numerous hives you know nothing about.

Division board feeders are another least favorite feeder, but they do eliminate the problem of robbing since the food is inside the colony. Division board feeders are the width and depth of a deep or medium frame and are usually placed on the edge of a super. In addition to hive manipulation, and the lose of a functioning frame, bees can drown, sometimes by the hundreds, in the syrup. Manufacturers have added pieces of 8" hardware cloth floats or rough end the sides to help reduce the risk of bees drowning, but it's not 100%. Plus beware, there's still another issue lingering!!! Beetles love the dark, protected areas these feeders provide.

Next, we have hive top feeders, which as the name conveys, fits on top of the hive. To install, all you do is remove the lid and inner cover, place the feeder directly on top of the upper super, fill it with the appropriate amount of syrup, put the lid back on and walk away. There is little to no disturbance to the colony because you don't have to dig around inside manipulating frames. The bees will crawl up the hardware cloth from the super

below and down to the syrup pool to feed. They are made to fit a standard 10, 8 or 5 frame hive body. Most have a self-enclosed, plastic unit holding one to five gallons of sugar syrup depending on the brand. These feeders tend to work the best, because they prevent leaking. If you need to put on a large amount of feed on in a short amount of time, this may be a good option for you.

But there are a few pitfalls. One, if not properly sealed they can allow bees, yellow jackets and other snooping insects to get trapped in the inner chamber of the feeder and drown. Bees are able to squeeze their way through the smallest of openings like under the inner cover/lid or they slide in-between the narrow openings in the wire mesh and outer wall. The newer hive top feeders have tried to eliminate this issue by making the feeders flush with the super and leaving no space for the bees to enter the syrup chamber from the outside.

Then if the slightest amount of sugar syrup leaks outside the colony it can draw in bees by the thousands. Even the strongest of colonies can be overwhelmed once clouds of bees force their way inside. Finally, there is the issue of cost; they are expensive. If you have more than one colony to feed, the cost goes up considerably.

Another major issue, entrance, division board and top feeders will not deliver the needed syrup if temperatures are cold. The food delivery method needs to be right on top of the cluster; it cannot be to the side, at the entrance or in a top feeder where the bees have to traverse up and around cold surfaces to access cold syrup. If temperatures are frigid, the bees will not be able to move any distance at all. Bees in cluster can starve with pounds of honey or gallons of syrup just inches away. This usually occurs when warmer weather is followed by extreme cold that sets in for days. The bees eat all surrounding honey and can't move to access the rest. Or if brood is present, they will NOT come off the brood since it's their job to keep it warm. Normally, larger clusters are not as susceptible to this, but smaller clusters can loose the battle quickly if they get separated from the honey source. That's why it's a good idea during your fall assessments to move honey frames in closer to the side and on top of the cluster. Remember bees prefer to move up and will do so during the winter so a good supply of honey above (not below) is required.

There are other methods of feeding, for example one, two, and five gallon buckets, Ziploc baggies, plastic soda bottles, and trays. We've tried them all, and found issues with each, which is why we've settled on the good ole standby to feed our bees: two-holed (with 2 7/8" apertures), migratory covers with inverted half-gallon mason jars. The small holes punched through the lid to allow access to the syrup and once you turn the jar upside down, vacuum suction prevents the syrup from pouring out. Yes, there are issues with this method as well, (glass breakage, leaks, jars being knocked off) but at some point you just have to settle on one and go with it. And no matter what time of year, if colonies are close to starvation, place the opening of the jars or bucket directly on top of the cluster. This allows the bees to use minimal effort to collect the syrup, especially if the weather outside is frightful.

There's also the question of what ratio (cane sugar to water, by weight) to feed this time of year: 2 to 1, or 1 to 1? We've never been as meticulous at the bee lab (or home) as to weigh components; we just have a feel for it. Granulated cane sugar is added to about the ¾-full point in a five-gallon bucket and then hot water stirred in until full. I imagine that our concoction is somewhere in between.

The last chore we need to perform before settling in for winter is to inspect our equipment. First of all move brood frames with old comb (3+ years) or nasty black comb in honey supers to the outer edge for removal next Spring. Research has shown, old comb is a reservoir for numerous contaminants, which is detrimental to the developing brood. Next replace old, decrepit hive bodies, supers, lids, inner covers, and bottom boards with newer equipment. They don't have to be pristine palaces, but they do need to protect the bees from the upcoming winter weather. Holes, cracks, and crevices allow cold winds to wick away at the cluster. Plus, cold rain dripping down on bees and brood is a recipe for disaster. These holes also allow access for critters to come and go. Mice especially love to make a beehive a home. Continual food supply, plus a warm cozy environment, makes hives a suitable rodent dwelling. Structurally tight equipment along with mouse guards will deter these issues.

A viable queen, strong healthy populations, ample food stores and sound equipment going into winter is what's needed for your colony/ies survival. It may seem like a lot, but it's really not. We accepted responsibility for these creatures when we brought them into our lives and sometimes they're going to need a little assistance; but just think what they give back in return. So, I'm willing to help out, I hope you are too.

Take care of you and your bees.

***~Jennifer Berry** is the research director at the University of Georgia Honey Bee Research Lab.*

Wintering Bees

A Cooperative Effort of Both Bees & Beekeeper

~James E. Tew

It's all forms of management

Feeding, protecting, treating, wrapping, and still more.

Fall and winter management is the last opportunity you will have to truly help your colonies. A quick search of my bee book library produced about a dozen books specifically on bee and hive management. Yet, with all that information and experience, managing honey bee colonies is still a relative thing and changeable task.

REMOVING THE HONEY CROP

It's getting to be late summer/early fall. The 2016 spring crop is made - if you got one. Some seasons, you can do everything right and still not make a drop of surplus honey. The fading days of summer are a good time to "rob" your bees. Removing surplus honey is the procedure beekeepers go through each year when they estimate how much honey to take and how much to leave. Only experience can tell you how to deal with this situation. Take too much and your bees starve during the winter. Leave too much, and you've lost part of your crop. Always err on the side of leaving too much.

So what's the best average numbers we have? In most areas a colony probably needs about 60-70 pounds of honey during most winters - no guarantees. An average two-story colony should weigh about 165-200 pounds. Some years this is too much while other years, the colonies may be left scant by spring.

How are you planning to get the crop off the bees? One simple way is to brush each frame free of bees. Bee escapes of various designs can be used that do not require handling individual frames, but do require two trips to the yard - one to put escapes on and one to take supers off. Many commercial operations use "bee blowers" (devices producing large quantities of low pressure air) or chemical repellents like Bee Go (butyric anhydride). Incidentally, common leaf blowers work to blow bees from supers.

STRIP THE COLONIES

Removing honey from bee colonies should be done quickly and efficiently. After removing the crop and while the colony is open, it's a good time to treat for *Varroa* mite infestations (if you are practicing fall *Varroa* mite control). *Varroa* mite populations need to be managed just as much as honey bee populations. It is important to do something either in the early spring or during late summer/early fall to control *Varroa*. Over time, with some successes and failures, you will acquire a feel for how well your particular control program is working.

Figure 1 *A colony that was killed by Varroa. The mites are oval shaped and reddish.*

LATE SEASON QUEEN MANAGEMENT

Fall re-queening is very possible - even desirable. Consider all the problems that are currently possible in acquiring and installing new queens in the traditional spring months. Get your queens from reputable queen producers. Most queens purchased in late summer or early fall have been "banked" in nursery colonies all summer, but there's not much you can do about that. In fact, it may not be all that harmful to the queens.

Re-queen as soon as possible after the honey is removed. Any colonies that don't take the new queens (or are weak) should probably be combined with another colony. Try to determine why the colonies are weak. If high levels of mites seem to have caused the colony's weakness, the chances are good that you will not be able to get it through the winter. However, if the hive appears to be salvageable, introduce queens in the same manner as you would introduce queens in spring months.

I like marked queens (queens with a bright dot of color on their backs). If you don't have the time or you don't have queen-marking experience, you can pay a bit more and most queen producers will mark the queen for you. This bright mark will help when searching for the queen.

Figure 2 *Queen Marked in green*

The queen is one of the colony's "Big Three" major components for productive hive management: (1) food stores, (2) diseases, and (3) the queen's condition. Even if you don't always see the queen, constantly check her progress by observing the condition and organization of the brood pattern, the characteristics of her adult workers, and the presence of eggs. Always check for the presence of eggs no matter why the colony is opened. Eggs tell you -- (1) if a queen was recently present, and (2) if the queen and colony are in sync with the current season. Lots of eggs are present in late winter/spring while there are declining numbers of eggs during fall and early winter.

GENERAL MAINTENANCE

While the colony is open, and as you check for the queen or evidence of her, check the general condition of the colony. Always look for American foulbrood (AFB). Any European foul brood (EFB) has probably corrected itself by now.

During the second visit after the honey has been removed, cull any bad combs. Actually, you can do that at any time that the colony is open and inspections are being made. What are bad combs? Generally, they are misshapen or distorted and have too much drone comb. Some beekeepers recommend destroying comb that is more than three to five years old. Though it should be, that procedure is not always followed. For many beekeepers destroying comb is too much work and expense for too little reward; however, old wax accumulates pesticides, environmental and in hive toxins, dirt, propolis, and "stuff." Refreshing a super on a routine basis with new comb keeps these out of the colony and away from the bees. How about the hive bodies? Everything in order there? Remove any pieces of equipment that have rotted or need repair. Do all these repair chores during the winter while sitting beside a nice warm fire.

If you live in a warm climate and if you want increased colony numbers next spring, making fall splits is not a bad idea. A single story colony with honey stores, a good population of both adult bees and brood, and a new queen can stand a "warm climate" winter quite well. In fact, in most instances, such a colony can frequently survive a cold winter. Either way, because these colonies may need feeding, watch them in late winter and early spring.

THE FALL FLOW

Now, with everything discussed so far, what if a fall nectar flow comes along? If you can get one, it's great. Most beekeepers want to keep the spring crop separated from the fall crop. Though nothing is wrong with it nutritionally and honey bees readily consume it, fall honey is usually darker and stronger flavored. Spring honey is usually typically preferred by honey customers.

Managing bees for a fall crop is much like the management recommendation for a spring crop. Get the supers on before the flow and keep them coming as long as the bees need the storage space. One change that should be considered is to remove most, if not all, the supers before the fall flow is over. You want the bees to really pack out the two brood bodies with ripened honey. That will be your bees' rations for the upcoming winter. Many beekeepers don't like to winter colonies on fall stores. Supplemental feeding may be necessary in order to get the colonies up the desired gross weight.

EXTRACTING THE CROP

At this point in this discussion, several things could have happened with the year's honey crop: (1) You extracted the spring crop during the summer and all is finished; (2) You are presently preparing to extract the spring crop in the fall; or (3) you have both a spring and fall crop with which to deal. That's neither good nor bad, but simply a fact of beekeeping -- honey must eventually be extracted or at least processed in some way.

Figure 3 *Tall hives with surplus honey for extracting*

Extracting the crop is not really beekeeping, but something more like specialty food processing. All the bee biology in the world won't help you understand how to design a filter system for an extracting layout. Extractors for small operations can be anything from a (new) modified plastic garbage can to a sophisticated computerized extracting device that will run 40 - 60 frames per cycle. The point is that at this time in late summer/early fall, most beekeepers make the change from managing bees to processing honey, only the scale varies.

As with stinging episodes, most beekeepers have their own extracting horror story that, in some way, concerns a run-away honey processing system in the kitchen or 2000 gallons spilled on the extracting plant floor. We all get our stories soon enough.

ORDER YOUR PACKAGES

Can you believe it? By the time September or October rolls around, you'd better be ordering your packages for the next spring season. Bee times have changed. Increasingly, package producers have been struggling to stay up with demand. The early beekeeper gets the package bees from the right producer at the right time.

STAY INFORMED

Something else that usually happens during August or September is the fall beekeeper meetings. You may have heard much of what is said at bee meetings, but there are so many new beekeepers that it needs to be said again (and again). It is critical to stay informed on all bee science updates and not just those on mite control or pesticide issues. The successful beekeeper is informed with good, dependable knowledge. If your state doesn't have a late summer or fall meeting, consider going to one of the regional or national meetings. It will be good for you to get information on the "bigger" beekeeping picture.

WINTER PREPARATIONS

Once the fall flow is over, timely beekeeping practices become important. But what is timely? When is the actual critical time to begin preparing colonies for winter?

Surprisingly, there are no absolute deadlines. Many hard-core wintering procedures can be done in August or September anywhere in the United States without ill consequences.

Many times, bee colonies can survive quite well with no help at all from beekeepers, but that's simply leaving too much to good luck and chance. In warm climates, you can begin winter preparations in October or even early November.

Figure 4 *Three colonies prepared for winter.*

In cool climates, begin winter preparations in September or early October. Ironically getting entrance reducers in place is one of the most demanding events. Entrance reducers keep mice out of the hive. Mice, too, must make winter preparations, and unlike us, they stay on schedule. Their successful winter survival depends on finding a warm dry place to pass the winter. A beehive is a perfect wintering site for mice. However, mice are inconsiderate hive guests. They chew up comb. They defecate inside the hive, and they keep the colony disrupted. Over a long winter, they can really wear out their welcome. Entrance reducers must be in place before the mice take up residence. That is the reducer's purpose-- to keep out mice, not to keep out the cold.

Late summer/early autumn is a good time to standardize and organize a yard. Get your colonies off the ground, fix gates or fences that surround the colonies. Cut back over-hanging limbs, and straighten up colonies that are out of plumb, making sure the back is just a bit higher than the front. It's so much easier to do these maintenance-type things before the weather gets cold.

So long as you are tidying things up in the yard, how's the paint on the hives? Use latex paint and don't put it on when it's below 40°F outside. Painting does not just keep colonies neat, but it also protects the wood from water penetration. Lumber costs have climbed so high that the labor and expense of painting hive equipment is generally worth the effort.

If hives are to be packed (insulated), you can get on with that at this time, too. Most beekeepers don't pack their colonies, but it's still an accepted practice. In years past, hives in cool or cold climates were packed and wintered outside, or they were put into cellars (cellaring) built for that purpose. Then and today, the cellars had to stay around 40-50° F, and have provisions for significant air movement. It would appear that cellaring bees was too much work with erratic results. Cellar wintering bee hives is uncommon now. However, there are always those who want to try "winter packing" hives.

Winter wrapping devices can be purchased from bee supply companies, or you can wrap your hives in black roofing felt. The black felt absorbs heat and keeps cold air out of cracks and crevices in the hive walls. Don't use true insulation. It absorbs water and becomes soggy. I'll bet you (with no data) that a piece of Styrofoam beneath the bottom board and beneath the outer cover would help the bees a bit.

Figure 5 *Two colonies packed for winter. Note lower entrance closed by snow.*

PROVIDE VENTILATION

Even if no insulation is used, warm air rising off the cluster has more water vapor than can be held as the air cools. It condenses within the hive. Though I have recommended previously the reduction of the bottom entrance, now I am suggesting new top entrance - probably about a quarter to three eighths of an inch beneath the inner cover. Two winter things happen at this point: (1) air can circulate (and escape) thereby stopping condensation from forming within the hive; and (2) the bees are given an upper entrance. This top entrance is useful in cold climates where snow and ice may block the lower entrance.

SPEAKING OF THE INNER COVER

It should be turned over so that the deep side is down, but don't do this until the fall flow is over. The deep side of the inner cover gives the bees more space to cluster over the frame top bars and thereby distribute winter food more easily throughout the hive. If this procedure is not done, colony life will go on; but it is one of those little things that is helpful to bees. Now, here's the rub. If you reverse the inner cover, you must be back there in late winter to turn it back over before the spring flow starts. Obviously, the bees would fill this space with burr comb and honey causing a bit of a mess to clean. Remember, deep side down during cold months and shallow side down during warm months.

When Preparing your colonies for Winter, above all else, do no harm!

COLONY LIFE

As you work your way through your colonies during late summer, watch for any that are light in honey stores. It must be said that all seasons are not surplus years. Sometimes the hives just don't get a good flow. If a colony appears to be light, but otherwise healthy, feed it thick syrup. To dissolve sugar into a solution, syrup this heavy will require some heat. The syrup made for spring stimulation can be tap-water warm, but that doesn't work well for winter stores. There are many types of feeders that you can use to get winter feed to the hives, but any feeder should: (1) supply only the amount the bees can take before fermentation occurs; (2) be readily usable by the bees; and (3) not incite robbing.

ROBBER BEE CONTROL

Once the fall flow is past, you should be alert for robbing activities - especially as you manipulate colonies. During a good flow, almost anything goes - requeening, supering, or making splits - all without much concern by the bees. But once the flow is over, *"Thy neighbor's food supply is fair game"*. You won't miss the symptoms of robbing. Bees will be fighting while others frantically try to get into the hive at any crack within the hive walls. Close down the hives under attack. Simply stuff grass into all the hive openings. Better yet - move the colony to another location where competition is not so stiff.

CONTROLLING SKUNKS, RACCOONS, AND OTHER SUCH PESTS

Small animals can be a significant nuisance to wintering colonies. In the case of small pests like skunks and raccoons, get the hives off the ground or fence them. In any case, do something before the colony goes into hard winter. Continued winter disruptions from critters like these keep the colony agitated both day and night.

In managing your bees during late summer and early fall, as always, do no harm. In our efforts to help, we all, to often, injure more than we help. From this discussion, select the items that you think will help you and your bees close down one season and prepare for another. Hive management is just one big cooperative cycle between you and your bees.

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Other Hives

Wintering Your Top Bar Hive

~ Christy Hemenway

Gold Star Honey bees® is a Maine company that manufactures top bar beehives. As the owner of the company and a beekeeper myself, shepherd I have seen a number of "bee-attitudes" come and go concerning top bar hives. We've muddled through "bees must go up"; "top bar hives make too many drones"; and "wax foundation gives bees a head start." Currently we seem to be stalled at "top bar hives don't over-winter." Let usLet's take take an in- depth look at this statement . . . and see what we can do to increase the odds of top bar hives overwintering.

Top bar hives have long been associated with Kenya, a sovereign state in East Africa. Kenya has many regions that range from tropical, hot and humid along the coast; to temperate regions along the plateau; and temperatures in the highlands that fall well below freezing. Still this association with Kenya appears to have fueled a belief that top bar hives can only succeed in hot climates.

At Gold Star Honey bees®, we believe differently. We hear from top bar beekeepers all over North America and get and we have seen the resultshave received reports of top bar hives that have overwintered successfully in Maine, Idaho, Illinois, Colorado and Nebraska, just to name a few. We collect these success stories, and make YouTube videos to share some of these storiesthem with people who are curious about the subject. You can find them on the Gold Star Honey bees® YouTube channel on our Success Stories playlist. (http://www.youtube.com/GoldStarHoney bees)

Because so much information hasis being collected been compiled on the successes ofhow to successfully overwinter ing top bar hives that an entire chapter of *The Thinking Beekeeper*, Chapter 7, has been devoted to the subjectin (Hemenway 2013). We're always interested in hearing from people who have successfully overwintered a top bar hive, and learning more about the methods used, so if you are one of those people and would like to share your story, please write to us at: bees@goldstarhoney bees.com.

Even though Mostany offears about top bar hives' abilities to overwinter seem are exaggerated to us, but there are some valid concerns and some significant differences between overwintering Langstroth hives and top bar hives. Let's talk about those . . .

Ventilation. The patterns of air movement inside these two hive types of are very different, due to their construction and inner workings. In a Langstroth hive, the top bars of the frames DO NOT touch. In fact, they CANNOT touch. They are purposely spaced apart, for two reasons: first to maintain the "bee space" between combs, and second, to allow the bees to move vertically between the boxes. In a top bar hive, the opposite is true – the top bars DO, and in fact MUST touch in order to maintain that same bee space. The bees in a top bar hive move horizontally, below the top bars. This is a big difference and affects many things about the workings of the hive.

Moisture

In a Langstroth hive, with vertical airflow, moisture in the hive is a concern. Air comes in through the hive entrance, a slot at the bottom of the hive, and it moves upward as it is warmed by the presence of the bees. This works in the same way that a chimney "drafts" to move smoke from your fireplace upward and out of your house. In winter, this warm air passes between the bars, and rises to the top of the hive, reaching the inner and outer covers of the hive, where it comes into contact with cold surfaces and condenses, then freezes. Due to this condensation, in Langstroth hives, it is beneficial to install some sort of absorbent material, often a piece of homasote board, or perhaps a thick layer of newspaper, above the inner cover to soak up this moisture and prevent it from raining down on the brood nest in the Spring, killing the next generation of bees.

In a top bar hive, moisture above the bees is not a concern. In a top bar hive, with the bars all in contact with each other, the air moves horizontally around the hive but there is no upward draft. There is also nowhere above the bees for moist air to condense on a cold surface and then drip down in Spring. Top bar hives with a glass

observation window, standard in Gold Star hives, .This may experience condensation on the inside of the window but since the window is located below the bees there is no risk of this moisture dropping onto the brood.

Winter Preparation

When it comes to preparing hives for Winter, there are three important issues, each of which a top bar beekeeper would consider a "four-letter word." These are **WIND, FOOD**, and **COLD**.

WIND

Our experience shows that **wind** is the single biggest threat to a top bar hive's ability to overwinter. Wind increases the effects of cold temperatures, and saps energy from the cluster. Most successfully overwintered top bar hives have been protected from the wind in some fashion, either by the natural features of their location, or by some sort of protection created by the beekeeper.

The many ways of protecting top bar beehives from wind that have been devised by top bar beekeepers are truly a testament to beekeeping resourcefulnesswho . Methods range from tarpaper, a take-off on the once-traditional wrapping of Langstroth hives, to planting a circular grove of trees and locating the hive within that circle. Other effective methods include attaching foam board insulation to the outer surfaces of the hive body;

wrapping the hive in a "tarp skirt"; building a hay or straw bale "fort" around the hives; or simply siting the hive in a protected corner of a privacy-fenced backyard.

We also use Pink Panther ® fiberglass insulation – bagged and tucked up inside the gable roofs of Gold Star hives. We do this partly for the insulating qualities but also to fill the space above the top bars. There is a small gap, designed in to each Gold Star Honey bees® hive, between the ends of the top bars and the edge of the roof. While this gap presents no problem provides benefits during the Summer season, and in fact it allows bees to exit the roof space after an inspection. However, in Winter we recommend filling thise space to prevent the movement of cold air over the top bars inside the roof. It also helps to deter mice from moving in above the bars because the insulation blocks their access to that space.

Avoid using anything to protect a top bar hive from wind that causes the hiveit to sweat inside it; anything that completely eliminates air movement around the hive; or anything that absorbs moisture that can then be transferred to the hive. This would include wrapping the hive entirely with any sort of plastic wrap, or building a hay bale fort surround that is too close and transfers moisture from the bales to the hive body.

FOOD

The second four-letter word is **food.** In top bar hives, just as in Langstroth hives, leaving adequate food stores for your bees during Winter is crucial to their survival. Then the question arises: how much food is enough? There isn't much data available about the winter food requirements of top bar hives, a. Aside from a general sense that a top bar hive seems to require less than a Langstroth hive. ThereIt is still plenty of up for speculation concerning whether this is because the bees in a top bar hive use their stores more conservatively; because they are able to heat the hive more efficiently; or because of some other reason altogether. In our experience in Maine, six to eight full bars of honey have typically been enough for a hive to make it through to Spring.

COLD

The third four-letter word is **cold.** Cold Winter temperatures are definitely a concern for bees, but with top bar hives, it is less of an issue than wind or food. comes since we have no control over how cold a winter will be, regulating managing for the wind and food supply, the other two factors we can control, becomes even more important. When you are able to lessen or eliminate the "wind-chill" effect, the cold is less of a problem than you might think. In fact, if there was no wind, and if the Winter would settle in to one temperature, and stay steady for the entire Winter, it's likely that bees would have a much easier time of it than they do when the temperature fluctuates wildly from deep cold to almost mild. You actually prepare your hive best for the cold by protecting it from the wind and by leaving adequate food stores in the hive.

When to quit

I am often asked about when to quit working a top bar hive in the Fall. Since the bees use propolis to seal gaps inside the hive in order to prevent cold drafts, it is best if the beekeeper in a cold Winter region does not break this propolis seal. In Maine that tends to mean that you should not be working the hive much later than the first half of October. In your location, the timing may be different. Pay attention as you inspect – as the temperature drops, the propolis becomes more and more brittle, and you can hear it "snap" as you break it free. If you are hearing the propolis snap, you are probably inspecting later in the season than is prudent.

Mice

It was a number of years before we got a report of mice inside the body of a Gold Star Hive, but alas, it did finally occur. We have startedrecommend using a square of ¼" mesh attached over a single open hive entrance to prevent mice getting into hives during the Winter. This is especially important if you've chosen to use hay bales

as wind protection, since the bales are likely to appeal to the mice as well.

Movement inside the hive

The question of whether the bees can move sideways in a top bar hive to get to food stores in Winter was answered dramatically one day, when I opened a hive, inspected a bar, and saw a hole almost the size of a dime at the top of the comb near the top bar. Since then I have seen many similar holes that seem to come and go at the whim of the bees.

Winter feeding

Since bees must stay tightly clustered together during the Winter months, in order to combat the cold, there are special challenges to feeding a top bar hive in the Winter. The bees cannot stray from the cluster to visit a distant feeder, so the best option we've found is to provide fondant and install it directly against the cluster. This necessitates a cold weather inspection. You will want to be prepared with fondant in a fondant feeder of some kind so that you are able to get into the hive, install the fondant, and get back out quickly.

If you don't have a fondant feeder Gold Star Honey bees® is developing a product we call the Flottum Fondant Feeder (Thank you, Mr. Kim Flottum!), which is available on our website in time. In a pinch you can fill a manila folder with fondant, staple it to a top bar, and cut several long slits in the side so that the bees can access the fondant, then put this top bar right up against the bees.

Overspring

With all types of hives, it seems that April is always the cruelest month. Top bar hives are just as susceptible as Langstroth hives to what's known as thethis April phenomenon.. With the April PhenomenonOften in April, the hive has actually overwintered, and you think you've succeeded in getting them through – but then due to some poor combination of weather and hive events, the bees don't "overspring." Be sure that this loss is not due to lack of food and forage – as the weather warms, but before the dandelions bloom, you can turn to feeding 1:1 syrup if necessary.

As you can see, there are specific concerns with each type of hive when it comes to protecting the bees from Winter. BecauseSince the interest in raising bees without chemicals and on clean natural comb in top bar hives is continuing to increase, I'm certain we will get better at overwintering in all types of equipment and have more success stories to share. I'm looking forward to hearing them.

Bzzzzzt!

***~Christy Hemenway**, Author of The Thinking Beekeeper series, including "The Thinking Beekeeper – A Guide to Natural Beekeeping in Top Bar Hives" and the forthcoming "Advanced Top Bar Beekeeping – Next Steps for the Thinking Beekeeper."*

CITY BEES

Keeping Bees Up on the Roof

~Toni Burnham

Rooftop apiaries are probably the signature image of urban beekeeping. Downtown, we are often short on personal space, and long on neighbors, but the sky is wide open. City rooftops have surprising benefits for both bees and their minders, though like every other hive site, local features will have a lot to do with both upside and downside of skyside beekeeping.

There is one major advantage to urban roofs that needs to be mentioned right away: despite any concerns we may cover here, the presence of large, increasingly green city rooftops means that almost any urban dweller should be able to find a safe and healthy place to partner up with *Apis mellifera!*

In fact, I am a beekeeper because of the rooftop paradise we encountered when we moved here. Our roof has a flat deck, and you reach it via a spiral staircase to a level where the bees are looking straight at trees and not at frightened humans. My roof practically demanded that I take up beekeeping. To be fair, you may have to convince yours.

Looking at the upside of rooftop beekeeping, many rooftops greatly reduce neighbor and vandalism concerns, and there are some pests which don't seem to do as well a story or so above ground. On the downside, beekeeper access can be difficult or even dangerous, hive moves achieve new dimensions in complexity, and wind has a whole new role to play. Luckily, others have come before us to tackle some of these problems, and we can look at a few cases here.

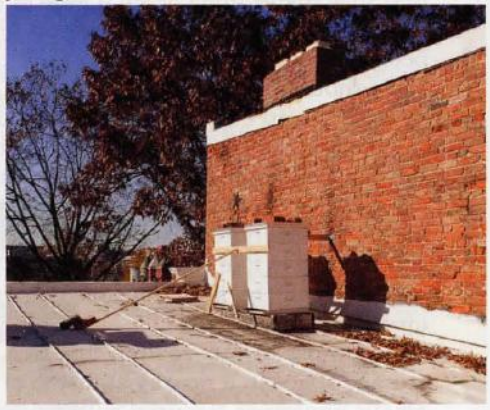
And a disclaimer: Nature being the way she is, you are likely to encounter variables not covered in this article, but here's my "Top Ten List" of issues which potential urban rooftop beekeepers should consider up front.

The Rooftop Beekeeping Top Ten:

1) Access
2) Beekeeper Safety
3) Honey bee Health and Safety
4) Structural Safety
5) Neighbors, Vandals and Other Third Parties
6) Honey Harvests On High
7) Moving a Rooftop Hive
8) Pest Management Issues
9) High Altitude Habitats
10) Wintering on the Roof

Number One: Access

As important as the bees are, your beekeeping plans have to start out with how you are going to get all the pieces into place, and how are you are going to manage to take care of them and yourself over the long haul. History shows that stairs, hatches, and ladders can quickly turn into a very long haul. Also, many rooftop beekeepers share their roof with other tenants, or may even have an out apiary on a roof that does not belong to them. In many cities, beekeepers have hives on publicly owned buildings like community and recreation centers, and it is not unusual for a business (especially a hotel or restaurant) to solicit a beekeeper to place colonies on their premises. These hive hosts, however, may impose access rules or restrictions that you have to take into account in your management plans.



Getting Established

You can set up a rooftop hive several ways, fortunately. And don't be foolish: never attempt heavy maneuvers at altitude alone.

If you have access via a wide opening like a doorway or a bulkhead, you can move a nuc or split relatively easily, and can bring fully constructed hive components via additional trips. Many of us are lucky enough to have stairs leading up to a roof door or hatch, but it is possible to lift complete components up a sturdy enough ladder (preferably angled and with good treads to avoid slippage).

At the Trinidad Rec Center, we used a high quality hand truck with good thick rubber tires to set up the apiary there. We lashed a three-medium hive (secured with staples) to the body of the cart and lift/rolled it up a ladder, rung by rung, from above and below through a hatch used by the HVAC people when they move components. Remember, if your roof has large equipment on it that someone repairs, it is worth your while to get to know the maintenance team and learn how he or she gets the job done.

After this adventure, my co-conspirator Del Voss used his ex-Iowa farm boy expertise to build a Hive Crane from parts in farm implement catalogs. His crane can be secured on a roof with cement blocks and can lift a small hive a couple of stories. (He also uses the thing to lift mature hives off of rickety stands so the latter can be reinforced or replaced – my hero!)

When the hatch is small

Most of the townhomes in this city do not have full sized doors or hatches for roof access. In these cases, beekeepers often carry up unassembled hive parts up and hammer them together on site, Packages are easy to carry up and install, nucs a little more tricky. Just remember, for harvests, splits and hive moving purposes, what goes up must come down! We have hints about this later.

Tools and feeding

MOST BEEKEEPERS END UP CARRYING LOADS OF STUFF AROUND WITH THEM AS THEY TEND THEIR HIVES, AND RUNNING TO GET A MISSING TOOL, OR MAKING SEPARATE TRIPS FOR SACKS OF SUGAR OR BUCKETS OF WATER HAVE A WHOLE NEW MEANING WHEN A HATCH AND A LADDER AND SEVERAL FLIGHTS OF STAIRS LIE BETWEEN YOU AND YOUR KIT.

Beekeepers need all that stuff. One of my favorite early beekeeping stories comes from the Montgomery County Beekeepers 2005 Field Day. Several experienced beeks were taking a few dozen newbees through our first hive inspections when a swarm landed 40 feet up a tree in the same apiary. Before you know it, middle-aged beeks in veils were running to their cars, one grabbed a saw, another a hundred feet of rope, someone had bed sheets, one an empty nuc box, and another was up that tree before the car folks got back. They got the swarm, but I got the impression that they were absolutely nuts.

However, today my car contains, among other things, just about everything you need to take down a bee tree. Beekeeping is like that. How are you going to guarantee access to all the stuff you need when you are a couple (or more) stories up?

At most of our rooftop apiaries, we either request storage space in a nearby stairwell or place a waterproof plastic container (secured with bricks, bungee cords, or both) with a minimum set of two hive tools of different types, a bee brush, entrance reducers, note pad, pen, smoker, fuel, lighters, hat veil, gloves, and a sealed white plastic HDPE bucket with a bag of dry cane sugar inside. Some sites keep complete jacket veils on site, but if the public has access, those can be expensive to lose. We also post a "Warning: Apiary" type of sign within 20 feet of the hives.

We are lucky in that many of our roof sites have working hose nozzles, and that some folks have rigged a hose up the back of the house. If not, you will have to haul your own H_2O up there. Use the plastic bucket for mixing food on site (if robbing is not an issue at the time). And keep in mind a water source for your bees!

Case Study One: The Less-Than-Perfect Roof

Matt Braun started his third year as a rooftop beekeeper in 2012, and his hives are on the roof of a row house on Capitol Hill. They're about 2.5 stories up, though his neighbor's house is one story taller and provides a decent windbreak.

Matt has a slightly slanted, antique tin roof with ridges and a small wooden hatch in the ceiling of his spare bedroom, similar to the photo here. Matt finds that being on the roof adds a bunch of complications that terrestrial beekeepers don't have to worry about. In no particular order, here are some things that he's spent a lot of time thinking about:

1. As his wife likes to point out, the roof structure and the surface are designed to keep weather and water out, and not to hold hundreds of pounds of bee hives, and more importantly, to hold up to foot traffic. Some roofs are certainly sturdier than others: his is 86 years old. Matt occasionally lies awake at night in bed staring up at the ceiling, wondering if the roof is about to give way, and 60,000 startled honey bees are going to come pouring through the roof. Realistically this probably isn't too much of a worry, but leaks are. Water damage from even a small leak could cost a small fortune and ruin your relationship with fellow residents (or the landlord). So, you have to be confident that the roof is going to hold up, and you should be vigilant about inspecting for damage, recoating more often than is the norm, and minimizing the number of extra people you take up there for show and tell.
2. On a similar note, I recommend a hive stand that spreads the load out, preferably perpendicular to the direction of the joists. This could be a pain with the metal ridges, and if the roof isn't flat. Matt cut 2x8s on an angle and ran them parallel for ~8 feet. You're probably planning on one hive, but spend a lot of time thinking about your stand, and make it from day one with space for at least three hives. When you're standing on the roof with a recently collected swarm in a burlap sack and need a place to dump them you'll be glad you planned ahead.
3. Invent a system where by the screen bottom board isn't dumping directly onto the roof coating. Lots of wax/propolis/crap builds up down there and it makes it harder to keep on eye on the roof itself underneath.
4. Matt's hives originally were not strapped down in any way – the telescoping covers had two bricks on top, and that was it. For about 24 months, that was fine. Since then, he recommends building a strapping system into your hive stand, especially it you're higher up and more exposed. If a heavily laden hive fell in strong winds, it could easily punch a hole in the metal roof. Also, if something goes wrong, you'll likely only figure it out on your next inspection since you don't see the hive every day like you would in your yard: the stakes are a bit higher. The rational engineer in Matt didn't think he needed straps at the beginning, but his emotional human side concluded that he'd sleep better through Super storm Sandy with them, so he added them this Summer. And the hives did fine!
5. Carrying things up and down through the hatch is a pain. When you forget something and have to run back down it's a hassle. If you can leave tools on the roof in a plastic tub (also strapped down so it doesn't fly away), it'll save you a lot of suffering. Similarly, maneuvering through the hatch and down a ladder carrying a 10 frame medium super full of capped honey is really difficult/dangerous (31 year old male in reasonably good shape here). I won't be doing that again. I'm building some boxes to carry four or five frames at a time.

Matt's bees haven't had any problems from the hottest summer days or the windiest winter nights. He says that all new beekeepers seem to worry about those things, but in practice they are rarely problems.

Matt's advice basically comes down to *plan really well before you bring a colony home.* Everything is more logistically challenging on the roof. He promises that you won't regret spending extra time working out as many details ahead of time as possible. Do whatever it takes to ensure your peace of mind on the windiest stormy night.

Case Study Two: Out Apiaries, or "What if it's not your roof?"

If your bees are not located on a roof which you own, you have special responsibilities and potential liabilities to other, non-beekeepers, as well as the chance to keep bees in locations that may be healthier than the limiting hive site options in tiny ground level yards.

For many urban beekeepers, their first hive is not going to be located in the same place they are living, especially for those in apartments or condos, or in rented accommodations. Many beekeepers are able to find public beekeeping programs at gardens or recreations centers, or are invited to place their hives at businesses such as hotels or restaurants, or even at their employers.

In many cities, building LEED-certified green buildings (with green roofs!) is the norm, and beekeepers are finding it relatively easy to pitch beekeeping to organizations that are already making these investments.

The opportunity is there, but it is always wise to weigh it against risks and responsibilities. And it is a good idea to get them spelled out in advance – key contacts, access times and means, on site storage, core responsibilities, what happens in case of damage, and what arrangements are necessary for exiting or expanding the apiary, among others. Look online for sample agreements related to public beekeeping, and consider adapting them for your apiary's needs!

In 2009, Izzy Hill, Chloe Wardropper, Rebecca Davis, and Gretchen Anderson launched an apiary that has since grown to three thriving hives on the roof of a community center in the most densely populated part of their city. They got help from, and volunteer for, a beekeeping education project sponsored by the Parks Department and Whole Foods.

There were strings attached with the offer of this apiary. The new beekeepers were expected to help care for publicly owned hives in the same apiary, and to participate in education and outreach programs involving both of the sponsors. Located above playing fields and fountains, they were also expected to keep an eye on swarms, robbing, and the need for water. Finally, they had no access to the apiary on Sunday at all, and could only get nighttime or early morning access with special assistance, arranged for in advance, from official staff members.

Sundays have developed into nail biters. Several major windstorms and blizzards have pelted DC on Saturday nights over the past three years, with hives located five stories up and wind barriers only on one side. The beekeepers made it through the first storm with no damage, and quickly ferried large cement blocks up to the roof and placed them on tele covers. Thus far, snow loads have not blocked lower entrances, but the beekeepers maintain upper entries just in case.

The Spring of 2012 was also a rare one for swarms in Washington, DC, and Izzy and Rebecca's hive popped out a monster, which attached itself to a tree trunk next to a very popular basketball court. Luckily, a history of close communication with not only the key staff member but also the front desk and the maintenance staff (and just about anyone in the building who showed the least curiosity) resulted in a quick phone call to an available beekeeper, as well as an invitation to bystanders to watch the swarm get hived from a safe distance and learn more about honey bee behavior and the environmental strength of their neighborhood.

Because everyone knew about the bees, knew who to call, and saw what a quick and informative response they could get, the program only got stronger.

When key collaborating staff left the Park department, it became important to seek out and develop a new relationship with her successor, who might not share the same interest in public beekeeping! Thus far, that request has come in the form of a greatly ramped up public education schedule, which is a challenge for such a small team of beekeepers. The next stage is to sit down and negotiate a clearly spelled out set of responsibilities and guarantees by both parties – something missing before now – including emergency contact plans as well as some scenarios for current participants exiting and others entering the project as needs change.

Just recently, the beekeepers harvested three supers of honey from this apiary, with several bottles designated for the public hearing on the broader legalization of beekeeping now just passed. Their efforts have been a key component in making these steps forward possible, in part because keeping bees on someone else's roof inevitably leads to talking about bees with people who would never have encountered them any other way!

Number Two: Beekeeper Safety

While it's a shame if an apiary does not work out for the bees, it's a tragedy if it causes harm to the beekeeper. Call it common sense, but look after yourself first when you are running around a story or more above grade.

Factoring in everything we said about access, remember that a fall or a back injury from hefting yourself or your tools and hive parts onto roofs ups the ante considerably. Take it slow. Take several trips, rather than rushing it all into one or two. Bring a buddy with you as often as you can when tending a rooftop apiary, and failing that, bring a well-charged cell phone. Keep it within reach.

Your bees are not the only ones who need water up there: during the Summer, you will, too. I put a weather station up next to my hives the same year they were installed, and discovered that Summer temperatures were routinely five to 10°F higher on the roof than on the ground, with less shade. Too many beekeepers let themselves get dehydrated in the average Summer beeyard: dizziness brings an additional hazard at elevation.

Throughout the year, we've recorded roof wind speeds that were not as high as the airport, but much higher than at ground level. Don't leave a lot of loose stuff (buckets, feeders, bottom board inserts, dead frames, etc.) laying around for you to trip on or to blow into your or a neighboring yard.

Finally, site your hives well away from roof edges, and let the bees fend for themselves during thunderstorms, hurricanes, and tornados. Even if they get toppled, they have handled worse, but you probably haven't.

Number Three: Honey Bee Health and Safety

Roofs are actually fairly groovy places to be a bee. Dr. Tom Seeley tells us that they would prefer to be at least 40 feet up in a tree anyway, and in places where trees are their main forage, rooftops are like front row seats.

Nonetheless, some roofs hold unnatural hazards for honey bees. Mine has air conditioning units and satellite dishes, bigger buildings have all this at a far larger scale, with additional ventilators for things like kitchens and furnaces and labs that may not be honeybee friendly.

If you have a choice, try to site your bees far from any roof edge, but also a good distance from machines that vibrate or blow fumes. Windbreaks make all the difference in long term hive vitality, and you can try to provide one (shrubs, cement blocks, hay bales) if you want to experiment.

On your initial site survey, keep an eye out for equipment that leaks (especially air conditioners) or other pools of suspicious liquid that might prove tempting to a thirsty bee. Make sure there is something better, like a really murky tray of algae filled water that you provided, if you think this might be an issue.

Some beekeepers have reported that pools and fountains have created honey bee problems, for different reasons. Fountains that run all Winter do that by using antifreeze – hazardous to bees as well as family pets – and some of the more luxurious apartments or hotels have them.

On the benefit side, it appears that pests like Small Hive Beetle have a relatively harder time completing their life cycles on roofs (though they can continue to fly in) and *Varroa* and wax moths are rumored to struggle a bit more in this more highly ventilated environment. Bees in North America do not seem to mind the hotter and colder temperatures, though I have used fans that help cool the hives on the hottest days.

Number Four: Structural Safety

If your potential rooftop apiary is on a private residence or an older public building it pays to have a look at, and account for, the structural strengths and weaknesses of the roof.

My roofer advised me to place my hives as close to the bearing walls as possible, and directly over roof joists that he identified for me. For townhomes, bearing walls are often the party walls between units, and they often jut above roof surfaces. This provides a double benefit of a windbreak and visual barrier from neighboring structures.

He also provided me with a protective roof walkway pad that I could place over the roof membrane itself in the places I would be traversing most frequently. These are available online in 30' rolls – consider splitting one with a friend.

> IF YOUR ROOF SURFACE REQUIRES A HIVE STAND, PLACE ITS SUPPORTING MEMBERS ON JOISTS AND NEAR BEARING WALLS IF AT ALL POSSIBLE, AND TRY TO SPREAD THE LOAD, ESPECIALLY IF YOUR STAND WILL HOLD MORE THAN ONE HIVE

It might not be a bad idea to use a skid proof pad here, too.

Try to watch the loads placed on your roof by numbers of visitors or the kinds of activities you undertake up there. I once terrified a fellow beekeeper by jumping around on his antique roof, trying to dislodge a swarm from an overhanging tree branch. Duh.

Educate yourself about the strengths and weaknesses of the roof surface you have been dealt. I found out the hard way that I needed to be more careful where I put down my lit smoker. Prepare to be honest with yourself if your roof needs significant repair before it can take on such a role, or if it's just not the right place for your or your bees.

Number 5: Neighbors, Vandals and Other Third Parties.

Probably the main benefit of urban rooftop beekeeping is the extraordinary solitude and separation from the ground level hubbub it brings, but even here other people do play a role. In the city, there is a strong statistical likelihood that you will run into someone who does not want bees and does not want to hear about it. Roof apiaries tilt the odds in the bees' direction!

Hiding in plain sight is just good policy for a home apiary in dense environments. It means that the people paying attention to your bees are more likely to be on the lookout for them because they appreciate them. While I

am lousy at keeping them secret (I write about bees in magazines, for example) about half of my neighbors still have no idea what I am doing up there. And we are both happier that way. My apiary is visible from an apartment building about a block away, so I painted the hive bodies the same color as the trim of my house. Most times, I think the hives look like additional HVAC gear.

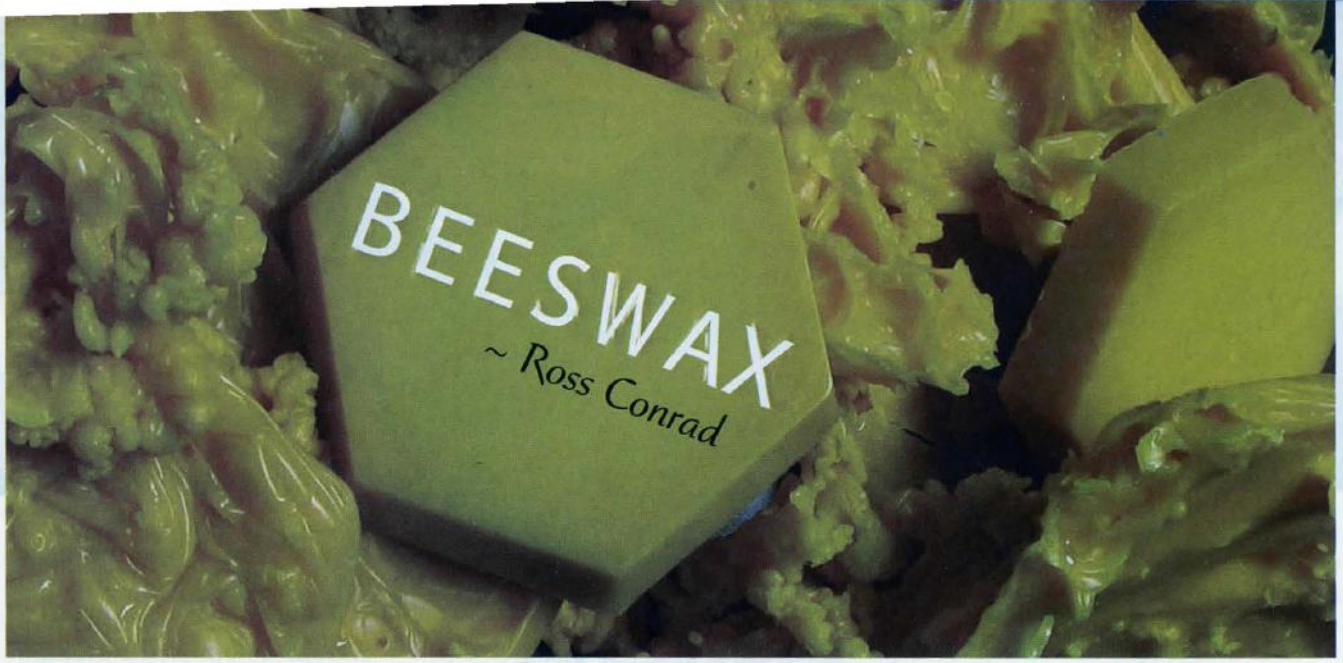
We have had sad conflicts where rooftop beekeepers here have had to remove hives in adverse conditions due to neighbor threats and complaints, and I do believe this could happen to anyone. The roof can protect you from a lot, but not from stupid or angry. You can do a lot to prevent the latter with good hive management, but there is no cure for the former. Try to manage your risk by lowering your profile and figuring out, in advance, with whom you are going to share.

Rooftop vandalism is rare, but if other people use the roof, make sure you post a sign that indicates that the bees are there, and that they are beneficial, but that unauthorized visitors place themselves at risk.

It is a good idea to communicate in advance with other roof users to prevent inadvertent interactions, and to build channels of communication that might come in handy if a swarm emerges or a weather event or accident topples your hive.

In summary, if its your roof, it's your business, but if you are sharing premises, be prepared to share information and expectations.

~Toni Burnham *Keeps bees on rooftops in the Washington, DC area where she lives.*



A colony of honey bees tends to be evaluated by the number and condition of the bees it contains. This narrow focus overlooks an extremely important component of a healthy hive: the beeswax comb. The combs in a hive can act as the skeleton, furniture, nursery, food pantry, and communication infrastructure of the colony, all at the same time. For beekeepers, honey bee comb is a source of valuable beeswax. Other types of bees produce wax that is very different from the wax produced by honey bees, of the species Apis. For example, certain species of stingless bees are reported to produce a wax that is more difficult to break and stickier than beeswax from Apis mellifera. Wax from stingless bees also tends to be dark brown and stretches without breaking when warmed.

The geometric shape of the cells found in beeswax comb result in the incredibly efficient engineering of the comb. The hexagon cross-section of each cell makes use of the least amount of material in order to create a lattice within a given volume. Hungarian mathematician, László Fejes Tóth, discovered that the shape used by the honey bee to build cells is not, theoretically, the most efficient shape possible. Tóth discovered a shape that would be .035% more efficient. However, this difference is too small to be measured on actual comb, and irrelevant to the colony's efficient use of wax given that natural comb varies considerably from the mathematical notion of perfect geometry. For all practical purposes, the shape of the cells that the honey bee uses allows a colony to store the most honey using the least amount of wax.

Wax scales being exuded from the wax glands.

Production

Honey bees build their comb from small wax flakes, or scales, that they produce from the four pairs of wax glands on the underside of their abdomen. Wax secretion is stimulated by the retention of carbohydrates within the systems of the younger honey bees. The wax is secreted in liquid form on the ventral surface of the abdominal tergites (plates on the underside of the bee's abdomen). As the liquid wax spreads over the surface of these plates, the wax hardens as it cools through contact with the air and forms a scale. Honey bees can produce up to eight scales of wax every 12 hours when necessary. A worker bee's wax glands seem to function best when the bee is 10-18 days old and they decline after the bee is older than 18 days, usually shrinking steadily until the end of her life. However, after swarming wax production and building is undertaken by bees of all ages with young bees producing wax earlier than they would in an established colony, and older bees regressing to resume beeswax production. Bees use stiff hairs on their hind legs to pass the scales to the middle legs, and then to the mandibles (jaws) where the wax is chewed during which saliva and enzymes are mixed with the wax. When it is the right consistency, the wax is used to construct comb and seal cells filled with honey.

This is nature's way of providing for the bee's needs. As long as a worker bee has access to empty comb to store excess nectar or honey that is not immediately needed for dietary requirements its wax glands are not activated. However, when there is no place to store excess carbohydrate resources within the hive and the carbohydrates are held within the body of the

Save all the wax you harvest during the season and when extracting

A solar wex melter is an easy and inexpensive way to begine the process of cleaning and purifying

bees without being digested, the bees will expend the biological energy to produce beeswax. This wax becomes the building material used to construct additional comb that will provide added storage space for the excess nectar and/or honey. Research has found that bees need to consume 6.6-8.8 pounds of honey for every pound of beeswax they produce. Wax producers also need to have previously eaten large amounts of pollen in order to have well-developed wax glands.

Workers mold the wax scales with their mandibles into circular cells while the temperature within the colony is maintained high enough that the wax is in a semi-liquid state during construction. Just as two bubbles that come together will form a perfectly straight side between them, the sides of the circular beeswax cells will flatten out against each other in the warmth of the clustering bees, resulting in the familiar hexagonal shaped cells that make up honey comb. In order to help prevent the nectar and honey that will be stored from spilling out of the cells, each cell is tilted slightly upward at an angle of approximately 10 degrees.

A pound of beeswax when formed into comb can hold about 22 pounds of honey. However, the top row of cells connecting the comb with the roof of the hive, tree cavity, or top bar, can hold more than 1,300 times its weight in honey, bees, brood, pollen and wax. It is only when the temperature inside the hive increases to over 95°F (35°C) that the wax will soften and can eventually melt, causing the comb to collapse. As a result, the bees make a great effort to regulate the temperature inside the hive. The incredible load that beeswax combs are asked to carry highlight the importance of making foundation from beeswax that is unadulterated, since foundation wax made from beeswax that has been mixed with other waxes or oils can cause problems for the bees and the beekeepers.

Design Considerations

L. L. Langstroth is most often credited with bringing the idea of bee space into modern beekeeping. When allowed to build combs naturally, a colony of honey bees will leave a bee space of about 5/16th of an inch between the combs. This space assists the hive in manipulating the temperature within the hive, aids with ventilation and acts as a hallway for the passage of bees traveling across the combs.

Rudolph Steiner, the founder of Biodynamics, has noted that each cell that makes up a honey bee comb takes on the shape of a hollowed out, or inverted crystal. When filled with nectar, honey or pollen, the food is stored in the shape of a crystal. This is also the shape that surrounds each bee egg as it hatches and transforms into a larvae, and finally a mature honey bee. Given the unique and powerful forces that crystals emit, it seems likely that honey bees are making use of these energies within the hive in ways that we are only able to vaguely guess at.

When bees build comb, they create a slight bulge in the rim around the opening of each cell. This bulge forms a net of six-sided mesh over the surface of the comb and plays an important role in the complex interaction between the physical properties of the beeswax, and the bee's communication behavior. When foragers return to the hive and perform the waggle dance, they send out vibrations along the rim of the comb during each waggle run that help communicate to and recruit additional foragers in the darkness of the hive where optical signals are ineffective.

Much has been made by some as to the importance of the cell orientation within a colony. This has become known as Housel positioning, named after one of its proponents, Michael Housel, of Orlando, FL. The basic idea is that the "Y" that is formed in the base of each cell has a certain orientation that occurs when bees build their comb naturally. For bees to be healthier and more productive it is theorized, this Housel positioning should be copied when beekeepers use foundation within the hive. The idea that there is a right way and a wrong way to install foundation within the frame would be valuable information if it were true. Unfortunately, studies of the cell orientation within hives filled with combs built naturally without foundation (Roger Morse [1983] and Shumakova & Komissar [2006]) does not support this hypothesis. Bees seem to orient the cells of the comb based upon the first cell built within the comb. Cell orientation will tend to be uniform within each comb, but may differ on adjacent combs.

The Nature of Beeswax

Since beeswax is a product of the body of the honey bee, it tends to have very similar characteristics no matter where in the world the beeswax is produced. Recent research has highlighted the absorbent nature of combs built from beeswax. Among other things, disease organisms and residues from chemical pesticides that are lipophilic (oil based) and therefore soluble in beeswax have been shown to build up in comb over time. This has resulted in the recommendation that combs be

rotated out and replaced on a regular basis. When using synthetic chemical mite controls or antibiotics in the hive, it is recommended that combs be replaced every couple of years. It is possible that if more natural treatments such as essential oils, organic acids, and herbs are utilized, rotation times may be able to be extended without seeing detrimental results on the colony's state of health. Since many of the non-synthetic/ non-drug treatments are relatively new, long-term impacts on comb is mostly unknown at this time. However, the prenderance of chemicals encountered out brought bact to the hive by frag has changed the repearment equatior to change every other year.

You can use your wax for candles, lotions, potions, cleaners and more to use or sell.

Beeswax is incredibly stable over time. Samples of wax from Egyptian tombs, the ruins of Rome, and Viking ships found at the bottom of the sea, have all been perfectly fine and undamaged. When chilled beeswax becomes brittle however, it may crack or break easily. This is why most suppliers of beeswax foundation will only ship orders when temperatures are relatively warm. The melting point of beeswax is around 145°F (63°C).

Beeswax will accumulate a whitish, frosted coating on its surface. This coating, known as "bloom", is a natural part of the wax that migrates to the surface. The appearance of bloom on items made of beeswax signifies that the items are made with 100% pure beeswax. Beeswax that has been diluted with other types of wax will not bloom. Rubbing the surface of the wax with a clean cloth will remove bloom from candles or other items. For items that are too delicate or ornate to clean with a cloth, warm water poured over it, or a blast of warm (not hot) air from a blow dryer will remove the bloom. A block of pure beeswax will have a pleasant aroma and when broken exposes a grainy surface inside. This is not the case if the wax has been adulterated with paraffin, fat or other oil.

Wax Harvesting and Processing

For most beekeepers, beeswax production is a byproduct of honey production. When honey is being extracted from the comb, the wax cappings are removed with an uncapping knife or machine. Wax derived from cappings is considered to be of the highest quality. This is because cappings wax will tend to be fresh wax that is less than a year old, containing a minimum of impurities making it very light in color. Wax collected from burr comb, hive scrapings, and old or broken combs will tend to be darker due to the increased presence of pollen, propolis, pupae cocoons, wax moth excrement, or other debris. Once it is melted down, beeswax should be clarified by mixing it with water to remove water soluble impurities such as honey, and then filtered. Small operations may use homemade filters such as sweatshirt material, fuzzy side up. Larger operations will often use steam along with a press of some kind for best results.

Slumgum is the term used to describe the residues left over from the process of rendering wax. Heating beeswax above 185°F (85°C) may cause discoloration. Oxalic acid or sunlight are among the things that can be used to lighten the color of beeswax through bleaching. Certain metals such as iron, brass, zinc, and copper should be avoided during the rendering process, as beeswax will darken when heated in the presence of these metals.

Uses

In 1911, researchers uncovered a human jawbone in a cave in Slovenia that contained a lump of beeswax. Scientists theorize that the beeswax may have been an attempt to treat a broken tooth. Not much of a fix, but probably the best they could come up with in the Neolithic era.

Apart from the bee's use of wax to produce comb and beekeeper's use of beeswax to manufacture comb foundation, the number and variety of uses humans have developed for beeswax in recent history is rather astounding. Uses include cosmetics and skin care, pharmaceuticals, candles, waterproofing, food production and chewing gum, surgery, polishes, various types of sculpting and art, as well as the manufacture of musical instruments, ammunition and armaments. Beeswax is an excellent lubricant and is useful for seasoning and curing cast-iron cookware, strengthening and preserving sewing thread, and in bow making.

Beeswax is a unique and extremely valuable product that is worth more pound for pound than honey. Not being a food product, beeswax is simpler to deal with, as it does not require special packaging or storage. Unfortunately, many beekeepers do not recognize the value of beeswax and knowledge of how to collect and process it is often lacking as well. While it is impossible to give statistics, it has been estimated that only about half of the world's production of beeswax makes it to market, while the rest is thrown away, ignored or lost.

~Ross Conrad is the author of the revised and expanded edition of Natural Beekeeping: Organic Approaches to Modern Apiculture.

Small Scale Wax

~ Ed Siman

All the capping wax is sitting in five gallon pails and it is too much of a bother to send it off to be processed. So why not take try to process it yourself. After all wax costs more to buy than honey and there seems to be a steady market for it.

Processing your own wax in a small volume does not require a very large investment and can reap reasonable dividends.

Equipment

Much of the equipment needed can be obtained for a good price from your local Salvation Army store. It may not be available the first time you visit the store but all the needed equipment will eventually show up.

1) 5 gallon pails
2) Large sieve
3) Cupcake pans (molds)
4) Crock pot
5) Ladle
6) Wax releasing agent
7) 1 lb. plastic butter containers or other plastic tubs (Molds)
8) An outdoor propane stove or turkey roaster.
9) Filters

Warning:

For safety perform the first part this process outdoors.

Wax will catch on fire.

Wax burns when it splashes on your skin.

Beeswax Properties From Wikipedia

- Beeswax has a relatively low melting point range of 62 to 64°C (144 to 147°F).
- If beeswax is heated above 85°C (185°F) discoloration occurs.
- The flash point of beeswax is 204.4°C (399.9°F)
- Density at 15°C is 958 to 970 kg/m³.
    - o Just a little lighter than water.
    - o We will make use of this attribute.

Assumption:

Before we start, I'll make an assumption that the wax is dirty and full of honey. If your wax has minimal honey mixed in then you can eliminate the first step.

Step 1: Remove the honey from the wax

This can be accomplished in

either of two easy ways:

1) Spread the wax out on cookie sheets and allow the bees to remove the honey. This is the easiest, most efficient and conservative way to remove the honey. Unfortunately, it does not work at temperatures below 60°F.
2) Put the wax in a five gallon pail and add warm water. Mix the wax and water, then strain the solution through a kitchen strainer. The honey water mixture will flow into the pail with the wax remaining in the strainer. The procedure may have to be repeated a couple of times to remove most of the honey from the wax. After the water settles, any wax that makes it through the strainer can be skimmed off the surface of the water and reunited with the wax in the strainer.

Step 2: Remove the bee's knees and other solids from the wax

This step requires melting the wax so it will flow through the strainer. For this we'll use the properties of water and wax to safely melt and separate the wax. Since water boils at 212°F. and wax melts at 145°F. and the flashpoint of wax is 400°F, you can melt the wax without worrying about it catching on fire as long as there is water in the container. The water boiling off at 212° will limit the temperature of the wax to 212°.

Warning: Do not let all the water

boil off or the mixture or the wax temperature will rise above 212°F.

Warning: Wax and water may boil over while you are processing it. Be careful; boil the wax/water outside in an easily cleanable area.

While the wax is melting, add a gallon of hot water to a five gallon pail. Once the wax is melted pour it through the strainer into the pail. The hot water in the pail will slow the solidification of the wax and allow the remaining impurities to slowly separate. The larger impurities will remain in the strainer.

After the mixture cools the result will be a layer of wax on top and a layer of impurities on the bottom. Depending on the degree of separation, this step may have to be repeated several times.

Step 3: Remove the bottom layer

Using a putty knife or your hive tool, scrape the layer of impurities from the cake of wax. Since you will probably get some wax in the scrapings, save them for further refinement.

Step 4: Re-melt the wax in a crock pot.

The crude refinement of the wax is complete. Now it's time to remove the last of the impurities and to mold the wax into sellable sized units. A crock pot works great for this step. It is best if you can get a crock pot that has variable temperature control, not just the standard Low, Med, Hi settings.

While the wax is melting, spray a wax releasing agent into your molds. And set them on a level surface.

Note: Wax releasing sprays are available at hobby stores.

Then attach your filter to a container that has a pouring spout. I use a Pyrex four cup measuring cup for the container and milk filters for the filtering device.

Note: I use standard and small cupcake pans as molds along with plastic one pound butter tubs for most of the molds. When I need a larger mold I use mini-bread pans.

Note: Milk filters are available in any farm supply store. They are extremely cheap (100 for $6.00) and are thrown away after one use. A coffee filter may also work but I have not tried using one.

Step 5: Filter and pour

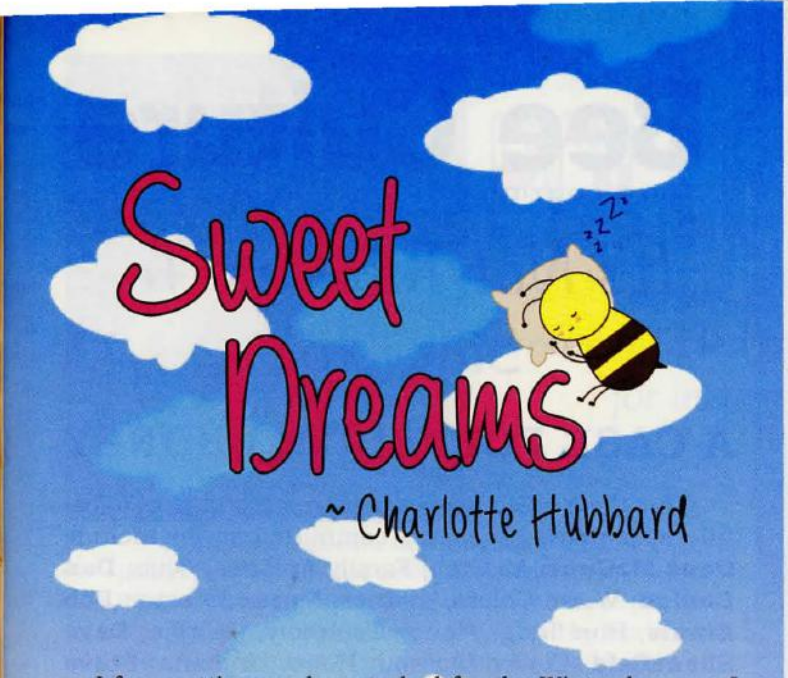
Once the wax is melted, use a ladle and filter the wax through your filtering device. When the wax hits the cool surface of the Pyrex measuring cup it will start solidifying. To delay the cooling, you can preheat the measuring cup in a microwave oven. Then pour the wax into your molds.

As the wax cools you will notice some fantastic designs forming on the top of the wax. When the wax is cool remove the wax from the molds. If the wax is stuck in the mold place the mold outside in cold weather or in a freezer. The cold will shrink the wax for easier removal.

Conclusion:

If you make your wax cakes in multiple sizes, your customers can purchase a volume that closely matches their needs.

~ Ed Siman



I fear putting my bees to bed for the Winter because I don't know what I'll do with myself. What do people without bees do with all their extra time? Write symphonies? Cure diseases? Use coupons before they expire?

I will so miss working my bees. I love everything about them: popping the inner cover to gaze into all quarter-million of their dark eyes, their awkward pollen-burdened landings, the flat beauty of worker brood. While I don't love the small hive beetle (SHB), I do find evil delight in halving them with a hive tool.

Historically, "putting the bees to bed" for me has been synonymous with "putting the bees down." In my early beekeeping years, the only expertise I could claim was the ability to NOT successfully overwinter. Some losses were likely due to the usual mysteries, but the first few years, most of my losses were due to my own stupidity.

As many husbands know too well, we womenfolk tend to be cold most of the time, except of course when we're too hot. There's about a two-degree window when we're just right, and that's as rare as bees emailing you when they're going to swarm.

Being female, and knowing the vast majority of bees in a going-into-Winter colony are female, in late October of that first year I lovingly and tightly wrapped each hive with black plastic, assuming they'd be cold. I stacked a few straw bales behind, and reduced the entrance to the smallest opening.

November was gusty. Since I was never warm myself, I figured "the girls" must also be chilly. I added a second layer of plastic to help hold in heat. I got a second cat to help keep me warm.

One December afternoon, parked on the couch and under two cats, I felt a cold draft. I could only imagine what that felt like in the hives.

After bundling up to venture outdoors, I rapped on the side of each hive, relieved to hear a low buzz of protest. I taped over the vent holes in each upper deep to stop drafts.

Feeling like a good bee Mom, I returned to watch the Steelers and eat pizza. The cats glared at me, but I ignored their hungry eyes, happy that my honey bees were now likely warm.

Oops. By the time the Steelers advanced to the play-offs a few weeks and a bitter cold snap later, my honey bees, like coupons when I remember to take them to the grocery, were likely all expired. Because honey bees don't have cats to keep them warm, they shiver to generate heat, which also generates moisture. They can generally handle being cold, but not being wet and cold. With insufficient ventilation, the wet-and-cold combination happens and it's often deadly.

Unfortunately only the cats and I successfully overwintered. With ignorance about preparing the apiary for Winter far deeper than the inches of dead bees piled in the bottom of each hive, I began researching and experimenting. Here's some of what else I've learned.

Mouse guards: If installed early Fall, they're very effective at keeping critters out of the hive. If installed late Fall, they're super-effective at trapping critters in the hive. It can be real exciting come Spring, when you're tearing apart a dead-out and find one thing not dead. I threw a hive tool at the giant rodent as he raced off. You'd think that with all my SHB-slicing experience I could've hit him. And gee, thanks for your help cats.

It's all about the numbers. Initially I was reluctant to combine weaker colonies with strong ones in the Fall. Not only would that require killing a queen, but it would mean fewer hives. We beekeepers like to brag about all our hives.

But, it's all about the numbers. More bees per hive means a higher survival rate, and I can always split the survivors to build back up to my usual 20,000-30,000 hives again come Spring.

Yes, like all beekeepers, perhaps I do occasionally exaggerate. Did I mention my five-foot swarm capture? They gave me 385 pounds of honey a month later.

Bottom boards: Yes – but screened or solid? There's research supporting both, so one Fall I experimented. Half my hives wintered with solid boards, the others with screened.

Exactly the same number of each survived. Gee, that was enlightening.

I think the key is to make sure you use a bottom board, regardless of type. I once dumped a package into a hive without a bottom board. If bees had hands they would've thrown them up and walked out on me. Thanks for your continued patience, Little Darlings.

Not to feed, or feed? And if you supplement their stores, what do you add? I've experimented with candy boards, the Mountain Camp Method, emergency sugar on the top, among other things.

Like my trials with bottom boards, the results were unconvincing. I've concluded that one of the most helpful things to feed for overwintering is pizza, to yourself. You can better stomach spring losses if your belly is full.

Especially if the pizza is purchased with an unexpired coupon.

***~Charlotte Hubbard**, bee spokesperson and keeper since 2008, manages about 20 hives in SW Michigan. Charlotte would appreciate the opportunity to encourage newbees at your conference and share her insights into the human side of beekeeping. Contact her via www.hubbardhive.com.*

POLLEN SUBSTITUTES

The use of a pollen substitute in the Spring is recommended for packages, nucleus colonies, and splits for increased production of bees and honey.

~Clarence Collison

Honey bee colonies depend on a cache of honey and pollen that is collected before overwintering to survive the long cold winters in northern temperate zones (Mattila and Otis 2006a). Stored pollen is consumed by workers when they resume brood rearing in early spring after the mostly broodless period that colonies enter during winter (Nolan 1925; Seeley and Visscher 1985). The nutrients that workers derive from consuming pollen provide all of the proteins, lipids, vitamins and minerals that are required for rearing larvae (DeGroot 1953; Haydak 1970; Manning 2001). Colonies require large Winter pollen reserves because brood rearing recommences within the protective warmth of the cluster long before ambient conditions favor foraging for additional food resources (Nolan 1925; Seeley and Visscher 1985; Farrar 1993). Because of the timing of the brood rearing schedule in the early Spring, colonies may deplete their pollen stores before additional pollen inputs are available from the environment. If this happens, brood rearing will suffer once workers have catabolized the nutritional reserves held in their bodies (Crailsheim 1990). Spring cold snaps have been correlated with interruptions in flight activity, reduced pollen intake, and increased brood cannibalism, resulting in smaller populations of nurses that must carry heavier nursing loads (Dustmann and von der Ohe 1988). Brood rearing may be suspended altogether when pollen reserves are exhausted (Imdorf et al. 1998). In northern temperate climates, early Spring remains the period during which pollen shortages occur most frequently. The supply of pollen available to a colony has the greatest influence over the number of workers that are reared by colonies (Allen and Jeffree 1956; Doull 1973; Hellmich and Rothenbuhler 1986) and Winter pollen reserves determine the size of the bee population the next Spring.

The protein obtained from pollen plays a major role in colony reproduction and the life of honey bees. A shortage of pollen or stores of poor quality pollen results in stunted growth and weight gain of young bees, reduced longevity and incomplete development of hypopharyngeal glands. This leads to insufficient royal jelly production to support normal growth and development of larvae or egg production by the adult queen (Standifer et al. 1977a; Zahra and Talal 2008). Colonies that lack access to pollen have a reduced capacity to rear brood, quickly decline in population, and may eventually die. Protein deficiency also affects the ability of honey bees to resist diseases (Matilla and Otis 2006b). As pollen is not always available, an alternative protein source is sometimes necessary to ensure bee health and continued colony development, as well as to maintain colony strength for pollination, overwintering and honey production (Standifer et al. 1980). For these reasons, beekeepers often find it advantageous to supplement the pollen diet of colonies in the Spring with additional pollen supplements/substitutes (Matilla and Otis 2006a). This is done not only to avoid some of the pitfalls associated with pollen deficits but also to improve the performance of colonies beyond that supported by natural reserves of pollen (Farrar 1993).

The protein supplemental foods fed to honey bees are usually divided into two classes: 1) pollen supplements (artificial high-protein diets containing five to 25 percent pollen) and 2) pollen substitutes (artificial high-protein diets containing no pollen). None of the protein supplemental foods fed to honey bees is a complete replacement for natural pollen, nor can they be regarded as more than adequate supplements for natural pollens (Standifer et al. 1977b).

A good protein supplement food for bees is one that they will readily consume and has the quality and quantity of proteins, lipids, vitamins, and minerals required for growth and development of individuals and reproduction of the colony. Several brewer's yeast products, Wheast, and soybean flour, fed singly or in combination, are palatable and contain the essential nutrients. The brewer's yeast products and soybean flour used in bee diet formulations can be supplied to bees as a dry mix inside or outside the hive or as a moist cake inside of the hive.

Soybean flour should be expeller processed (44-percent protein) to remove excess fat and improve biological availability of the protein (Standifer et al. 1977b).

Two field experiments with a commercial pollen supplement provided information on possible relationships between pollen, brood rearing and consumption of the supplement (Doull 1973). When colonies were provided with the supplement continuously for one year, the results showed that brood rearing

"In northern temperate climates, early Spring remains the period during which pollen shortages occur most frequently."

"An investment in supplementing the pollen diet of colonies would be returned for situations in which large Spring populations are important, but long-term improvement in honey yields may only result when Spring foraging is severely reduced by inclement weather."

was initiated and maintained by pollen and that consumption of the supplement varied in direct relationship to the rate of brood rearing. In a second experiment with colonies on a nectar flow, but virtually devoid of pollen, they did not consume the pollen supplement and reared larvae from less than 20% of eggs laid. When an extract of pollen was added to the supplement, the bees consumed it readily, and eventually reared larvae from 91% of eggs laid. The extract of pollen induced the bees to eat the supplement and Doull (1973) concluded that this caused their hypopharyngeal glands to become active so that they could feed more newly emerged larvae. The author also suggested the presence of a chemical or chemicals in pollen, which may serve as a trigger to activate the hypopharyngeal glands and that bees secreting larval food, would then feed on supplements that do not contain the primary phagostimulants that are contained in pollen.

The effects of changes in Spring pollen diet on the development of honey bee colonies were examined in a three-year study (2002-2004) (Mattila and Otis 2006a). Pollen supplemented and pollen-limited conditions were created in colonies every spring, and brood rearing and honey yields were subsequently monitored throughout the Summer. In all three years, colonies that were supplemented with pollen or a pollen substitute in the spring started rearing brood earlier than colonies in other treatment groups and produced the most workers by late April or early May. In 2002, these initial differences were reflected by a two-fold increase in annual honey yields by September for colonies that were pollen-supplemented during the Spring compared with pollen-limited colonies. In 2003 and 2004, differences between treatment groups in the cumulative number of workers produced by colonies disappeared by midsummer, and all colonies had similar annual honey yields (exception: in one year, productivity was low for colonies supplemented with pollen before wintering). Discrepancies between years coincided with differences in Spring weather conditions. Colonies supplemented with pollen or a substitute during the Spring performed similarly in all respects. These results indicate that an investment in supplementing the pollen diet of colonies would be returned for situations in which large Spring populations are important, but long-term improvement in honey yields may only result when Spring foraging is severely reduced by inclement weather.

Package colonies of bees fed pollen substitute upon installation in the Spring were more productive than package colonies that were not fed a pollen substitute. Treated colonies produced more drawn comb, more brood and more honey by the end of the honey flow (Nabors 2000). The pollen substitute did not induce swarming. All colonies were fed enough sucrose syrup to draw out foundation in the brood area before the honey flow began. The use of a pollen substitute in the Spring is recommended for packages, nucleus colonies, and splits for increased production of bees and honey.

Commercially available pollen substitute diets for honey bees were evaluated for consumption and colony growth (brood and adult populations) and compared with pollen cake and high fructose corn syrup (HFCS) (DeGrandi-Hoffman et al. 2008). Two trials were conducted; the first for 12 weeks during the Fall and Winter in southern California and a second for two months in the Summer in southern Arizona. The diets tested were FeedBee, Bee-Pro®, and MegaBee® (liquid and patty form) in Trial one and Bee-Pro® and MegaBee® in Trial two.

In both trials, Bee-Pro® and MegaBee® patties were consumed at rates that were comparable to pollen cakes. Colonies consumed significantly less FeedBee than the other diets. There was a significant relationship between the amount of diet consumed and the change in brood area and adult population size in both trials. Colonies fed MegaBee® patty produced significantly more brood than those fed pollen cake or any other diet in Trial one. The lowest brood production occurred in colonies fed FeedBee or HFCS. Adult populations in colonies fed MegaBee® liquid or patty did not differ from those fed pollen cake, and were significantly larger than colonies fed Bee-Pro® or FeedBee. In Trial two, when some pollen was being collected by colonies Bee-Pro® and MegaBee® did not differ from pollen cake in brood or adult population growth.

Pollen substitute palatability tests were done in commercial apiaries in early Spring 2004 (Saffari et al. 2010). In this trial, three different feeds, FeedBee, TLS

Bee Feed and Bee-Pro® were fed to 153 colonies in 12 bee yards for six weeks (March 25th- May 6th) in southern Ontario. Two methods of feeding were used: 1) No-choice feeding, where each yard received only one of the three feeds, and 2) Choice feeding, where each yard received all three experimental feeds. The mean feed intake (g/colony/six weeks) of FeedBee was 960 g and 883 g for the first and second feeding methods, respectively. These amounts were significantly greater than for the other two feeds. The amount of Bee-Pro® consumed (g/colony/six weeks) in the two feeding methods was 224 g and 106 g and for the TLS Bee Feed, 115 g and 52 g, respectively. These results indicate that FeedBee in powder/dry form is highly palatable to honey bees. The results show that it is well accepted by bees during the shortage or absence of natural pollen.

Adequate substitutes for pollen are necessary for maintaining healthy colonies during periods of pollen dearth. DeJong et al. (2009) compared two commercial diets with bee collected pollen and acacia pod flour (used by beekeepers is some parts of Brazil) by measuring their effect on hemolymph (blood) protein contents of young bees exclusively fed on these diets. The commercial diets included a non-soy based substitute diet named FeedBee and a soy-based diet, named Bee-Pro®. The diets were each given in patty form to groups of 100 Africanized honey bees in hoarding cages, maintained and fed from emergence until six days of age. Sucrose, in the form of sugar syrup, was used as a protein free control. FeedBee, Bee-Pro®, pollen and acacia pod flour diets increased protein titers in the hemolymph by factors of 2.65, 2.51, 1.76 and 1.69, respectively over protein titers in bees fed only sucrose solution. The bees fed FeedBee and Bee-Pro® had their hemolymph significantly enriched in protein compared to the controls and those fed acacia pod flour had titers slightly higher than those fed pollen. All four proteinaceous diets were significantly superior to sucrose alone.

Morais et al. (2013) compared two artificial protein diets formulated from locally-available ingredients in Brazil with bee bread and a non-protein sucrose diet. Groups of 100 newly-emerged, adult workers of Africanized honey bees and European honey bees were confined in small cages and fed on one of four diets for seven days. The artificial diets included a high protein diet made of soy milk powder and albumin (D1), and a lower protein level diet consisting of soy milk powder, brewer's yeast and rice bran (D2). The initial protein levels in newly emerged bees were approximately 18-21 µg/µL hemolymph. After feeding on the diets for seven days, the protein levels in the hemolymph were similar among the protein diet groups (~37-49 µg/µL after seven days), although Africanized bees acquired higher protein levels, increasing 145 and 100% on diets D1 and D2, respectively, versus 83 and 60% in the European bees. All the protein diets resulted in significantly higher levels of protein than sucrose solution alone. In the field, the two pollen substitute diets were tested during periods of low pollen availability in the field in two regions of Brazil. Food consumption, population development, colony weight, and honey production were evaluated to determine the impact of the diets on colony strength parameters.

The colonies fed artificial diets had a significant improvement in all parameters, while control colonies dwindled during the dearth period. They concluded that these two artificial protein diets have good potential as pollen substitutes during dearth periods and that Africanized bees more efficiently utilize artificial protein diets than do European honey bees.

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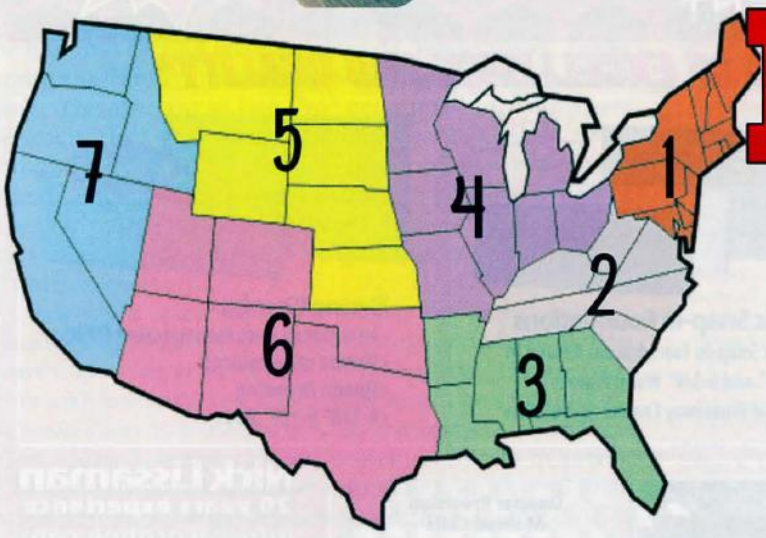
Regional Reports



We have over 100 field reporters spread out over the country, living in the seven regions you see on the map. Though somewhat generalized, the information they provide will give you some idea of what they've seen over the past few months, and what it means to their beekeeping management and marketing plans. Because of the influx of foreign honey recently, we were interested in how these products will influence their pricing, and what effect it might have on management for next year's crop. We also were interested in what they would be doing over the fall months because of the weather this summer. So check out the region you live in and take a look at what others there see happening, and use what you can.

Region 1.

By far most reporters will have prices remain unchanged this season, with a smattering actually increasing prices to offset costs. Moreover, they will remain the same size and keep doing much the same thing next year as this. Far too little rain, with some areas getting just enough this year has lead to an average to less than average crop compared to most years. Poor weather means feeding this fall, along with combining weak colonies and double checking queen health so colonies make it to spring. This winter? Long and cold is the prediction. Be safe and keep your bees protected.

Region 2.

Prices remain mostly unchanged this season, with hardly anybody changing what they will be doing next year, although several are looking at branching out into wax products and local pollination as income increases. Rain has been high to average in most areas with about an even split between average to just below crop across the area. Feeding and queen health are concerns, especially since the coming winter will be similar, to colder than last, most feel.

Region 3.

Mostly unchanged prices, but some raising prices seems to be the picture here, with, like the rest, hardly anybody changing gears for next year. But a solid average crop is good, meaning feeding and most things, except checking queens isn't a priority (but as always, beekeeping is local, so you better check). Winter, according to our reporters, will be similar to last year, and since you already know what that was, be prepared

Region 4.

Keeping prices where they are, and not changing the focus of their operation is the norm in the region, too. Changing focus means picking up more pollination jobs, raising more queens or nucs, or branching out to making wax products... all these in addition to making honey to cover rising expenses. A just right amount of rain in most places this summer means an average to a bit below average crop is expected, so feeding both sugar and protein, combining weak colonies and making sure queens are healthy are all on the to-do list. Winter, like last year, will be...like last year, but some fear a longer, colder season. Get the weather App and make sure.

Region 5.

Staying course on price, with a few raising the price a bit, along with nobody making any career changes because of all this foreign honey seems to be the song of the day in this region. But not enough to just barely enough rain was trouble, and the honey crop was way, way down, or so it seems at first. That means feeding is on top of the do now list, and stressed colonies always seem to have queen problems...so check out your royal highness and make sure all is well.

Region 6.

Although more are keeping prices about the same, a significant minority are raising them to make up all those price increases for queens and feed and medications. And, since it's easy to get into pollination in this region quite a few are thinking of it to help make ends meet, but most aren't. Not enough rain, or just barely enough rain is an old story here, meaning a just barely average to below average crop is scheduled. Feeding, combining weak colonies and checking queens are all top of the list right now, and winter? Just like last year, and the year before say all the predictors. Stay tuned.

Region 7.

Rock steady prices, even if sitting on less than steady gound seems to be the rule here, with essentially nobody changing focus in mid-stream. Average, though not much, rainfall gets an average to just below average crop in the warehouse this fall. So, feeding both sugar and protein will be required, and checking queens is the norm. Winter? Just like last year wins the vote. We'll know in March, when the almonds are in bloom.

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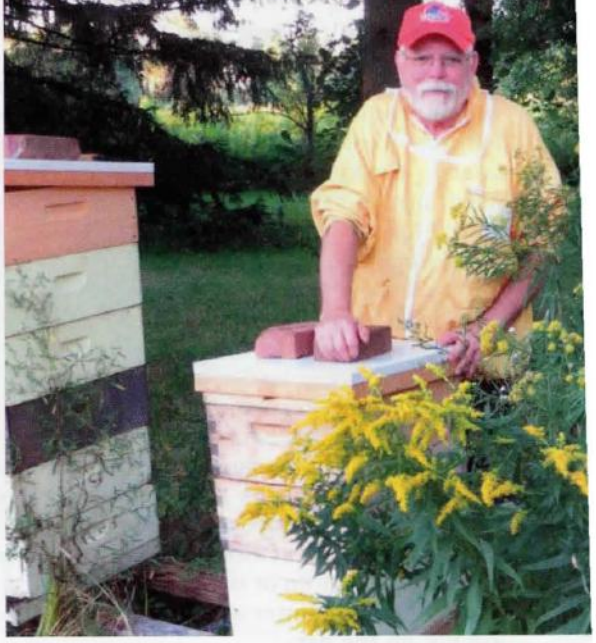
The Editor's Hive

~Kim Flottum



The Care and Feeding Of Honey Bees. Or Not.

There's two extremes on being a beekeeper. Way over there, there's a group that says any intrusion into your bees, anytime at all, is one too many. The bees know what they are doing and you simply don't need to bother them. Opening a colony is a stressful activity for them because you disrupt the normal course of events, cause a mass communication interruption when you add smoke, break bridge comb and propolis seals, and in all likely hood you will kill a few bees no matter how careful you are. You have, goes the feeling, extremely violated their personal space and time, and caused some level of chaos that most likely wasn't needed.

On the other side, not paying attention to what's going on borders on neglect and, goes the sentiment of this group, these bees will surely die if you aren't right on top of everything that's happening and making sure everything is exactly the way...somebody...thinks it should be, all...of...the...time. Certainly twice-a-week examinations are required and more often if you even think there's something amiss. Their goal is to remove every frame, find the queen every time, count the drones, measure the honey, smell the brood, look for mites, take Nosema samples, scrape all the burr comb and propolis off every surface, destroy every small hive beetle, and keep everybody in check with enough smoke to get the local fire department excited.

Well, let's think about this from a couple of different angles.

First, both extremes are just that – extreme. Let's start with where the bees are. In a box they didn't choose, in a place they didn't choose. Yes, bees do know what to do, if they have the tools necessary to do what they need. First, they need a cavity...think hollow tree. What's the difference between a tree and the box you put them in...no matter square with frames or long with bars? For starters, your box is right on the ground, not 20+' in the air. It's got an opening big enough to drive a truck through, not a knot hole the size of a quarter. It's got an 'r' factor of 3 or 4, not less than one. On the bottom it has a collection area that is a living ecosystem of biotic consumption, not a hard floor that's hard to clean, or a screened floor that's a major draft all of the time. So there's some differences you need to think about, and anticipate. Winters are cold in a box only ¾" of an inch thick, so is additional protection a good idea? Reducing that entrance is a good idea too. And that's just for starters.

Another thing about location is there aren't 2, 3, 20 colonies all sitting together, sharing everything everybody has...like a kid in a class room with a cold, soon, every kid in that class room has that cold. Same with bees.

And your queen. The one that came with the package you got last spring, or will get next spring. How's she doing? Here's the thing about queens. Or one of the things about queens. In the wild or in a hive that's not being kept, the colony will deal with the queen...if she's making enough brood and enough pheromones, the rest of the colony is going to be happy...in a manner of speaking. If something goes missing...she dies, gets old, diseased or quits for any reason, they'll get rid of her, fast or slow but she's history, and they'll raise a new one. But there are some maybes that can happen. If the colony swarms for instance, the reigning queen leaves the colony with the swarm, leaving behind queen cells ripe and ready to get going. Soon, just one of those new queens ends up running the show and colony life goes on. Sometimes though something goes wrong and there is no new queen. And, without a queen there is no brood and with no brood there is no way the colony can continue and it will die. No questions asked.

In a regular hive, managed oh, so carefully by a beekeeper, queens can go missing too. Dropping off a frame, getting squeezed between the frame and the wall, squished with a hive tool...all happen. Now, that's not the end of the world for the colony. They can and will raise a queen, given they have the resources to do so...brood, food and time. That's where the beekeeper can step in and help. Adding brood from another colony if none exists, feeding, and doing it all in a timely manner. That's the difference between keeping bees and having bees.

There's more of course. Simply feeding. This past summer in my part of Ohio there was an extreme dearth from the end of June to the middle of September. Not much at all coming in. Not enough, in fact, for most of the colonies to get by day to day. Some beekeepers had to feed in summer. In Summer! Or those colonies would have starved. You can say a colony that can't make its own way should be allowed to continue, but that colony did not choose to be where it was put, and if it doesn't rain...

That feeding thing happens again in the fall, before winter sets in. A light summer crop, over harvesting, no fall crop, a colony goes queenless and is short on foragers later in the summer, pests or disease happen, can get fixed, but you have a weak colony...all these point to a stored-for-winter food shortage. Left alone, the colony is dead come March. Checked and fed, the colony is alive and well come April.

These are just a few examples of the difference between having bees – that is leaving them to their own devices and live or let die, and keeping bees. Like keeping all livestock, the keeper assumes the responsibility of care and maintenance when you start, and for the duration of your care. That care can range from minimal where only the toughest problems are given assistance, to average care, where preventive maintenance is a normal routine and usually the best direction to follow, to excessive care, where it borders on or is actually interfering with the day to day...but no matter where you are...neglect and abuse are not on the list.

Have a plan. Really.

Almost without exception, any task you set out to do requires some planning. Maybe just a second's thought on...Wow, it's really nice outside, time for a stroll around the neighborhood; to, I need to expand the garden next spring, now where will that go, what tools will I need, when will I have time, and who can help? Planning goes from completely spontaneous, to hours of prep.

Keeping bees falls somewhere in between, once you've got everything established and you're involved in the usual care and management of your hives (see above). Getting started, of course, is an ongoing, but this is the time of year for some reflection on this past summer... maybe your first, maybe more than your first, but right now, be spontaneous, take a seat, lean back and let's think about how things usually go when you go out to work the bees.

Let's start simple. Why are you going out to work the bees? Before you get your suit, smoker, hive tool, and work bucket and scrap pail, why are you going to open a colony and take a look? Did you review your last visit in the notebook/computer/mobile/whatever it is you keep your records in? Wait, no records? I'm going to guarantee you, you don't have records of some kind, you're not going to remember what you did, what you'll need, when you should go, or anything about keeping bees. You're simply going for a visit if you don't have a plan, and a big part of that plan is what's going on so you know what to prepare for. Get a record keeping device of some kind so you can keep records. There's all sorts of ways to do this... high tech with your mobile phone in the bee yard to the cloud so you and as many of your friends as you want can see what's happening all over the area...that's about as high tech as you can get, to something as simple as a spiral notebook and a pencil, which is about as simple as you can get.

But if you have a good record book you'll know where to start. What should you expect to find if you... did nothing last time except look and see? Did you note how much brood, both open and sealed there was...a simple guess is good...say, eight frames about half sealed on both sides is a good estimate, along with – maybe three frames with some open on both sides. Both of those give you a starting point this time. Are you looking to see how much honey they have? How much comb has been built since you were there last time? Just to see if the queen is present... eggs, open brood are good places to look to see if she was there recently, three days ago at the most. Looking to see if they need food, have eaten the food you gave them and need more? What about moving frames around a little bit, getting those on the outside that haven't been touched closer to the middle so they do? All of these things are notes from last time, or, notes for next time so you know what you had, and, what you should expect, or hope to find. Without a past the future is in trouble.

But wait, there's more.

No matter why you are going to take a look, do you have everything you need, just to get there and back in one piece. When I was just starting, working for the USDA folks in Wisconsin, we had a sign by the door that said – Got Your.... – and it listed everything you would need on a beeyard run. Now, our yards were maybe 20 miles away from the lab so if you forgot something retrieving it was a major task, so the list by the door.

It had the obvious items....smokers, not one but always two. A couple of pails with hive tools, not one, but always three (there were always two folks making the trip), newspaper, bee brushes, mouse guards, hive closures, a hammer and nails and screws, and a dozen or so frames and rolls of duct tape. Then the extra beesuit under the seat, the extra veil, too, in case one got ripped or torn, or...well, just in case. We always, always had feeders and feed in the truckbox before we left, and we always, always had a pail of smoker fuel there too to keep it dry. There was a weed whacker, a shovel, a couple of 2" x 4"s in case one of the hive stands was broke, and we always had tied down an extra cover and inner cover, because covers would always go missing...vandals, wind, ghosts, we never knew, but we always had one, along with a couple of bottom boards and deep and medium supers. Not so obvious was a notebook, pencils, (when paper gets wet in the rain or from honey or sweat, ink runs, pencil lead doesn't and won't, always use pencil), calculator, maps, gas can, ruler (both foot long, and a tape measure), two raincoats, extra gloves, both medium and large sizes, flashlights and spotter lights for the truck and I'm sure there was more I am forgetting. But you see the point.

When you go to the backyard, the garage is only steps away, and something forgotten can be retrieved easily, well kind of. A trick is to keep a lot of this stuff in the beeyard, in a plastic bag in a super on a bottom board with a cover. Easy to get to, saves steps and time, and it will, I guarantee you, make you a better beekeeper because you're are keeping bees, not running errands.

We've been pleased with how well BEEKeeping has been received so far with newsstand and web page requests, so we're expanding our reach and, starting in January you can receive BEEKeeping as a subscription! Get BEEKeeping at home instead of hunting for it at a feed store. You can sign up now, and when the Spring issue comes out BOOM! Right there in you mailbox, the first week of January.

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Kim Flottum

Phil Knows!

Q: How to get a hive ready for winter
From a Minnesota beekeeper

This is my second year as a beekeeper. Last year the bees in my colony dwindled away by fall and were gone! Like in the wind. I purchased a nuc this spring, and tried again. So far, so good. Now September. I would really like to get these bees through the winter. Any advice you can offer is appreciated.

A: A: Around this time of year, I am often asked to give talks on "Preparing Hives for Winter". I'm happy to oblige, though I prefer to call it "Helping Bees Get Ready for Winter", since they are quite capable of making preparations on their own. Feral colonies do it all the time without human intervention. Still, feral colonies have a high mortality rate, and we should expect our bees to fare better with some assistance from us.

The factors which experts agree are critical to a colony's surviving the winter are:

- a strong population
- sufficient food stores.
- healthy bees (as disease and parasite free as possible)
- preparation of the hive itself

Paying attention to these things now will pay dividends in the spring.

How many bees does it take? Obviously, conditions vary from region to region, but researches from Minnesota to Florida recommend going into winter with a minimum of about 25,000 bees. That is the equivalent of one deep box in which all frames are covered in bees. Smaller populations may be sufficient in the south – even in Kentucky I have successfully wintered five frame nucs – but it is more difficult and requires balancing food stores, bee populations, and hive construction. Further north, the operative term is minimum. The more bees the better. All colonies lose some bees during the winter, and a population which is small in November may not survive until spring. A large cluster is more effective at maintaining core temperature, and facilitates movement to honey stores. Beekeepers with multiple colonies often combine two weak hives, or a weak and a strong one, to optimize chances of winter survival.

How much food do they need? This too, varies with geography. The amount of stored honey (or sugar syrup) that a colony requires depends on where it is located. My hives in Kentucky need 50 to 60 pounds apiece. In Minnesota, where winter is a much more serious proposition, it might take 100 pounds or more. It's always best to check with beekeepers in your area or with your local apiary inspector for guidelines specific to your region. In order to gauge the amount in a hive, here are some approximate capacities of FULL frames of stored honey (sugar syrup is pretty much the same):

- 1 Deep Frame ≈ 6 pounds
- 1 Shallow Frame ≈ 2.5 pounds
- 10 Deep Frames ≈ 60 plus pounds
- 10 Shallow Frames ≈ 25 to 30 pounds

Most beekeepers use two deep brood boxes as hives, and bees tend to fill the top deep with honey as fall progresses. It's easy to see from the above figures that a colony in your area, even with a top deep full of food stores, will still need some in the bottom box to get through the winter.

Your colony will need its winter stores in place by the end of the fall nectar flow, before the onset of cold weather. If you need to feed, that is the time to do it – not after the bees have formed their winter cluster. For fall feeding, use a thick syrup of 2 parts sugar to 1 part water, heated to make the sugar dissolve completely. In order to know whether a colony has sufficient stores, or is at least accumulating them, you MUST LOOK in your hives. As you do so, remember to check for stored pollen or signs its being brought in. Pollen is essential to brood rearing. Your bees in Minnesota won't be doing any of that this winter, but stores of pollen will give them a head start on the spring build-up so there will be plenty of bees to collect early nectar. A number of protein supplements are available to augment natural pollen sources. These can be purchased as patties (placed on the top of the hive), or in the form of a powder, which can be made into patties or even fed dry. Bees will store some of the powder as well as using some immediately.

How can I tell if my colony is healthy? The best indication (other than a large number of bees in the hive) is that the colony is bringing in food stores and rearing brood. The presence of brood in all stages (eggs, larvae, and pupae) tells you that you have a queen and that she's doing her job. It also means that the colony will have the young "fall bees" which are so crucial for its winter survival. These are the bees that will exceed the

average workers' six-week life expectancy and be there to start the colony's build up in the spring

Just as they have for the last several decades, *Varroa* mites pose the greatest threat to the health of our honey bees. The best practice is to monitor for mites several times a year and treat as needed, but I realize that testing and evaluating the results can be a daunting task for new beekeepers. If you are already monitoring, on your own or with the help of a mentor, good for you. My advice to new beekeepers who don't is to go ahead and treat for the first couple of years until they acquire the skill and confidence to monitor effectively. Most winter losses are related to mites. In addition to the harm it inflicts directly, a heavy *Varroa* infestation can make it impossible for a colony to rear the brood it needs to survive the winter. Mites are also vectors for several viruses which adversely affect a colony's health. I recommend that new beekeepers treat annually in the late summer or early fall.

How do I prepare the hive? There are several steps you should take, one of which is to provide proper ventilation. That might seem counter intuitive. One would think that making hives as airtight as possible would protect colonies from winter cold, but, in fact, cam do the opposite. Like all animals, bees breathe and their respiration produces moisture. If the moisture has no way of escaping, bees become damp and vulnerable to chill. In nature, bee trees contain lots of natural openings. Some the bees fill with propolis, but others are left open on purpose to allow excess moisture to be vented away from the colony. Beekeepers can produce the same effect in their hives year around - to help lower the moisture content of honey in summer, and to maintain a drier hive in winter. It's easy enough to do with slight modifications, mostly involving the lid. I use small sticks placed on the edge of one side of my inner cover to elevate one side of outer cover just slightly, allowing air to flow between them. Some beekeepers accomplish the same thing by cutting notches in inner covers. In areas with heavy snowfall, a little more may be required; ventilation at the top is even more critical when deep snow or a layer of ice seals the hive's entrance. Northern beekeepers sometimes compensate by creating upper entrances, for instance by drilling ¾" holes in the top brood box.

Another modification beekeepers should make in the fall is to mouse-proof hives. Warm dry hives are highly desirable winter quarters for mice. They squeeze through entrances and make nests in out of the way corners, destroying frames and comb, and sometimes dining on brood, bees and food stores. Bees tend to ignore them as long as nests are located away from the cluster. The problem is easily avoided by installing entrance reducers before the beginning of cold weather. I prefer the metal kind. They keep mice out as effectively as wooden ones, but the perforations allow more air movement through the hive.

The severity of Minnesota winters could require additional preparations that are unnecessary further south. Bees in most of the country handle cold weather by forming a cluster and sharing body heat, which provides sufficient warmth. In the less temperate regions of Canada and the northern U.S., beekeepers sometimes wrap hives in tar paper, cardboard, or other material in order to reduce drafts and insulate them against the more extreme cold there. The simplest (though not the cheapest) option for a new beekeeper with one or two colonies is hive wrap from a beekeeping supplier. It is enough to protect one hive, comes with directions, and is designed for removal and re-use. The question of whether to wrap or not to wrap depends on specific circumstances (How sheltered are the hives?) as well as on regional climate. The best sources of advice will be your local apiary inspector and beekeeping association. Keep in mind that improper wrapping which eliminates ventilation can actually make things worse.

I'm so glad to get a question about winter preparation in September. It's frustrating, for them and for me, when beekeepers wait until cold weather is on the doorstep and it's too late for any but emergency measures. There is no way to guarantee a colony's winter survival, but by taking a few steps now, you can give your bees the best possible chance. A quarter of all feral colonies die out in their first year. With our help, ours should have a much better success rate than that.

~Phil Craft I welcome your questions. You can send them to me by email at: phil@philcrafthivecraft.com, or by mail to Bee Culture magazine. Though only a few will appear in the magazine, I will respond to all questions personally. As in my "Ask Phil" column in Bee Culture, I identify correspondents only by state, never by name. I look forward to hearing from you, and wish you the best in getting started in beekeeping.

CATCH THE BUZZ

First Hexagonal Coin Features A Honey Bee, and has Resin Inclusion

The Reserve Bank of New Zealand has unveiled (August 1) a new coin paying homage to the humble honey bee, or Apis mellifera. The honey bee is an integral part of our lives, providing honey while pollinating flowers and plants that provide the human race with needed sustenance. The life and hierarchy of the honey bee is complicated, with an organized society of three adult castes comprising of the queen, workers, and drones, each with a specific purpose and function.

Queens, who are responsible for producing and laying eggs, live for an average of two-to-three years and sometimes longer. Just one queen can lay thousands of eggs throughout her life.

Worker honey bees comprise the largest number of individuals; between 20,000 to 80,000 workers may live in any hive. They have a life span of only six weeks during the honey production season, when they store nectar, feed larvae, and produce copious amounts of honey.

The life of a drone or a male honey bee isn't as fortunate as his counterparts, since they begin life as an unfertilized egg laid by the queen. His primary purpose is simple: to mate with the queen; their life span focuses specifically on this single task. If a mature drone successfully mates with a queen, his life ends soon after the mating flight. If he is unsuccessful, he will be ejected from the hive at the end of the active summer season and eventually die of cold or starvation.

New Zealand has been recognized as one of the most advanced beekeeping countries in the world. Beekeeping was first introduced to Northland in 1839 as a home craft, but it has developed into a progressive and valuable industry. Today, the busy honey bee pollinates roughly one-third of everything we eat, making it essential to agriculture.

In addition to pollinating fruit and vegetable crops, the honey bee produces several varieties of New Zealand honey. From the delicate pōhutukawa through to the stronger flavored kāmahi and rewarewa, and the robust jellied mānuka honey, these variations are endless and exclusive to New Zealand.

The natural antibiotic qualities of some mānuka honeys has also led to an international market for health care products. Last year alone, New Zealand exported nearly NZ $300 million worth of local honey. Sadly, honey bees worldwide are under threat as a result of serious pests and diseases, in particular the Varroa mite in New Zealand. This collectible legal tender commemorative coin aims to raise awareness of the crucial role the honey bee plays in food production.

The six-sided coin is produced by the BH Mayer's Mint GmbH on behalf of the Reserve Bank of New Zealand and is designed by Hannah Stancliffe-White. The reverse design incorporates the hexagonal shape as part of the overall motif based on a cell of honeycomb in a hive. In the honey-making process, worker bees build a honeycomb structure of cells where nectar and pollen are stored, and larvae develop. The honey bee is brought to life on the coin with three-dimensional engraving and color printing. It is depicted sitting on the honeycomb, which has been partially filled with translucent amber-colored resin, replicating real honey.

By Michael Alexander, from Coin Update

Honey Bee antibiotics won't be over the counter after Jan1. Get Ready.

"Bees are insects, but few veterinarians realize they are also classified as food animals," said Dr. Don Hoenig, co-owner of One Health Veterinary Consulting, and part of the team at Betterbee Beekeeping, speaking at the American Veterinarian convention this past July. "This January, the FDA will be enforcing new rules regarding honey bees and prescriptions. This is a new opportunity for veterinarians, and we should tap into the need for education."

Effective Jan. 1, 2017, antibiotics used by beekeepers will no longer be available over the counter. In an effort to address concerns with antibiotic resistance, the FDA has ruled that antibiotics used to treat common bee diseases will now need to be ordered by a veterinarian either through a prescription or Veterinary Feed Directive (VFD). Beekeepers can no longer diagnose and treat problems requiring antibiotics without a licensed veterinarian.

According to www.honey.com, there are 115,000 to 125,000 beekeepers across the United States operating in the billion-dollar industry. The Bee Informed Partnership surveyed beekeepers and found that only 1/14 currently use drugs. "Most beekeepers will not be affected by the FDA changes," said Dr. Chris Cripps, co-owner of Betterbee, a beekeeping supply company in Greenwich, NY. "But at the same time, most U.S. veterinarians don't know about bees or their diseases. We have a gap to fill." Dr. Cripps is also speaking at an AVMA Convention in San Antonio, in July, about the new mandates.

Betterbee sells beekeeping supplies online and in its store in upstate New York and is a go-to source for education in basic beekeeping to advanced management and disease detection, but, like the vast majority of veterinary practices, the business currently provides no clinical services to honey bees.

So who is going to step up come Jan. 1?

Initially, veterinary "stepper uppers" may be skewed more heavily toward veterinarians in large-animal practices, which already incorporate a business model of going to the patients, and not vice versa. Drs. Hoenig and Cripps both agree that veterinarians involved will have an affinity for bees and a desire to get the necessary education. "Veterinarians have always self-selected what topics they want to delve into and what animals they will specialize in at their practice," said Dr. Hoenig. "Curriculums evolve, but the common factor is always meeting the standards of care."

In order to write a VFD, the veterinarian also needs to have established a Veterinary Client Patient Relationship, or VCPR. As Dr. Hoenig explained, a veterinarian can't "phone in" a prescription for beekeepers. According to the FDA Guidance document, this needs to be either a state-

or federal-defined VCPR in which a veterinarian engages with a client to assume responsibility for making decisions about animal health and has sufficient knowledge of the patient by virtue of patient examination and/or visits to the facility where patient is managed. This would include a visit to the beeyard during which a veterinarian looks at records of treatment, opens a percentage of the hives and evaluates the health of the colony. The expiration date of the VFD is not to exceed six months.

With the word out since 2013 on changing FDA regulations, Dr. Cripps has fielded calls from veterinary medical schools at Cornell University and Mississippi State University. "The Deans have heard about the FDA changes and want to know how they can best serve the students," said Dr. Cripps. "Bees have been in the curriculum in the veterinary medical program at the National Autonomous University of Mexico as well as most other programs outside North America. I expect our U.S. schools to follow in some manner."

Antibiotics are also used to treat bacterial diseases, such as American Foulbrood (AFB). The highly contagious disease kills developing bees, with millions of infectious spores produced in each affected bee. As bees clean their hive, they carry spores to all parts of the hive, including the honey, and to other hives. AFB spores are so difficult to kill that they can be reactivated after 70 years of storage. Fire and gamma-irradiation are typically used to clean up affected hives.

"If beekeepers treat their hives with sugar infused with antibiotics, clinical AFB can be suppressed," said Dr. Cripps. "With the new regulatory measures in place, we might see a resurgence of the disease because antibiotics now cannot be administered without a prescription or VFD, and some beekeepers may forego finding a veterinarian to save time and money. For most large beekeepers, though, added cost for veterinary care could be quite minimal per hive."

A possible resurgence could cause havoc during pollination season, said Dr. Cripps. Flatbed trailers bring tens of thousands of hives to places like California to pollinate almonds, and Maine to pollinate blueberries and apples. Orchards pay up to $200 a hive to have the bees stay for a short period to pollinate trees so they produce more and better fruit or nuts. It's big business with a potentially big risk. If infected hives introduce disease to a temporarily heavily populated area, "disease could spread rapidly as the hives go to the next crop or home," according to Dr. Cripps.

"This is reality," said Dr. Hoenig. "Veterinarians need to get educated through our local associations, in wet labs and through meetings like the AVMA Convention and, hopefully, USDA accreditation modules. We need to have involvement throughout the country. It's a challenge and a One Health opportunity for veterinarians, where we can make a difference to the overall well being of animals, people and the environment. We need to work together."

Mann Lake's Thomas' Break Ground On Paws and Claws Animal Rescue and Resort Project

Smiles, applause, even happy tears were evident at the Aug. 11 groundbreaking for Paws and Claws Rescue and Resort south of Hackensack.

As cameras clicked and onlookers clapped, the Paws and Claws Board of Directors, representatives of Nor-Son Construction and others each flipped a shovelful of dirt in the air to mark the start of construction on the new pet shelter/pet boarding facility serving the Hackensack area, Cass County and beyond.

"It's a good day, but we have a long way to go yet," declared an emotional Betty Thomas, chair of Paws and Claws' Board, speaking to 40-50 people who gathered later at The Hub in Hackensack.

Betty's husband Jack Thomas explained how the idea for Paws and Claws came about. More than 30 years ago, the Thomases started Mann Lake Ltd., a business serving beekeepers with products ranging from frames and hives to bee medications. Since then, Mann Lake has grown to be one of the larges

Betty's husband Jack Thomas explained how the idea for Paws and Claws came about. More than 30 years ago, the Thomases started Mann Lake Ltd., a business serving beekeepers with products ranging from frames and hives to bee medications. Since then, Mann Lake has grown to be one of the largest suppliers of beekeeping products in the world.

Five or six years ago, Jack and Betty were discussing what to do with their estate. The couple has no children, and Mann Lake Ltd. is now employee-owned. Betty, who grew up on a farm, suggested doing something for animals, especially domestic pets.

"I want to thank her for that vision," Jack declared. "She brought this project to where it is today. It will be a great asset to Cass County and will help the economy. Area resorts are already asking when it will be open so guests can board their pets."

Paws and Claws Executive Director Jim Clark noted that 420 people have donated to Paws and Claws from as far away as Florida and Hawaii.

Construction will be led by Nor-Son of Baxter, design-build architects, utilizing local subcontractors and suppliers where and when possible.

"They were our preferred contractor," Clark added.

Nor-Son Architect Sam Bontrager presented an overview of the project.

If all goes as planned, Paws and Claws will open in the spring of 2017. Groundwork will begin in mid-September on the 22-acre parcel about 1 mile south of Hackensack at the corner of Highway 371 and Cemetery Road, with the main entrance off Hwy. 371. Only about 5 acres of the 22 acres will be disturbed, Bontrager added.

The 13,000 square foot building will utilize the latest energy-saving technologies including a wood-fired gasification furnace and solar array.

It will feature

☐Separate wings for pets waiting for adoption and boarded pets so there will be no cross-contamination;

☐Separate quarantine area for animals just arrived before they move to the shelter;

☐Outdoor exercise areas for dogs, based on size (small, medium, large);

☐Indoor "cat colony" room;

☐Special HVAC air handling system with 11 zones to separate air breathed by cats and dogs, healthy and fragile animals, humans and animals;

☐Community rooms and commons area;

☐Grooming area; and more.

Throughout the construction process, photos and updates will be posted on the website.

For more information on Paws and Claws or to make a tax-deductible gift, visit the website www.pawsandclawsrr.org, email to info@pawsandclawsrr.org or call (218) 675-7297 (PAWS).

So, You Wanna Be A Beekeeper?

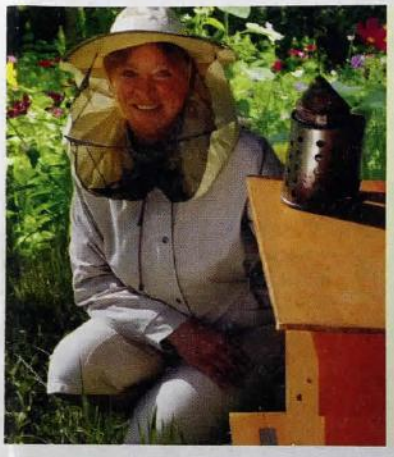
It's easier than ever to get started, but harder than ever to survive...

"The bee population is declining," begins the description on the package, which contains a complete, pre-assembled beehive and sits on the shelf of my local Orsheln Farm & Home store.

Then comes the obligatory statement that a third of our food supply depends on their survival. But finally, the good news: Keeping bees is "simpler than you think!" Just add bees, and "only minimal management is required. The bees know what to do!"

Let's begin with the fact that the bee population is not, in fact, declining – a little detail that I seem to reiterate to someone about once a week on average. While feral colonies in this country were mostly wiped out in the late '80s/early '90s by tracheal and varroa mites and have yet to recover substantially, managed colonies have been rising in the United States for a decade or more, and for a half century worldwide – as reflected in ongoing surveys by the USDA and FAO. As for the food supply, the largest demand for pollination by far in this country is almonds, and this year's crop is expected to rise by about six percent.

That said, it is clear to anyone who has done this for awhile that it has gotten increasingly difficult to keep bee colonies alive from year to year. It's also clear that the primary culprit is the parasitic Varroa mite, with its voracious appetite and attendant viruses. (Again, something I spend entirely too much time explaining to both the general public and - sadly - even some beekeepers.)



Simpler Than You Think!
This hive is pre-assembled for easy set up and use. Everything you need to provide a home for bees is included in this box. Bees and other supplies must be purchased separately.

Once your hive is set up and bees are installed only minimal management is required.

The bees know what to do!

It's not cell phones. It's not GMOs. It's not neonics. It's not even global warming, as was lately suggested by one or another of the myriad interest groups who have in recent years glommed onto the phenomenon of "colony collapse" as a means of promoting their own varied agendas.

Another population that is expanding, and quite rapidly, is that of grant-writers. One species seeks tax money for "research" to "save the bees". This endowment is typically used to feed enormous quantities of some substance or other to captive pollinators, watch them die, and then trumpet dubious findings to the media – always prefaced with dire warnings of the danger that disappearing bees present to our food supply, and ending with the caveat, "More research is needed."

A different variant seeks money for beekeeper "training", and I put that word within quotes for a reason. From what I've seen offered, this education can encompass as little as four hours, often without benefit of a nearby association for meetings or mentoring – and even in some cases without an actual beekeeper in the role of instructor! Can the graduate of this course, who subsequently spends his time on Facebook inquiring about the difference between a queen and a drone, really be considered a beekeeper? Or is he one of those people whom George Imirie famously termed "bee havers"?

As the folks at the Bee Informed Partnership report, small-time beekeepers with no plan in place for varroa control may well be skewing the annual colony loss numbers by doing harm not only to their own colonies but to those of others nearby.

And then you have this new breed of equipment vendors who market their wares at farm and hardware stores, which I'll admit is rather refreshing on the surface - beekeeping is becoming mainstream! After all, beekeeping is not a secret society, and about 40 years ago one could purchase this stuff through the Sears Roebuck catalog.

But this is not your grandfather's beekeeping. Our problems for the most part are much more challenging than before. It's nice that bees are now a bit more accessible, but let's face it: Putting bees in a box in the yard does not make one a beekeeper. And unless you live on an island, when your neglected bees swarm, they end up in the neighbor's tree, and possibly her attic. When they crash in the fall, your problems become the problems of every other beekeeper in a couple-mile radius. You are your neighbor's beekeeper.

I'm certainly not here to discourage anyone from keeping bees. I've done my share of teaching and mentoring over the past few years, and will continue to do so.

But if you're one of those who think you can "help save the bees" just by giving them a place to live and then leaving them alone, I say go for it.

Just please, don't do it in my neighborhood.

~ Eugene Makovec