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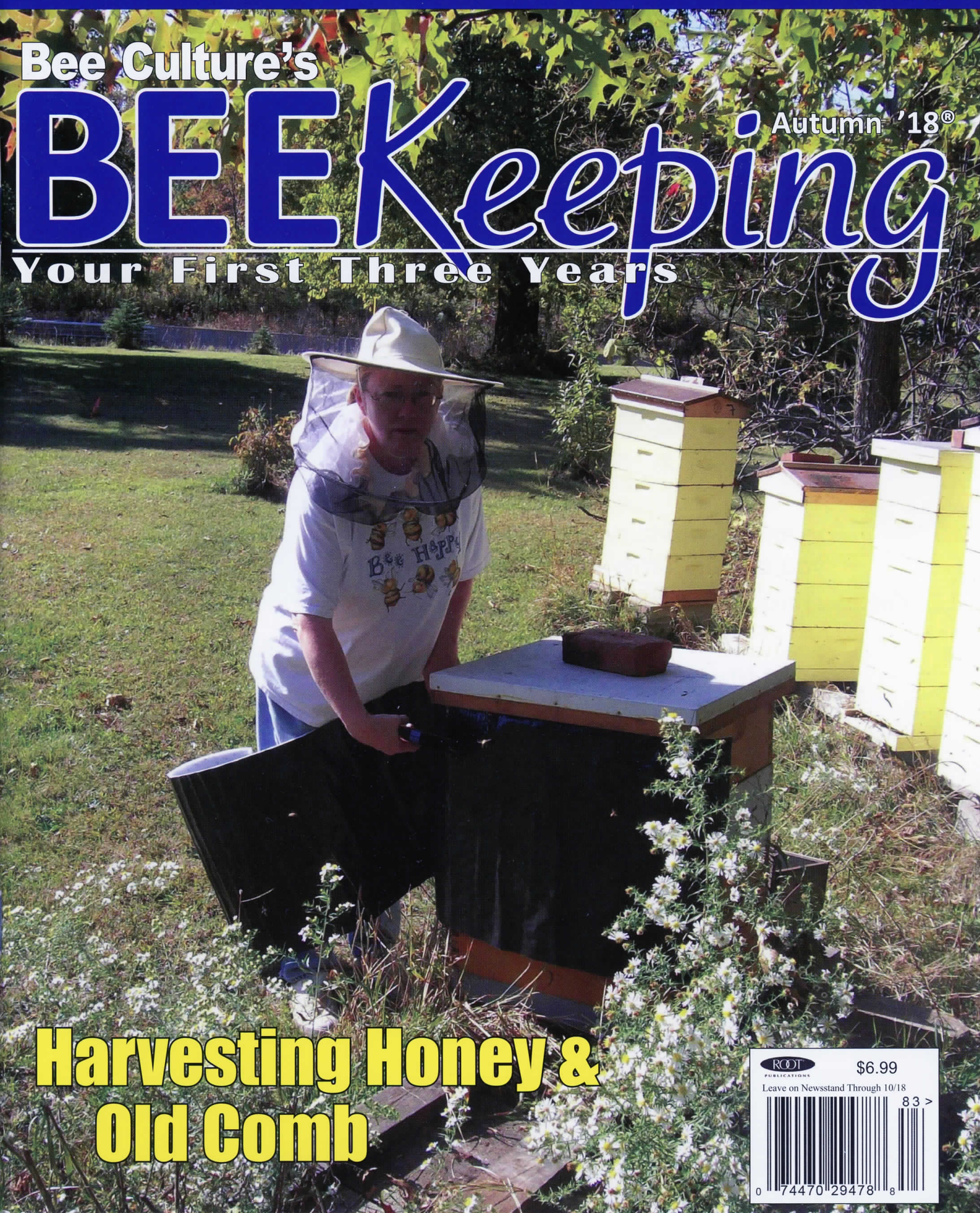

Harvesting Honey & Old Comb

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Your First Three Years

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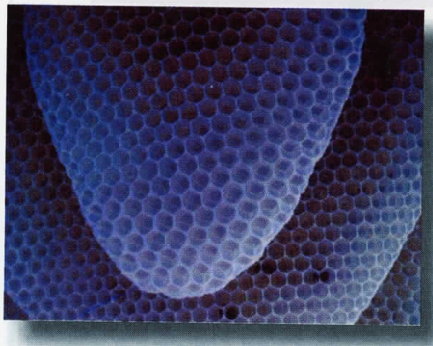

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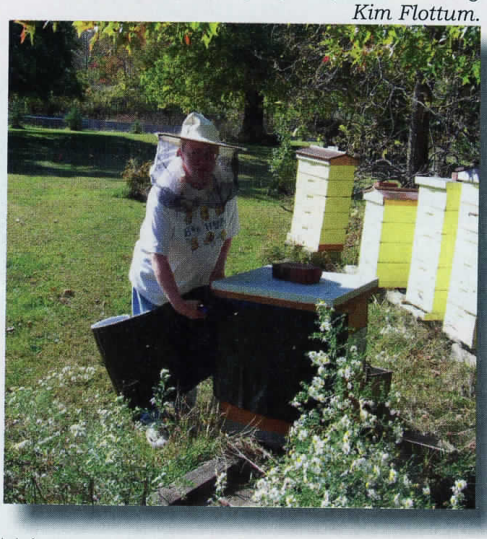
Now is the time to start thinking of winter protection. Have it ready to apply, but don't do it too soon. Wait for a light frost first. Photo by Kim Flottum.



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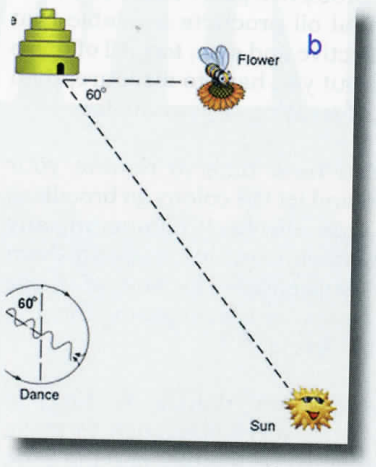
BEEKeeping

Your First Three Years



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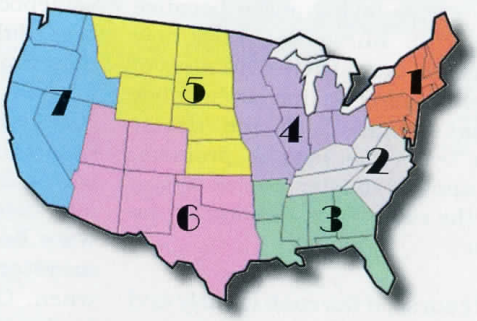

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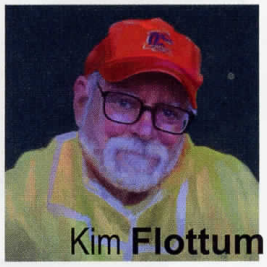
The Editor's Hive



We have our bees in Northeast Ohio, not far from Cleveland and lake Erie. Our Winters aren't too bad because we are just south of Lake Erie's snow belt, and Summers tend toward not too hot because we are kind of close enough to get some of the cool lake breezes. But Mother Nature bats last and some Winters are way too cold, and some Summers way too hot.

This Spring was like that – way, way too hot. And then, too much rain, with some cold mixed in, way too often. What this weather pattern did was to fast forward the bloom time of some plants, then the cool rainy slowed down others so what happened was...lots of stuff bloomed at the same time. Normally there's a predictable sequence both I, and our bees can depend on. This year that sequence went to heck and there was way more bloom than there should be, then none, then too much.

When all this bloom is early there aren't as many bees in a hive yet and this simple lack of a labor force means there will be less nectar gathered. Or, and sometimes this happens, the labor force is redistributed and foragers are pushed out the door earlier than usual to take advantage of this abundance, and the queen slows, maybe stops laying eggs because most of the nurse bees are now foragers. So, later, there's a dearth of new bees coming on line so the labor force is dampened. If the nectar flow is over this isn't a problem, but if another buster comes along, again, the colony misses some of the harvest.

Of course, if the rush is early and the colony is able to take advantage of it, a large population and lots of stored honey is the result, but if the beekeeper isn't on top of things swarming becomes the next course of action. Providing, of course, the weather cooperates.

But this erratic weather really messes up any plans for working the bees. I'm on the road a lot so just any old time I want to check, add, split, treat, feed, doesn't work. My windows of opportunity are not numerous, and too often too early, too late, or not enough or too much. And way too often, getting done what needs done when it needs done doesn't happen, at all. This reflects an old friend's Rule of Rights – Do the right thing at the right time the right way with the right number of bees. And you will do all right as a beekeeper. That is exactly true, and almost impossible to accomplish some years.

Late July, early August is when Winter prep, for both bees and beekeepers, really starts in a beehive, and the best thing a beekeeper can do is to 'take care of the bees that take care of the bees that go into Winter'. It's sort of like, if your grandparents aren't healthy, they won't be able to take care of your parents, and in turn your parents won't be able to take care of you, so when Winter comes, you're underfed, sick from Varroa infestations and the viruses that comes with that, living in a home just slightly tainted with pesticides from what your nest mates keep bringing back all Summer, and there's just not quite enough food to get you and your buddies through the Winter. Somebody didn't take care of the bees, didn't so the right thing at the right time, that's for sure.

So it's not too late to do the right thing. Check for mite loads in your colony the easy way. Check out our sister pubs article at **https://www.beeculture.com/easy-hive-monitoring/** for what and how and when. Once you know if your mite load is too high, you'll have to decide on what treatment options to use. My first choice is always the organic acids, and my choice is Formic Plus, a disposable pad with formic acid soaked in that evaporates in the hive, killing any mites that are not in cells. You have to apply it for some time to make sure you get any mites that were in cells for the first application, but it is effective, safe for your bees and does not contaminate the wax. Win, Win, Win I think.

Of course there are a slew of other products that are effective and safe...oxalic acid as a spray, drizzle or gas. This last one requires the most protective gear. There a several essential oil products available that are effective and safe, too. All of these work, but you have to measure, then treat, if treating is your choice.

You have time to remove your queen and let the colony go broodless for a time, effectively eliminating any place mites can hide, making them more susceptible to any of these treatments, or just exposing them to the real world.

And then there's feeding to make sure there is enough to make it through the Winter, making sure the queen is healthy and doing her job...you should still have several frames of open and sealed brood in the brood nest, and if not, suspect the queen of wearing out, especially if you had an overload of mites.

If you are going to add Winter protection to your hives now is the time to get it going. Not on yet, not until the second hard frost in your area, but have it ready. Ventilation is needed, too. If you have a screened bottom board close it 2/3rds and have an upper entrance, usually your inner cover slot with the outer cover pushed away from it so warm air can escape and not condense on the inner cover and drip back down.

There's more of course. Get a book, talk to your mentor, take a class. Do the right thing, the right way, at the right time, with the right number of bees, and you'll have bees next Spring. It all starts now.

1ST YEAR HIVE TASKS

Ann **Harman**

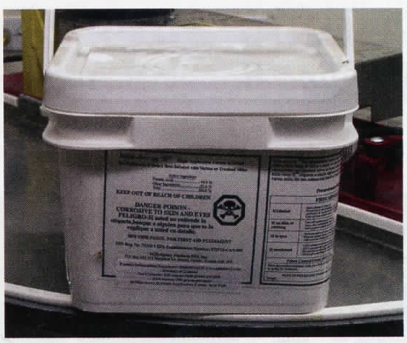
Feeding, sugar syrup and maybe even a protein substitute may be necessary.

- Monitor queen performance.
- If original queen has not increased colony numbers plan on requeening no later than end of August or the very beginning of September, depending on your climate.
- If colony is weak examine for disease or other conditions.
- If queen performance is poor, a weak colony can be combined with a strong one; eliminate weak colony queen.
- Plan your hive inspections for minimum time to avoid robbing.
- Monitor drawing out comb.
- Packages and nucs started in Spring should be in completed hives with all comb drawn out by end of July.
- A water source is important. Bees can use 1 to 2 gallons of water a day for regulating hive temperature and to provide a drink for the bees.
- Be a Weather Watcher and a Plant Watcher.
- If drought or dearth of flowers then feed 1:1 sugar syrup if needed.
- If feeding syrup, put feed on all colonies to prevent robbing.
- Always feed syrup inside the hive, not at the entrance.

Keep your beeyards free of weeds to avoid getting tangled up and tripping, especially when carrying equipment.

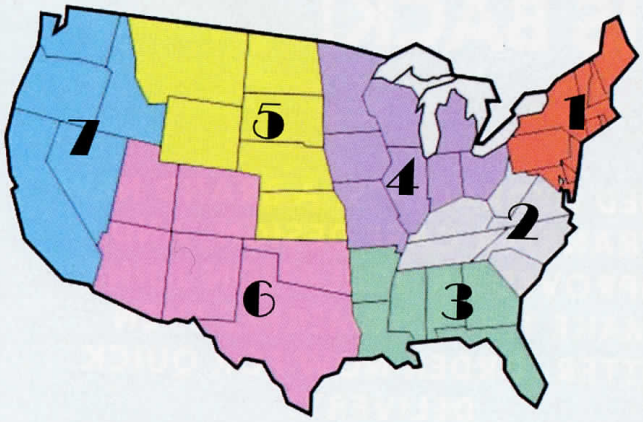
- Keep grass and weeds mowed to give bees easy flight from the hive.
- Check yourself for ticks acquired from grass and weeds.
- Switch feed to 2:1 sugar syrup in September.
- Check the beeyard after heavy thunderstorms and high winds.
- Monitor *Varroa* population and control if more than 3 mites per hundred bees are found.
- If choosing a treatment, read the miticide label carefully. Monitor daytime temperatures. Follow label instructions!

- Action against mites is essential in July/ early August.
- Look for small hive beetles; check underside of pollen patties.
- Use beetle traps or other means of control.
- The bees' New Year begins August first. Celebrate if all is well!



Control mites in your bees. If using a treatment, choose carefully, and follow label instructions.

Autumn Honey Report



	% Important						% Less Important					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Price	59	53	55	59	66	60	41	47	45	41	34	40
Label Design	46	49	35	38	45	40	54	51	65	62	55	60
Name on Label	67	64	60	71	71	73	33	36	40	29	29	27
Local Honey on Label	61	77	66	61	55	55	39	23	34	34	45	45
Variety of Honey/label	32	19	24	23	25	20	78	81	76	77	75	80
Second Label	5	8	9	14	18	18	95	92	91	86	82	82
Location I sell	57	58	54	58	66	61	43	42	46	42	34	39
Time of Year	17	28	17	23	29	31	83	72	84	77	71	69
Glass Container	35	31	36	35	40	37	65	69	64	65	60	64
Plastic Container	19	17	19	14	16	13	81	83	81	86	84	87
12 oz. size	32	35	32	38	38	43	68	65	68	62	62	57
1 lb. size	56	60	55	48	56	62	44	40	45	52	44	38
2 lb. size	35	55	37	35	42	52	65	45	63	65	58	48
5 lb. size	38	42	36	23	27	40	62	58	64	77	73	60
Quart jar	46	45	44	45	44	46	54	55	56	55	56	54
Pint Jar	42	40	36	41	36	31	58	60	64	59	64	69
Specialty Jar	10	13	13	11	10	16	90	87	87	89	90	84
Gallon	-	-	24	15	11	25	-	-	76	85	89	75
Raw	-	-	67	67	64	67	-	-	40	33	36	33
Color	-	-	27	41	26	30	-	-	73	59	74	70
Other Products	-	-	-	2	8	13	-	-	-	98	92	87

Selling Honey

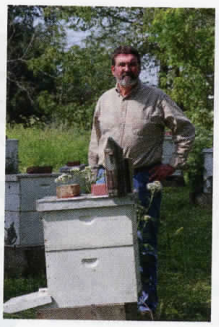
So, what's it take to sell your honey? Of course is it good comes in first, and when selling retail (1:1), giving a taste is the best way to introduce your customers to your products. But there are a host of secondary factors that can, and do influence whether someone will, or even wants to consider buying the efforts of your bees. Price certainly enters in, but perhaps not as much as you'd suspect. Look at the history of its importance here. Over half, yes, but it's only #5 of the top five most important factors. The first, of course, is having your name on the label. That's because almost everywhere it's the law, but it also conveys where the honey comes from. Interestingly, putting LOCAL on the label remains less important than the other top 5 reasons. But putting RAW HONEY on the label tells another story. The product in this jar hasn't been heated or filtered and it is as good as nature intended. A friend defines RAW as totally unheated and unfiltered, so it may contain pollen and occasionally bee parts. And bee parts taste like chicken he claims. It works for him. The size of the container still is in the ranking, and we suspect price has something to do with it. The 12 oz., 1, 2 and 5 lb. continue being relevant in importance, but surprisingly, the gallon jug got a bump this year. Still, the 1 pounder leads the way, no matter glass or plastic, but glass is important. Is that because what beekeepers want to sell, or what customers want to buy? Location. Location. Location. It's where you sell that still matters. It has to do with who you know, and who knows you. If you're at a farm market, you probably know their names, so it's who you are. But if you're in a grocery store, you never see them in person, so it's your product – price, presentation, color and label – that makes the decision for the customer.

REPORTING REGIONS								SUMMARY			History	
	1	2	3	4	5	6	7	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS												
55 Gal. Drum, Light	2.19	2.20	2.35	2.60	2.27	2.21	2.19	1.25-3.05	2.23	2.23	2.28	2.18
55 Gal. Drum, Ambr	2.02	2.14	2.06	2.48	2.02	2.06	2.02	1.25-2.65	2.08	2.08	2.26	2.09
60# Light (retail)	186.48	186.05	191.25	192.33	159.00	196.68	220.00	75.00-280.00	195.46	3.26	203.03	201.32
60# Amber (retail)	179.99	185.60	190.00	182.33	179.99	189.74	220.00	75.00-260.00	192.47	3.21	201.90	200.94
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	91.85	75.31	90.80	86.00	57.84	84.00	91.85	57.60-134.40	87.71	7.31	83.04	89.45
1# 24/case	137.80	107.03	123.05	120.48	131.72	124.71	128.40	86.40-211.20	126.79	5.28	126.08	123.67
2# 12/case	124.10	95.07	109.78	105.80	107.16	98.40	114.00	79.20-192.00	112.61	4.69	111.26	108.25
12.oz. Plas. 24/cs	109.46	97.53	93.00	82.40	78.00	104.32	97.20	66.00-172.80	99.52	5.53	100.33	99.70
5# 6/case	134.76	108.32	186.00	113.70	107.28	115.50	134.76	71.50-210.00	128.77	4.29	125.30	123.18
Quarts 12/case	165.75	144.79	130.61	179.73	158.50	130.61	144.00	109.20-250.00	151.89	4.22	146.58	148.87
Pints 12/case	113.26	92.67	77.00	128.00	111.00	75.98	84.00	65.00-189.00	99.52	5.53	95.08	88.05
RETAIL SHELF PRICES												
1/2#	5.49	4.37	4.92	4.55	3.86	4.05	5.49	3.09-9.00	4.94	9.88	4.85	5.00
12 oz. Plastic	6.93	5.18	5.46	5.66	4.72	7.39	5.60	3.50-12.00	6.12	8.16	5.77	5.73
1# Glass/Plastic	8.23	6.84	7.65	6.80	6.46	7.08	8.50	4.00-14.00	7.46	7.46	7.39	7.28
2# Glass/Plastic	13.28	10.06	12.64	10.90	11.42	10.12	14.50	6.10-22.00	12.51	6.25	12.09	12.24
Pint	11.61	9.36	9.37	8.00	10.00	10.45	8.40	6.00-20.00	10.22	6.81	10.29	9.99
Quart	20.25	16.68	16.63	16.08	17.60	17.16	20.65	9.25-36.00	17.88	5.96	17.05	17.07
5# Glass/Plastic	27.65	25.32	33.75	23.60	24.57	22.89	27.65	14.48-43.25	26.43	5.29	26.61	26.39
1# Cream	11.20	8.25	11.20	6.75	7.71	11.20	9.00	6.00-20.00	9.40	9.40	9.64	9.49
1# Cut Comb	13.31	9.33	9.00	10.00	15.00	6.50	14.00	6.00-24.00	11.61	11.61	11.33	11.28
Ross Round	9.35	6.76	9.35	9.00	9.35	7.63	12.49	4.75-14.00	9.33	12.44	9.08	9.47
Wholesale Wax (Lt)	6.97	5.15	5.33	6.19	6.00	6.00	7.50	3.00-12.00	6.44	-	6.56	5.94
Wholesale Wax (Dk)	6.02	4.73	4.39	6.00	6.02	4.00	9.00	2.55-10.00	5.77	-	5.69	5.51
Pollination Fee/Col.	95.98	75.83	72.50	78.75	100.00	90.00	95.98	50.00-160.00	86.96	-	83.65	92.04

Got Questions?

Phil Knows!

Phil **Craft**



A beekeeper in Washington state writes:

Q: I live in Carlton, WA. We just had a devastating wildfire that burned nearly 400 square miles and is still burning. My bees survived, although the fire burned within a foot of their hives. They are in my garden, which is full of flowers and blooming herbs and veggies - so there is a small bit of foraging food within the garden, but all of the wildflowers that they visited are now gone. They appeared to have eaten some of their honey stores during the fire, and there is not enough vegetation around for them to adequately create and store more food for Winter. There is not much information out there on the effect of wildfire on honeybees and how to care for them through the next Winter. Have you had any experience with this? What do you suggest?

Phil replies:

A: Congratulations on your narrow escape. I just received an email from a friend reporting that her cousin recently lost his hives in a Washington wildfire. You are not alone.

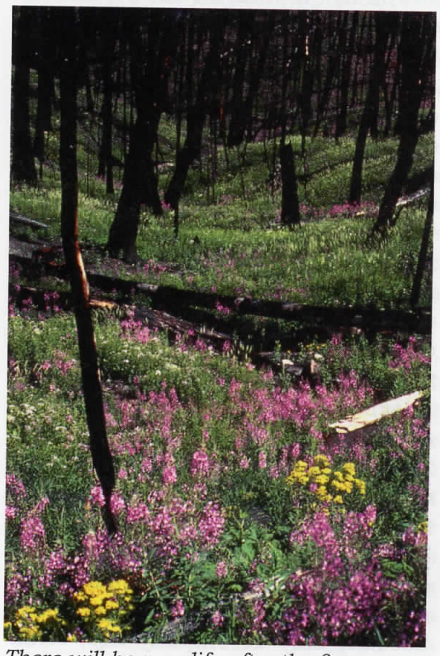
For now – and at least until Spring – you are, in effect, living in a desert. You will have to be prepared to provide all the resources that your hives need. This includes not only carbohydrates (in the form of sugar syrup as a honey substitute), but also protein (in the form of patties as a replacement for pollen).

Your first step is to assess your hives' immediate needs. Go through them and count frames of stored honey, both full and partial, and make notes. Each hive needs a minimum of two or three deep frames of honey at all times; later, of course, they will have to have more to get them through the Winter. If you do not see the necessary minimum in the hives now, it's time to do some feeding. Mixing a thick syrup of two parts granulated sugar to one part water will encourage the bees to use what they need immediately and store the rest as reserves.

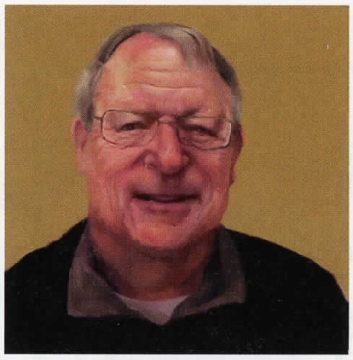
In the Fall, the colony's focus should change to the raising of brood, and its food requirements will change also. September and October are for rearing Winter bees – the ones which will survive until Spring and supply the biomass to provide warmth to the hive throughout the Winter. Normally, this activity is stimulated by the Autumn nectar flow. If you don't see fresh nectar being deposited in the cells in early September (which I doubt you will), you will have to imitate a flow by feeding a thin syrup of equal parts water and sugar. Since your goal at this time is to encourage brood production and not the storage of food reserves, don't let the bees occupy too much of the brood space with syrup. Stop feeding for a while if they fill up more than few frames. In the meantime, as larvae start to develop, the nurse bees will need protein. In the absence of natural pollen sources, you'll have to purchase some protein patties. Place one on the top bars of the top brood box in each hive, and keep a patty on throughout September and October. If they consume most of one, add another.

In the middle of October, it's time for the hives' focus to change again – this time to storing food for Winter. About the 10th of the month, switch back to a thick syrup, 2:1 sugar to water. The bees will tend to store the thicker syrup, and you can give them as much as they will take. Each hive will need about 50 pounds of stored syrup, in the absence of honey, to get through the Winter. A deep frame full of syrup provides about six pounds of food reserves, a medium frame about four, and a shallow frame about two and a half. Normally, by mid-October the colonies start cutting back on brood production and begin to fill the top brood box with honey. Under these most abnormal conditions, the change to thicker syrup will help prompt that behavior. A full medium box or a mostly full deep, together with what is stored in the bottom, will go a long way toward meeting your hives' Winter food needs.

In the Spring, it is to be hoped, there will be new plant growth, a re-flowering, and fresh nectar being brought into the hive. Early in the season, watch for pollen on the legs of returning bees; if there is pollen, there is likely nectar as well. In Spring, as in Fall, you want to see brood being raised. Monitor your hives closely for fresh nectar, pollen, and brood. If you're lucky, things will be back to normal, but it's possible that there will still be dearths created by the fire. Let what you see in the hives be your guide.



There will be new life after the fire



WAGGLE DANCE COMMUNICATION WITHIN THE HIVE

Clarence **Collison**

Honey bees communicate to nestmates locations of resources, including food, water, tree resin (propolis) and nest sites, by making waggle dances. Dances are composed of repeated waggle runs, which encode the distance and direction vector from the hive or swarm to the resource. Distance is encoded in the duration of the waggle run, and direction is encoded in the angle of the dancer's body relative to vertical (Schürch et al. 2013).

The waggle dance can be regarded as a repetition of movements consisting of a waggle "run" and a return run. During the waggle run, the dancer swings her body from side to side in a pendulum-like manner, 13-15 times per second, and she produces dance sounds by vibrating her wings dorsoventrally (Wenner 1962). The bee moves her body continuously forward, but her legs do not move at all or perform only a few slow-motion strides (Tautz et al. 1996). In the return run, the dancer circles back to start a new sequence. Some parameters of the waggle run are correlated with the location of the advertised feeding site. The angle between the sun's azimuth and the direction to food in the field equals the angle between gravity and waggle run, which is called waggle run angle. The distance to the food source is indicated in the duration of the waggle run: the longer the duration of the waggle run, the further away is the feeding site (von Frisch 1967). Dance followers mostly accompany the dancing bee. The interaction between dancers and dance followers can be broken up into the following successive steps: First, bees motivated to follow a dancer detect, localize and approach the dancer (Tautz and Rohrseitz 1998). Second, they accompany her, often for many circuits (Esch and Bastian 1970), and thus become dance followers. Third, after following a number of dances, they often fly out and find the indicated food source.

Little is known about how waggle dance followers are able to read the waggle dance in the darkness of the hive. Initial observations showed that not all of the bees that appear to be dance followers behave the same. Some bees maneuver themselves behind the dancer, while others do not. The paths of a single dancer, trained to an artificial food source, and her followers were traced during the waggle runs. The success of these dance followers was compared to their position relative to the dancer. The results of this study show that during a waggle run a dance follower must position itself within a 30° arc behind the dancer in order to obtain the dance information. The results suggest that bees are using the position of their own bodies to determine direction (Judd 1994).

The behavior of bees surrounding a dancing bee was studied, using two colonies in observation hives in a shaded part of an apiary. Video recordings and macro-photography were used to view an area of the dance field. Two distinct behaviors were recognized: that of followers and that of attendants. The attendants stood around the dance field with their antennae stretched towards the dancer, and only occasionally moved with the dancer. Followers continuously ran with the dancer, keeping their heads within the border of the dancer's figure-eight paths at all times. The angle between the body of the follower and that of the dancer was 90° during most of the dance, except at the exit of the waggle run. At that time the follower had to cross over to the opposite side of the dancer. The distance between the head of the follower and the dancer's body was nearly always smaller (1,758 cases out of a total of 1,882) than the length of an extended antenna. During the return run the follower touched the dancer with antennae most of the time, whereas during the waggle run the followers intermittently touched the dancer. Either one bee (81 % of cases) or two bees (18%) followed the dance simultaneously. The second follower and all other bees were usually pushed out of the follower's position because of a lack of space at the inner side of the dancer (Božič and Valenlinčič 1991).

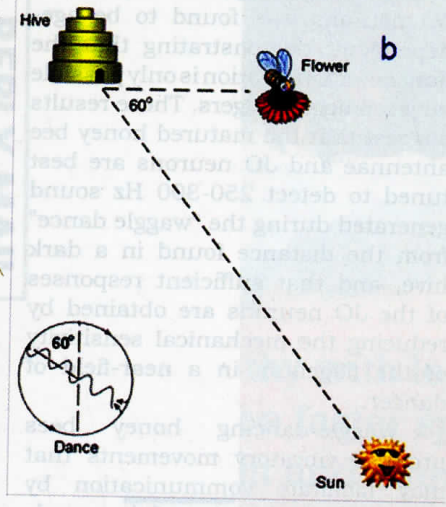
Biesmeijer and Seeley (2005) studied the extent to which worker honey bees acquire information from waggle dances throughout their careers as foragers. Small groups of foragers were monitored from time of orientation flights to time of death and all in-hive behaviors relating to foraging were recorded. In the context of a novice forager finding her first food source, 60% of the bees relied, at least in part, on acquiring information from waggle dances (being recruited) rather than searching independently (scouting). In the context of an experienced forager whose foraging has been interrupted, 37% of the time the bees resumed foraging by following waggle dances (being reactivated) rather than examining the food source on their own (inspecting). And in the context of an experienced forager engaged in foraging, 17% of the time the bees initiated a foraging trip by following a waggle dance. Such dance following was observed much more often after an unsuccessful than after a successful foraging trip. Successful foragers often followed dances just briefly; perhaps to confirm that the kind of flowers they had been visiting were still yielding forage. Overall,

waggle dance following for food discovery accounted for 12-25% of all interactions with dancers (9% by novice foragers and 3-16% by experienced foragers) whereas dance following for reactivation and confirmation accounted for the other 75-88% (26% for reactivation and 49-62% for confirmation). They concluded that foragers make extensive use of the waggle dance not only to start work at new, unfamiliar food sources but also to resume work at old, familiar food sources.

The behavior of 38 honey bee dance followers and the patterns of antennal contact between followers and dancer were monitored during ten waggle runs for a feeding site 1200 meters from the hive. The analysis was restricted to waggle runs with a maximum of five followers, allowing the followers to choose between different positions around the dancer. At the beginning of the waggle run, followers are rather evenly spaced around the dancer. During the waggle run, the followers tend to accumulate at the rear end of the dancer. At the end of the waggle run, all followers are found in a ±60° arc behind the dancer. The body orientation angles of the followers depend on their position relative to the dancer. The follower bees have intense antennal contact with the dancer. At least one temporal parameter of the contact pattern may inform the followers about their position relative to the dancer, may guide the dance followers to the rear end of the dancer and may allow them to extract information about the location of the food source advertised by the dance. The role of antennal contact for dance communication appears to have been underestimated in previous studies (Rohrseitz and Tautz 1999).

Tautz (1996) reported that the nature of the floor on which the bees dance has considerable influence on the recruitment of nestmates to a food source. Dancers on combs with open empty cells recruit three times as many nestmates to a food source as dancers on capped brood cells.

Honey bee foragers can follow waggle dances (social information) to obtain vector information about the location of profitable food sources or they can use route memories (private information) acquired during previous foraging trips. The relative use of social information versus private information is poorly understood. It is hypothesized that social information should be prioritized when the use of private information has a low benefit. Grüter and Ratnieks (2011) tested this hypothesis by training foragers to a high-quality 2 M sucrose feeder, which subsequently became unrewarding. As foragers continued to experience zero reward from their private route information they increased the time spent following waggle dances advertising an alternative food source with the same odor. A significant proportion



of foragers successfully switched to the food source indicated by dances. Overall, trained foragers showed a strong attachment to the known but currently unrewarding feeder, even after repeatedly following dances advertising a profitable alternative. Successful recruits to the novel food source advertised by the waggle dances had more social information about this source in that they had followed dances for longer. Their results suggest that honey bee foragers follow a strategy that is conservative in terms of switching from one food patch to another.

Hydrocarbons emitted by waggle-dancing honey bees are known to reactivate experienced foragers to visit known food sources. Gilley (2014) investigated whether these hydrocarbons also increase waggle-dance recruitment by observing recruitment and dancing behavior when the dance compounds are introduced into the hive. If the hydrocarbons emitted by waggle-dancing bees affect the recruitment of foragers to a food source, then the number of recruits arriving at a food source should be greater after introduction of dance compounds versus a pure-solvent control. This prediction was supported by the results of experiments in which recruits were captured at a feeder following introduction of dance compounds into a hive. This study also tested two nonexclusive behavioral mechanism(s) by which the compounds might stimulate recruitment; 1) increased recruitment could occur by means of increasing the recruitment effectiveness of each dance and/or 2) increased recruitment could occur by increasing the intensity of waggle-dancing. These hypotheses were tested by examining video records of the dancing and recruitment behavior of individually marked bees following dance compound introduction. Comparisons of numbers of dance followers and numbers of recruits per dance and waggle run showed no significant differences between dance compound and solvent-control introduction, thus providing no support for the first hypothesis. Comparison of the number of waggle-dance bouts and the number of waggle runs revealed significantly more dancing during morning dance-compound introduction than morning solvent-control introduction, supporting the second hypothesis. These results suggest that the waggle-dance hydrocarbons play an important role in honey bee foraging recruitment by stimulating foragers to perform waggle dances following periods of inactivity.

Thom et al. (2007) used solid-phase micro-extraction and gas chromatography coupled with mass spectrometry to show that waggle-dancing bees produce and release two alkanes, tricosane and pentacosane, and two alkenes, Z-(9)-tricosene and Z-(9)-pentacosene, onto their abdomens and into the air. Non-dancing foragers returning from the same food source produce these substances in only minute quantities. Injection of the scent significantly affects worker behavior by increasing the number of bees that exit the hive. The results of this study suggest that these compounds are semiochemicals involved in worker recruitment. By showing that

honey bee waggle dancers produce and release behaviorally active chemicals, this study reveals a new dimension in the organization of honey bee foraging.

From the honey bee dances, human observers can read the distance and direction of the food source. When foragers collect food in a short, narrow tunnel, they dance as if the food source were much farther away. Dancers gauge distance by retinal image flow on the way to their destination. Their visually driven odometer misreads distance because the close tunnel walls increase optic flow. Esch et al. (2001) examined how hive mates interpret these dances. They were able to show that recruited bees search outside in the direction of the tunnel at exaggerated distances and not inside the tunnel where the foragers come from. Thus, dances must convey information about the direction of the food source and the total amount of image motion en route to the food source, but they do not convey information about absolute distances. They also found that perceived distances on various outdoor routes from the same hive could be considerably different. Navigational errors are avoided as recruits and dancers tend to fly in the same direction. Reported racial differences in honey bee dances (von Frisch 1967) could have arisen merely from differences in the environments in which these bees flew.

The sound and air flows generated during the waggle dance by the dancer's wing and abdominal vibrations have been implicated as important cues for the bees following the dancer. To understand the neural mechanisms of honey bee dance communication, Tsujiuchi et al. 2007, analyzed the anatomy of the antenna and Johnston's organ (JO) in the pedicel of the antenna, as well as the mechanical and neural response characteristics of antenna and JO to acoustic stimuli, respectively. The honey bee JO consists of about 300-320 scolopidia (fundamental unit of a mechanoreceptor organ in insects, sensitive to sound (vibrations of the air) or substrate vibrations) connected with about 48 cuticular "knobs" around the circumference of the pedicel. Each scolopidium contains bipolar sensory neurons with both type I and II cilia. These neurons convert mechanical vibrations into a nerve impulse. The mechanical sensitivities of the antennal flagellum (antennal segments beyond the second segment) are specifically high in response to low but not high intensity stimuli of 265-350 Hz frequencies (Hz = hertz, one vibration cycle/second). The honey bee flagellum is a sensitive movement detector responding to 20 nm tip displacement. Furthermore, the JO neurons have the ability to preserve both frequency and temporal information of acoustic stimuli including the "waggle dance" sound. Intriguingly, the response of JO neurons was found to be age-dependent, demonstrating that the dance communication is only possible between aged foragers. These results suggest that the matured honey bee antennae and JO neurons are best tuned to detect 250-300 Hz sound generated during the "waggle dance" from the distance found in a dark hive, and that sufficient responses of the JO neurons are obtained by reducing the mechanical sensitivity of the flagellum in a near-field of dancer.

Waggle-dancing honey bees produce vibratory movements that may facilitate communication by indicating the location of the waggle dancer. However, an important component of these vibrations has never been previously detected in the comb. Nieh and Tautz (2000) developed a method of fine-scale behavioral analysis that allowed them to analyze separately comb vibrations near a honey bee waggle dancer during the waggle and return phases of her dance. They simultaneously recorded honey bee waggle dances using digital video and laser-Doppler vibrometry and performed a behavior-locked Fast Fourier Transform analysis on the substratum vibrations. This analysis revealed significantly higher-amplitude 200-300 Hz vibrations during the waggle phase than during the return phase. They found no significant differences in the flanking frequency regions between 100-200 Hz and 300-400 Hz. They recorded peak waggle phase vibrations from 206 to 292 Hz with a mean of 244 Hz. Therefore, the dance followers likely obtain cues from both sound and substrate vibrations.

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Harvesting Honey & Old Comb

Ross **Conrad**

When is the best time to harvest honey from the hive? . . . It's a question that crosses the mind of most every beekeeper eventually. As with many beekeeping questions, the answer is "it depends."

The honey bee is one of the only creatures on earth, other than humans, that will take more than they need from the environment around them. This is due to their powerful hoarding instinct. As long as there is room in the hive to store nectar and ripen it into honey, and there are nectar sources accessible due to favorable weather, a hive of bees will keep collecting nectar and storing it in the hive as honey even though they may already have far more honey stored than is necessary in order to survive a long cold Winter.

Beekeepers take advantage of this hoarding instinct by increasing the capacity of the hive to hold honey whenever the combs in the hive are close to being fully utilized by adding another honey super to our Langstroth hives or additional frames to the top bar hives. Some beekeepers have even designed top bar hives so that standard Langstroth style honey supers with frames can be added on top after all the top bars have been filled below (see photo).

There are numerous factors that go into the decision when to harvest honey from hives. To begin with, one must be patient. The bees must be given adequate time to collect nectar and process it into honey by reducing the moisture content of the nectar below about 18%. Rush the process and harvest before it is fully ripened by the bees and you may end up with fermented honey. Not the end of the world since it is still edible and makes great mead, but if high quality honey that stores well or is for sale is your goal, low moisture is what you want. A good rule of thumb is to not extract unless at least 75% of the cells in the honey combs are capped. By extracting one uncapped honey frame for every three capped frames of honey, the overall moisture content will tend to be below the level where fermentation will occur.

The other extreme is to wait until all the blossoming plants have finished blooming in order to maximize the honey crop by harvesting as late in the season as possible. Unfortunately, in the Northeast the last of the major nectar flows ends in late September when temperatures typically are getting quite chilly at night. The cold temperatures make honey in the combs thick and much more difficult to extract. Robbing pressure is also very strong at this time of year. With no other sources of nectar to forage on and Winter right around the corner, honey supers must be kept covered and protected from marauding bees as they are being taken off hives. The extra effort involved in defending your crop from robbing bees greatly reduces the joy of the honey harvest.

Another reason why it is not usually preferable to put off the honey harvest until late in the season is because some of the treatments used for pests and diseases are temperature sensitive. Wait too long and average daytime temperatures may not be favorable for effective treatments.

Since most pest and disease treatments should not be used when honey supers to be harvested are on the hive due to contamination concerns, all harvesting may need to be completed before any treatments can begin. Given the importance of "taking care of the bees that will raise the bees that will live through the Winter" (to paraphrase Bee Culture editor Kim Flottum) treatments for *Varroa* and disease must take place early enough to ensure healthy Winter bees. As a result, the temperature requirements of treatments may serve to dictate when the honey harvest should happen.

When a colony has stored far more honey than they can reasonably be expected to consume during a long Winter, I believe it is best to harvest the excess rather than leave it on the hive for the Winter. While some well-meaning beekeepers will wait to harvest their honey in Spring rather than Autumn in an effort to be sure the bees have enough honey for Winter, there are a number of reasons why I don't believe this is a good idea.

Winter honey that does not get used and is still in the hive come Spring will often become crystallized (at least in the Northeast). Thus, each Spring the bees can be seen uncapping honey that was unused during the Winter and sucking up what little liquid remains of the honey, while the numerous sugar

crystals will be found on the bottom board or on the ground as they are removed from the hive as debris by the bees. In addition, crystalized honey is hard to extract. This makes life for the beekeeper much more difficult both due to the longer time it takes to extract crystalized honey and the extra wear and tear on the extracting equipment. It also increases the potential for comb blowouts during the extracting process and additional energy will be required to run the extractor since the crystalized honey will require it to run for a longer period of time.

The combs holding the honey left over in Spring may also become moldy depending on weather conditions and the strength of the colony, and this may impact the quality of the honey harvested. In addition, leaving more space on the hive than necessary (in the form of extra honey supers that the bees don't need), which must be maintained and patrolled by the colony is usually a bad idea during these days of weak hives, small hive beetles, wax moths, etc.

Perhaps the most important reason why I don't like the idea of waiting to harvest honey from hives until Spring is because the bees may need any honey that is found left over in the hive in Spring to get themselves ready for the upcoming Winter. Life for the honey bee in the Northeast is primarily about reproducing and surviving Winter. Although colonies of bees may historically build up and store enough honey for Winter in your location, what if this is the year that a drought or some other weather abnormality prevents the bees from storing enough honey to survive the coming Winter? Any honey left over from the previous Winter and found in the hive in Spring may just be what is needed to ensure the colony will be well provisioned for next Winter. At minimum, it can help reduce the amount of feeding that may be required by the beekeeper during Winter preparations. Since I can't predict the weather and know with any certainty what the season will be like, I prefer to only harvest all excess honey in late Summer here in Vermont. This is because this is the only time of year when I can be pretty sure just how much honey the colony is likely to have going into Winter and I am able to determine if the amount of honey in the hive is going to be enough for the colony to survive the cold season dearth.

There are a few exceptions to the general rule of a single late Summer harvest that must be acknowledged. For example, a beekeeper that wants to offer honey varietals in order to serve novelty markets or to compete with other beekeepers by specializing their product line will have to take the risk that the honey varietals that are harvested in Spring or early Summer will not be needed in order for the colony to get through Winter. Sure, such a situation may be remedied by feeding sugar syrup to the bees later in the season, but given the mounting evidence that indicates that bees are much healthier when raised and maintained on natural honey and pollen rather than substitutes, the wisdom of harvesting early and potentially leaving the hive short on naturally derived food stores becomes questionable.

Another potential reason a beekeeper may decide to harvest honey before late Summer or early Autumn in the Northeast is due to poor planning (or limited finances) that results in the beekeeper not having

Escape Boards

enough equipment to super hives in a timely manner and take advantage of the area's major nectar flows. Full supers of honey can be harvested, quickly extracted and put back on hives to fill up again, making up for the lack of extra honey supers. Such a scenario is a lot more work than simply harvesting all at once at the end of the season, but on some occasions this may be the best that one can do.

Whenever one chooses to harvest their honey, it is critical these days that the harvest is timed so that extracting can be done within two-to-three days of removing the bees from the frames of honey and taking

Making cappings wax

the honey from the hive. The sooner extracting and processing takes place after harvesting the better in order to prevent wax moths, or small hive beetles from getting established on the unprotected combs and ruining all the hard work done by both bee and beekeeper.

The honey harvest is often one of the most enjoyable and rewarding parts of keeping bees. In a sense it is the culmination of all the hard work that has come before. When timed correctly, it can go fairly smoothly and efficiently while at the same time helping to set the colony up for a successful Winter and high productivity in the following season. May your harvest be fruitful and timely this year.

Removing Old Comb

Although I have been keeping bees for over 20

⇨

years, I think the supreme importance of proper comb management on the overall health of the hive is really only just really sinking in. When I began beekeeping, beekeepers would brag about how long they had been reusing old combs. Claims of combs being 20 years old, or older, black as night and still in use, were not uncommon.

Why replace old comb regularly?

Since Colony Collapse Disorder reared its ugly head, volumes of research have consistently indicated that beeswax combs have the potential to attract, absorb and build up numerous chemical contaminants.[1,2,3,4,5] Over time, beeswax comb can also potentially build up significant levels of viruses and other bee pathogens.[6] Additional research has shown that the sub-lethal levels of pesticides that can be found on combs in a typical beehive can make a hive more susceptible to pathogens that may be present.[7,8] The level of pathogens in a hive also impacts the ability of bees to tolerate *Varroa* mites.[9] Among the vectors that may contribute to pesticide and pathogen build-up in the combs are foraging workers, drifting bees, pollen, and beekeepers themselves. The preponderance of scientific evidence has led to the general recommendation that beeswax combs in hives be replaced every three-to-five years.

Some approaches to comb replacement

Various techniques have been developed to achieve the goal of comb replacement in the hive. Each beekeeper must choose the one that fits into their beekeeping operation the best. Most methods require that frames be marked in some way so that the year that the comb was built by the bees can be tracked. To accomplish this some beekeepers will write on the top bar, others use thumb tacks pushed into the top-bar of each frame that are color coded for the year in much the same way that the age of marked queens is monitored. Some beekeepers may use the color of the comb as a way to judge its age. However, the color of the comb can be deceiving since combs used for honey storage will tend to darken much more slowly than combs used for brood rearing.

An older top bar comb

The most dramatic way to replace comb in a hive is all at once. This is hard on the bees since they must build up the hive's comb supply in its entirety in time for Winter, and the comb-less period temporarily reduces the ability of the colony to raise young and expand the worker population. Since the creation of new comb is dependent upon the availability of copious amounts of carbohydrates (sugar in the form of nectar or syrup) rebuilding an entire hive worth of comb often takes a lot of money and time invested in feeding unless the bees are located in an especially rich and productive foraging area.

In order to temper the huge investment of time and resources required to create new comb most beekeepers will opt to replace a small portion of the colony's comb at a time. A common recommendation is to replace two-to-three combs in each box each year. In this way all 10 frames of comb in the standard 10-frame hive body or super will be replaced within five years or less. One way to accomplish this task is to rotate the oldest combs in the hive to the outside positions in each box in Autumn. Then in early Spring, when the colony has a modest population and much of the comb in the hive is empty, the outside frames are removed and replaced with foundation.

The making of nucleus colonies with three to five frames of brood, honey, pollen and bees is another way to rotate old combs out of a hive. By the same token, it is a good practice to always include a couple frames of foundation when ever a nucleus colony is installed into an eight- or 10-frame hive body. It works well to place the foundation in positions #2 and #9 and allow the straight combs on either side of the foundation help guide the bees in building a straight comb within the frame.

Another approach is to utilize a three deep hive body system for each hive. Early in Spring, when the bees are primarily occupying the top hive bodies, the bottom hive body that is mostly empty can be completely removed and all the frames replaced. By replacing all the frames in a single deep box each year, frames in the three-hive body hive are never allowed to become older than three years. A modification of this approach is to use five medium boxes for each hive. By replacing all the old frames in the bottom box when reversing the hive each Spring, a five-year comb rotation will be achieved.

What to do with those old combs?

As I outlined in the July 2014 issue of *Bee Culture*, beeswax is an incredibly unique and valuable product from the hive. The old combs we cull from our hives on a yearly basis can become an important source of wax that can produce an additional income stream. Combs that still have eggs, larva or brood that has yet to hatch should not be culled from the hive. Ideally only old empty combs are removed and replaced. However, we all know that the "ideal" is often not the real-world situation we have to work with. Sometimes, old combs being culled from our hives will still have small amounts of honey or nectar in them. In such a case, it's a good idea to not allow these carbohydrate resources to go to waste, and instead leave the frames out for the bees to rob out and take back to their hive. Just be sure to leave the frames to be robbed out at least 300 feet away from the beeyard if you have more than one hive, in order to prevent your hives from trying to rob each other.

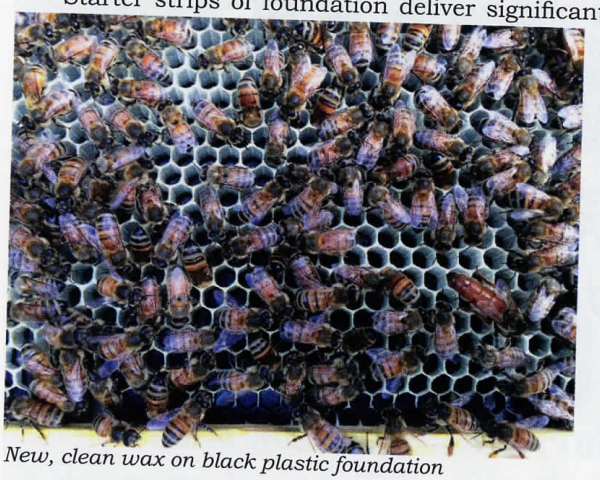
Options for getting new comb started

Numerous options exist when it comes to providing the bees with the opportunity and incentive to build new combs. Each option has various pros and cons related to time and labor, durability, cost, honey bee acceptance, reliably straight worker comb, and the initial level of potential chemical contamination (a problem that is ubiquitous due to contamination of commercial beeswax used to manufacture foundation).

Beeswax coated plastic foundation is the most durable option available. While it tends to cost more than sheets of 100 percent beeswax foundation, it takes less time and labor to assemble, and the potential level of the initial chemical contamination is likely to be lower since the majority of the foundation is made of plastic rather than wax. The beeswax coating on plastic foundation is important because honey bees are unlikely to accept the plastic foundation without it. Plastic foundation becomes a problem when it comes to disposal, a problem that is not an issue with other options. When it comes to harvesting the beeswax, all other options allow the wax to be removed in a solar wax melter. Old frames of comb built on plastic foundation require a lot more labor in order to harvest the wax since the plastic will warp in the heat of a solar wax melter and so the wax must be scraped off each comb manually if the plastic foundation is to be preserved and reused.

Sheets of 100 percent beeswax foundation have stood the test of time for producing consistently straight combs of worker sized cells at a price that is typically less than that of plastic. Beeswax foundation is not as durable as plastic foundation even when wired and the time and labor required to produce frames of wired wax foundation can be significantly more than that required to assemble frames of plastic foundation. Since full sheets of foundation have the highest wax content of all the options available, the level of the initial chemical contamination has the potential to be the highest. Honey bee acceptance of beeswax foundation is not a problem and the entire comb can be rendered down with the exception of any metal supports such as wires or pins.

Starter strips of foundation deliver significant cost savings over the use of full sheets since the bees will build the majority of comb naturally without the benefit of foundation. Starter strips can be made of either 100 percent pure beeswax or beeswax coated plastic. In the case of starter strips made of plastic, disposal issues are reduced, though not eliminated. Time and labor association with starter strips of wax is about the same as for full sheets of foundation since the time saved by not having to support the foundation strip with wires or support pins is used by the time required to cut up the full sheets of foundation into strips. Potential initial contamination issues are greatly reduced since much less commercial beeswax is being used to begin with. Strips take more time and attention in order to produce consistently straight combs. While mostly natural comb built from starter strips may contain significant amounts of drone cells, science is starting to support the idea that a certain level of drone comb is important to maintain the health of a colony. Starter strips do not result in finished combs that are as durable as full sheets of beeswax foundation, however this weakness can be overcome with careful management and handling.



New, clean wax on black plastic foundation

Foundation

One hundred percent natural comb is the least expensive option and requires the least amount of time and labor since the bees are given no foundation at all, and instead are given frames or top bars that are shaped in such a way that simply encourages the bees to build their comb in place. Natural comb also has the potential to contain the least amount of chemical contamination since absolutely no commercial beeswax is utilized in the construction of the comb. As with starter strips, combs are likely to contain significant amounts of drone cells, and more time may be required to ensure that the combs are consistently built straight. In addition, greater care in handling and management is needed with frames of naturally built comb due to the lack of comb support typically provided by wires or pins.

Get those new combs drawn out

All new combs, whether they are built from full sheets of foundation, starter strips, or built naturally without foundation will require a honey flow. In order to get combs drawn out in a timely manner, it is best to time your comb rotation activities to coincide with the local honey flows whenever possible. If the timing is off or the honey flows don't materialize, feeding an artificial diet rich in carbohydrates will be necessary.

Given what we know about the pesticide and pathogen laden environment that today's honey bees have to navigate, the importance of comb ⇨

New wax is always better than old wax

management has never been greater. With the many options for comb rotation available, beekeepers have little excuse not to adopt a method that ensures hives are filled with comb that have relatively low levels of pesticides and pathogens year-round.

Ross Conrad is the author of Natural Beekeeping 2nd Edition published 2013 by Chelsea Green Publishers.

Ross Conrad manages his comb and his bees in Vermont.

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NUTRITION THOUGHTS

Charlie **Vanden Heuvel**

The three legs of survival for the honey bee consist of a viable Queen, sufficient nurse population to sustain the brood production, and nutrition. In the struggle to maintain healthy hives it seems the third leg is least considered. As beekeepers, pests and diseases along with brood patterns seem to dominate literature. Much like our own health, paying a bit of attention to nutrition appears prudent.

Multiple factors impact the stress of the honey bee colony. Anecdotal evidence derived from beekeepers strongly suggests that applying timely and consistent feeding regimens (both protein and carbohydrates) suffered diminished losses (Sagili 2012).

Honey bees require carbohydrates (derived from sugars in nectar or honey), amino acids (protein in pollen), lipids (fatty acids, sterols), vitamins, minerals (salts), and water. Each of these elements must be present in the right ratio for a colony to thrive.

Pollen is gathered from plants and flowers, it is the male contribution to the next generation of plants. The pollen is mixed with nectar to form 'bee bread', a protein-rich food which is fed to the young brood propelling their growth from egg to larvae to pupae and ultimately becoming a healthy adult bee.

Uncapped honey

Nosema ceranae, a gut parasite, has been treated with Fumagillin, which is no longer being manufactured. Evidence strongly suggests diverse pollen intake from quality sources drastically reduces the prevalence of this affliction (Eischen and Graham, 2008). Parallels are easy to visualize between human health and the honey bee when it comes to nutritional balance. Commercial bees thrust into the mono pollen culture in the almond pollination endeavor were found suffering.

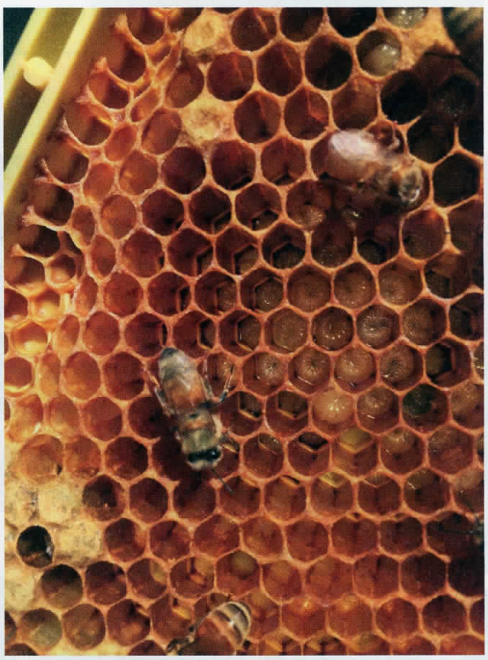
Bee nutrition consists of two primary sources: pollen and nectar. Pollen is the honey bees' source of protein, lipids, sterols, vitamins, minerals and certain carbohydrates. (Todd and Betherick, 1942). Nurse bees provision pollen, having been processed along with the addition of glandular secretions in feedings to the brood. Bee bread or worker jelly undergoes conversion through paired food glands, hypopharyngeal glands (HPG) located in the frontal area of the worker bee's head. This protein-rich jelly is fed to the Queen, Drone and Worker larvae.

Nectar becomes the primary source of carbohydrates. Sugar concentration, varying from 5% to 75%, typically ranges in the 25% to 40% range. The foraging bee sucks up the flower's nectar through its proboscis storing it in her honey crop (stomach). Should the forager require energy, she is able to allow some of the crop nectar into her system via the preventriculus, a structure posteriorly situated on the crop allowing it to flow into the digestive midgut. This structure also acts as a one-way value preventing contamination of the nectar in the crop (Huang, 2010).

Nectar consists of complex array of chemicals along with sugars. Amino acids, lipids, proteins, organic acids, vitamins and inorganic minerals are also evident (Baker and Baker, 1975).

Honey, for the bee, is the source for energy-intensive foraging and colony thermoregulation. The adult bee requires continuous carbohydrate intake. Younger adult bees sustain themselves through abdominal lipids. These lipids are diminished as the bee progresses into its latter life gathering nectar and pollen.

Resistance to pathogens, are enhanced through enzyme-based immune responses of encapsulation, phenyloxidase, and lysozyme activity (Siva-Jothy et al., 2005). Simply put, poor nutrition allows the ever-present disease and pest onslaught to prevail leading to colony demise.



Uncapped brood

Malnutrition in honey bee populations lead to immune system impairment and increased pesticide susceptibility. Focusing

hive management toward prophylactic treatments in pest and diseases in lieu of an eye toward to balanced nutrition diminishes survivability and weakens lines of successive generations.

Immunocompetence within a colony produces stress, giving way to biotic stress factors allowing vectored viral pathogens as well as pests to take hold (Gennaro Di Prisco, 2016). Thus, a correlation exists between nutrition and the ability of the honey bee to ward off singular but more often multiple stress agents. Reduction of foraging habitat coupled with inattention to the importance of nutritional needs has led to higher incidences of loss.

Identified stress factors on honey bee health include a variety of issues. Although pesticides are one of the identified sources, singular focusing on this issue muddies other prevalent ones. Beekeeping, especially in the smaller backyard variety, has escalated significantly. Although the new beekeeper ventures with a big heart, often the lack of knowledge of honey bee biology and behavior results in hive losses.

How often is the cry emitted from a bee loss due to Small Hive Beetle, Wax Moth or the seasonal Winter loss? All while ignoring nutritional needs of the bee. Attention to pre-Winter management leads to lessor losses, and of course, strong colonies emerging in the Spring.

Ignoring this vital leg of nutrition in the honey beehive's health produces poor management. The introduction of the *Varroa* Destructor Mite in the late 1980s exacerbated this oft-neglected aspect. Viruses, evident prior to the onslaught of the mite, took a quantum leap forward in their presence as the *Varroa* proved an exceptional vector. Consider the relationship of the mosquito to viral proliferation as a parallel to the *Varroa's* role in the honey bee's health.

The reduced foraging habitat must be considered commensurate with the hives micro-climate in consideration of bee nutrition. Supporting the protein sustenance with pollen substitute is a positive management technique. Substitute alone fails to provide additional requirements such as sterols. Peppering the patty with fresh pollen brings greater nutritional balance.

Encouragement amongst new beekeepers to seek out education through books, local bee clubs, and viable mentoring should be developed. Sporadic attention to the health of the hive only leads to tears of sadness. Numerous sources exist delineating hive management. Unfortunately, the novitiate is unaware of these sources or ignores their importance.

Let us not focus our entire research army toward new acaricides. An enhanced appreciation of the nutritional needs, physiology and sources of honey bee nutrition is strongly indicated.

Capped honey

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Feeders

It's not only what you feed your bees, but how you feed them

David **MacFawn**

Feeding your bees for their survival is critical if they are out of food. Sugar syrup feeders and pollen feeders are important for feeding. Each type of feeder has its place. In the southeast the pollen feeder has replaced pollen patties due to Small Hive Beetles (SHB) reproducing in pollen patties.

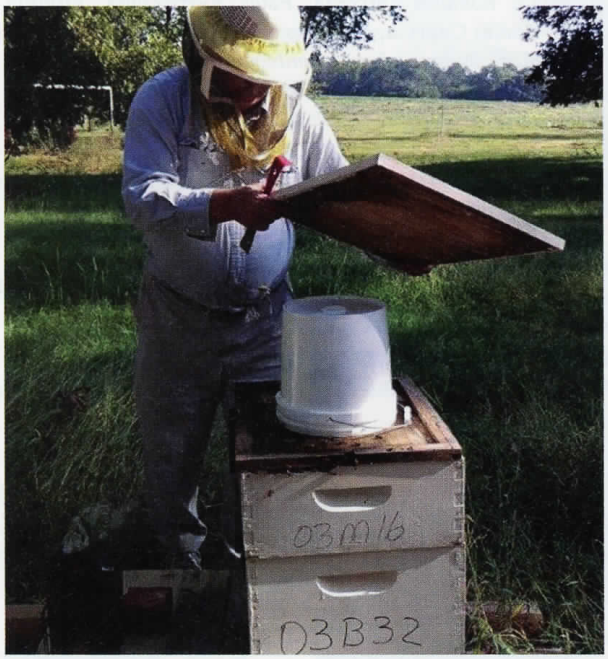
Sugar Syrup Feeders

Pail feeders are inexpensive (about $8 for a two gallon). However, they do require an inner cover. The pail feeder is inverted and the pail sides squeezed and released to create a vacuum so the feeder will not leak. Then the feeder is placed over the Porter bee escape hole on the inner cover. Pail feeders are easy to fill, transport, and clean. Most beekeepers place a deep super around the pail feeder to prevent hive issues with weather. Tiny holes punched in the lid or a screen allow the bees access to the syrup. If you use a migratory cover without an inner cover as your standard configuration, you will need to use an additional inner cover to place the pail feeder on.

Frame feeders, also known as Division Board feeders, work well in warm weather. However, in cold weather the bees may not be able to access the sugar syrup. Frame feeders are easy to fill when the feeder is placed on the side of the brood chamber or super. The super above is merely slid over, the frame feeder filled, then the super slid back into place. A float, such as a twig or popsicle stick, or other material needs to be placed in the frame feeder to keep bees from drowning. Cleaning the frame feeder may be tricky since it needs to be removed from the hive.

Jar feeders work well in warm weather or cool weather in the southeast. In much of the southeast it rarely gets below about 25°F. Sugar syrup will typically not freeze in much of the southeast. Bees can access the syrup in warm or cool weather. When the bees move upward through the equipment stack in the Winter, and they exhaust their honey stores and reach the feeder, the bees can huddle under the feeder and access the sugar syrup. Jar feeders are inexpensive, the jars can be transported easily, and cleaned easily. It should be noted glass jars may break in the beeyard causing an issue. Thick plastic jars are recommended; thin plastic jars will collapse.

A 10-frame hive top feeder (also called Miller Feeders) with floats costs around $27. A two gallon pail feeder costs around $9, plus an inner cover which cost around $11 means the beekeeper has about $20 initial invested. Therefore, a hive top feeder configuration is about $7 more expensive than a two gallon pail feed configuration. If you only have a few hives it may not matter. A hive top feeder is easier to refill than a pail feeder which results in less management time. With hive top feeders, the bees access the syrup via the opening between the reservoirs. Mold in both will need periodic cleaning. Use of Honey Bee Healthy has been proven to reduce mold in all types of feeders. Hive top feeders will hold greater than two gallons, and a pail can hold about two gallons. The feeder size is important if the beekeeper has outyards. Larger



Pail feeder

Frame feeder

Hive top feeder

feeders are preferred for outyards so you do not have to make as many trips.

Yard, or open, feeders should be at least approximately 200 feet away from the apiary to prevent robbing. A yard feeder may be as simple as a bucket with straw so the bees do not drown in the sugar syrup. However, the issues with yard feeders are:

- Weak colonies may not get their fair share of the sugar syrup
- They may spread diseases
- The bees cannot access the sugar syrup in cold weather when the bees do not fly (typically less than 48 to 50°F)

However, yard feeders have their place for time efficiency and reduced labor.

Boardman entrance feeders should only be used to dispense water. Feeding sugar syrup via a Boardman can cause robbing. Also, feeding sugar syrup via a Boardman in the Winter results in the bees not being able to access the syrup if the bees are clustered. Visible clustering occurs at 57°F. Boardman feeders are inexpensive, only around $5 plus the jar cost.

If you are a Top Bar Hive user, I refer you to Dr. Wyatt Mangum's Top-Bar Hive Book for feeding discussions.[1]

Pollen Feeders

In some locations there may be seasonal pollen dearth's. Pollen dearth's are especially critical in Autumn when the Winter bees are developing. Lack of pollen will reduce brood production even if you have plenty of nectar/honey. It takes pollen and honey to produce young bees. Hence, it may be viable and important to feed pollen substitute to stimulate brood production.

Several methods are available. The beekeeper can feed pollen patties or dry pollen in feeders. Pollen patties have lost favor in the southeast due to small hive beetles (SHB) reproducing in the pollen patties. Dry pollen in pollen feeders has replaced pollen patties as the method of choice in the southeast. A pollen feeder may be as simple as a pail turned 90° on it's side and nailed on a tree (Figure 7) or a more elaborate pollen feeder (Figures 8 & 9).

Another way to feed dry pollen substitute is to ⇨

Jar or Boardman feeder

place a small amount on top of an inner cover. However, you need to watch if the pollen substitute gets wet from the hive moisture and attracts SHB. Putting pollen substitute on top of an inner cover will help colony pollen shortage in cold weather when the bees cannot fly.

Pollen patties use to be placed immediately above the brood nest. A small quantity was used to minimize attracting SHB and of an amount that the bees could consume in a couple days. However, each hive had to be opened which required a lot of time.

Figure 7

Figure 8

In Closing

Each type of feeder has its use, benefits, and disadvantages. The pail feeder is the most versatile for warm and cold weather. It is also an inexpensive way to feed syrup. Yard feeders are even less expensive but have some disadvantages. Pollen feeders are also important for continued brood production during pollen dearth's especially in Autumn. Feeding dry pollen substitute in pollen feeders alleviates some of the Small Hive Beetle issue inside the hive.

1Mangum, Wyatt A. "Top-Bar Hive Beekeeping: Wisdom & Pleasure Combined," ISBN 978-0-9851284-0-1.

Figure 9

Be Sure To Watch The Wacky Weather

Ann **Harman**

Not enough snow, too much rain, high winds, drought, too cold, too hot. Have you paid attention to the weather? Your bees have. Bees have just as much difficulty coping with wacky weather as we do, but in a different way. As beekeepers we need to link the weather we are and have been observing to the needs of the bees. Yes, they have ways of coping, up to a point. Sometimes that point is too many dead bees to have a viable colony, especially if Winter is approaching. It really is difficult to think of Winter on a roasting-hot sunny August "dog day." August, known in many parts of the world for its hot, steamy days, were probably called "dog days" because the dog star, Sirius, becomes visible and follows the constellation Orion, the hunter, through the sky in the northern hemisphere.

Autumn brings with it the goldenrod

August is the beginning of the Bee New Year. In the far northern areas of the U.S. the bees may have started Winter preparations. In the deep south and desert areas of the southwest the bees' Winter plans have not yet begun. No matter where you live August is an important month for bees. In the temperate areas Spring brings a profusion of flowers for both pollen and nectar. Early Summer seems to provide a number of plants for bees. However, in many parts of the U.S. August can be a month for dearth of blooms – plus wacky weather, especially thunderstorms or drought.

Autumn plants in the wild, such as goldenrod and aster, do not come into bloom until after the cooler days of September and October. Other bee plants are also in bloom at that time. Suitable bee plants, except ones planted in flower gardens, can be scarce in many parts of the country during August. We tend to think of a garden around a house as being filled with blossoms and in turn being filled with visiting bees. Those carefully tended gardens do help. But stop for a minute – you tell your honey customers that it takes two million blossoms for bees to fill that one-pound jar of honey you just sold them. Does your flower garden have two million blossoms? Even if it did, is that one pound of honey enough for a colony of bees during August?

The higher the temperature, the shorter lifetime a flower has. The plant itself may continue living and even grow some stems and leaves, but the flower may only stay for a day or so, depending on the type of plant. During that bloom time the visiting bee may receive a banquet lasting for several days or merely a snack that lasts one day. Start paying attention to what the flowers are doing. Find a bee plant, call it your "target plant" and pay attention to its blossoms. Then you will understand better what your bees are receiving.

The United States has its share of weather horrors – tornadoes and hurricanes. Not everyone, everywhere will encounter those, but ferocious thunderstorms with wind and hail are more common. Bee forage and forage areas are subject to damage from any of the three. Hurricanes are East Coast problems with an official long season from June 1 through November 30. But September seems to be the peak month. Bee pasture can simply be flooded; useful trees blown down. Tornadoes demolish everything in their narrow path but the usual season of March through June is shorter than hurricane season. Even though you breathe a sigh of relief when you, and your hives, missed one of those three storms, consider that some of your bees' favorite food sources may have been affected.

Can rain day after day after day affect our bees? Bees cannot fly in rain – if hit by one drop a bee can be tumbled. So bees stay home and eat their stored honey. But that amount of honey is also needed for raising bees and feeding the house bees. If a few days without rain occur after those endless days of rain, the nectar can be more dilute than normal and pollen may have been washed out of some blossoms. Therefore endless days of rain can be as serious as endless days without rain – a drought.

Drought can occur anytime, anywhere. You might only notice lack of rain if your garden tomato plants look a bit wilted. As you go out to water your tomatoes think about the bee forage. Nectar has a high water content. If water is lacking, nectar production will be diminished meaning much less for the bees. During prolonged drought the plants will have to curtail both their growth and production of flowers. You can obtain drought severity as well as other drought information, including maps, from **www.drought.gov**.

Do bees need to be fed during the Summer months? If they need

it, yes! You need to be a Weather Watcher and a Plant Watcher and then look inside your hives to make certain they have enough stores of pollen and honey for survival. Keep records! Every colony has its own behavior and number of bees so do not assume all have the same food stores.

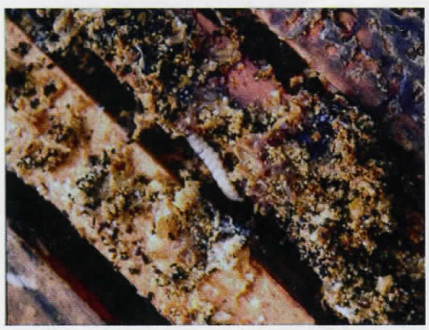
If you could have a look at a colony's calendar you will see it has marked August as Robbing Month. A small colony with plenty of honey stored is a prime target for robbing by a strong colony, even if the strong one has plenty of food. Spilling sugar syrup in the beeyard, using entrance feeders, feeding only some colonies even with in-hive feeders all give the robbers a chance to take advantage of "fly-in fast food" honey. Guard bees will confront robbers and some fighting may be seen at the entrance. Also robbers tend to fly quickly straight in, while foraging bees seem to be slower and more deliberate in their arrival. Pay attention to action at the entrance.

You do not want to assist the robbers! Inspections late in daylight hours can help because bees are returning home when daylight is disappearing. Installing a robbing screen on each hive works very well. You can purchase a robbing screen from some equipment suppliers but you need to call it a Moving Screen to find it. If an inspection has to be done, draping an old bath towel on top of a removed hive body can help. You can purchase a Manipulation Cloth from Brushy Mountain Bee Farm.

The minute you notice robbing take action immediately. Stuffing all the entrances with grass and weeds will stop robbing. When the grass wilts the bees will shove it away. Another trick is to immediately remove all the tops off all the hives. Yes, it works! You can put the tops back on after dark. With only a few hives letting a lawn sprinkler to sprinkle the entrances sends all the bees home – they think it's raining. You can also use entrance reducers on the hives to make it easier to be defended.

You may not be ready to requeen a weak colony but you do need to keep monitoring it. During these Summer months you just might see – ewwww! – an icky-looking white wormy thing moving across a comb. Depending on where you live this industrious whitish larva could be a wax moth larva or a small hive beetle larva. Your colony does not want either of these. But it has not had the number of bees to keep the hive safe. Now it is your task to see what you can rescue.

At first glance both the shb and wax moth larva look the same. Fortunately in books, booklets and also on the internet good photos and drawings can be found. If you Google wax moth larvae vs small hive beetle larvae you will find excellent information. One clue that you can look for are trails of webbing on the comb made by wax moth larvae. The beetle larvae do not make webbing but they will "slime" honey stores. The honey is actually fermenting so it will have an odor usually described as that of rotting oranges.



Wax Moth

Small Hive Beetle

If you do not have information on each of the pests, you can obtain it easily since many states have Cooperative Extension Service bulletins available. Or you can Google eXtension small hive beetle and eXtension wax moth. These eXtension sites give information on the pests and their control.

In the meantime what can you do for that weak colony? Is there an experienced beekeeper in your local club who could help you determine the extent of damage and whether the weak colony can be salvaged? If you are a First Year Beekeeper, do you have a mentor? Both being a member of a local beekeeping club and having a mentor are extremely important to your progress in beekeeping. Although you can get a dozen different pieces of information from only eight or 10 beekeepers, the advice and help you receive are valuable. Start building your beekeeping library and reference materials. Did you take beekeeping classes? Then review your notes and any handouts.

Now just one more problem. *Varroa* mites. All colonies have *Varroa* with the possible exception of African bee colonies, but they have their own special problems. An ideal time for treatment is early to mid-July when *Varroa* numbers can be reaching their peak. But testing for *Varroa* can be done at any time. You can use the powdered sugar shake or an alcohol wash. You can make your own test kit or you can buy one. It does not matter. What does matter is that you **do** test and treat if necessary. The threshold of three mites per 100 bees will tell you if you should treat. Testing after treatment can tell you how effective your treatment was. In warmer climates where brood may be raised into the later Autumn months it may be wise to test for *Varroa* levels again.

Many treatments for *Varroa* are available. Select one that fits your style of beekeeping. Do it correctly. Follow instructions! The death of *Varroa* and the life of your bees are important. As is the purity of any honey crop you make this season. If you have selected one of the chemical treatments you must read the label for daytime temperatures and for use when honey supers are on the hive.

So during these Summer months your bees have had to face the weather (drought, severe storms), theft of their hard-earned honey stores, invasion by wax moth and small hive beetle and the viruses carried by *Varroa*. Is there anything else that could possibly happen? Well, a colony could decide, all by themselves, to cast a late small swarm. Why? Because they felt like it. Wave it goodbye. Something good just happened. You now have a break in the brood cycle that will help with *Varroa* control.

Fall Inspections In The Southeast

What to look for and why.

Jennifer **Berry**

So far, 2018 has been a fairly decent year for most of us southern beekeepers. Years of disappointing nectar flows, (due in part to water-starved or water-soaked landscapes), didn't occur. This year, when the Spring rains did arrive, they stopped just as the bloom began to open, letting the sun shine in and the nectar flow. Assuming we were diligent beekeepers and took care of any issues throughout the Summer, our bees could be stronger than ever going into Winter and hence into the 2019 Spring nectar flow. But, if we haven't prepared our colonies for Winter yet, it's already late August, so we better get moving! This is the time to check our colonies for food, queen performance, disease and pest activity, and take care of any other issue as well. So grab those colony data sheets and let's get cracking by checking each and every colony from top to bottom.

Start by removing the lid and looking for small hive beetles (SHBs). Populations are higher than normal this year due to our warm Winter and moist Spring and Summer; therefore some colonies may have more than they can handle. If you see these little black devils scurrying about, placing traps in your colony may be the way to go. There are several on the market and available through the bee supply companies. We've tried them all and have had the best success with the Beetle Jail Baitable (plastic, two-chambered reservoir, with a center chamber to place bait which snaps onto a frame) and the Beetle Blaster (single chambered reservoir which rests between two frames). Both work by filling them with oil. The beetles scurry into them to hide from the bees and end up drowning in the oil. However, be careful when filling these traps to not fill them to the top. Only fill the reservoirs about half way, otherwise you may spill oil onto the bees when placing them into the hive and the oil will kill bees **instantly**. Since temperatures are still warm, beetles mainly keep to the outskirts of the hive, so place the traps where you see the most beetles. As temperatures begin to drop they will begin to migrate towards the cluster. But, for now, most SHBs can be found in the upper supers, hiding in the corners and in-between the frame parts. A word of caution; SHBs love frame spacers and plastic frames because they provide little pockets into which the beetles can hide and disappear.

Another new strategy for dropping beetle populations, is a Brawny Dine-A-Max beetle towel. It's basically a micro fiber, industrial paper towel, that the bees chew on, causing it to be turned into fluffy/fuzzy material. Once the towel has been transformed the spines on the beetle's legs become entangled and ensnared in the fabric. After a few weeks, the fabric may be covered in beetles or not. Every colony is different. From my experience, if the bees heavily propolize the towels, then very few beetles get trapped, but if they don't and "fluff" them up, then there are plenty of beetles caught within the threads.

Small Hive Beetle

The next task is to assess the amount of honey stores. Depending on numerous factors, nectar flows can differ drastically from one apiary to the next. If flows were below par, or too much honey was taken for human consumption, feeding must become a priority. Once the temperature drops, it is difficult for the bees to break cluster to collect and store the food. All the syrup in the world will be useless if the bees can't get to it. And think in terms of gallons when feeding. It has been my experience that five gallons of a 2:1 sugar solution (two parts sugar to one part water) will yield one full medium super (roughly 35 pounds). Depending on your neck of the woods, this may not be enough. If you are unsure of how much honey is required to get a colony through Winter in your region, consult an experienced beekeeper in your area. The further north bees are kept, the more honey is required to survive the Winter. The rule of thumb we go by this time of year and here in the Piedmont region of Georgia; for every frame of bees/brood, they will need a frame of capped honey. But depending on how the Winter shakes out, you may still need to feed during the critical months of

January and February when the queen is laying eggs like crazy in anticipation of Spring.

A word of caution; feeding this time of year can be tricky, so be careful not to trigger robbing (when

Honey

bees from a neighboring colony/ies invade and steal most or all of the invadee's honey). A single drop of sugar syrup clinging to the side of a colony or spilled at the entrance will attract attention, especially if nothing else is available. Once bees start robbing it becomes a feeding frenzy, with even strong colonies succumbing to the onslaught. That is why I don't use top feeders, entrance feeders, or baggies. We use 2 – 5lb honey jars, so I'm feeding one gallon at a time. Also, if a colony is starving or in desperate need of food and the weather outside is chilly, I can put the food directly above the cluster so all the bees have to do is lift their heads and eat. Bees cannot, will not, break out of the cluster and traverse across cold surfaces in order to eat. They just can't do it. So another item for your check list is to make sure the honey is properly placed. Honey should be above and surrounding the sides of the cluster. Not to the bottom. As Winter progresses, the bees move up and into the supers above.

Next moving into the brood chamber, check the viability of the queen. How does her brood pattern look? Are there skipped/open cells? Do you see any supersedure cells? If the pattern is spotty and the colony population is weaker than most, you may want to look for other problems first, such as disease or mite infestation before automatically assuming there are queen issues. However, the queen could be old, poorly mated, injured, or not properly reared. If you determine that the queen is failing, and the colony is weak, your best bet is to combine the colony with a strong one or one needing a boost. Weak colonies rarely survive the Winter, so there's no sense in allowing the colony to limp along when you could have spared the bees and equipment from eventual disaster. Plus, re-queening this late in the game can be tricky, even if you could find a supply of queens.

Goldenrod blooms in North Georgia during September and moves south, with the Piedmont region usually experiencing a pollen flow by early October. So far, there's good ground moisture in place and plenty of sunshine, so the south should experience a decent bloom. In years past, drought prior to, or excessive rain during the bloom meant minimal amounts of late-season pollen. Since adequate amounts of pollen must be available to produce Winter bees (which we'll explore in a minute), check the pollen supplies. If pollen stores are lacking you may not want to wait for the Fall pollen, just in case it doesn't materialize. Pollen patties are simple and easy to install and can be purchased already mixed together or in powder form. You may want to try several to see which you prefer. Another word of caution: SHBs love pollen patties. If you are seeing SHBs, portion out the pollen patties in stages (a ¼ or ½ patty at a time) otherwise they remain in the hive too long and the beetles will oviposit into them creating a wiggling, disgusting, beetle larval mess.

Next, examine the brood area for disease. You want to see healthy, white larva in the cells. Also, look for depressed cappings or ones with holes. Open these and inspect the pupae. Anything slightly off-color may be a sign of trouble (unless the pupa is in its later stage of development). Again, if you are unsure about what may be ailing your colony, consult a professional for diagnosis and treatment options.

Another chore before the Winter winds come a howling, is to inspect your equipment. Move frames with old comb to the outer edge so that they can be removed in the Spring and replaced with new foundation.

Brood

Old brood comb is a reservoir for numerous contaminants, which can be detrimental to the developing brood and should be removed every three years. Replace old, decrepit hive bodies, supers, lids, inner covers and bottom boards with newer equipment. Beehives don't have to be pristine little palaces; however, they do need to protect the bees from the upcoming frigid Winter weather. Gaping holes and cracks allow access for critters to come and go. Mice especially love to make their Winter homes in a beehive. A continual food supply, plus a warm cozy environment, make hives a suitable rodent dwelling. Structurally tight equipment and mouse guards discourage these unwanted guests.

Queen issues, food supplies, disease, and bad equipment are all things that need to be addressed before the arctic air descends upon us. Yet, there is still one more thing that we must not overlook: *Varroa*

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mites. By the end of Summer, mite populations may be skyrocketing. Please don't wait until your colonies are crashing. Once the downward spiral begins, it is almost impossible for them to recover. Check those mite populations today. Not only is it important to get their numbers under control for the existing bees, but also for the future bees that will bring the colony into the New

Varroa Mite

Year. I'll get back to the importance of reducing mite populations, but first let's talk about these future bees.

The average lifespan of honey bees varies considerably based on the season when they emerge. These variations have been designated into two groups of bees dubbed Summer bees and Winter bees. Summer bees live approximately one month, while Winter bees can live anywhere from six to eight months. Winter bees emerge will begin to emerge in August or September, depending on location, and differ from Summer bees by several physiological characteristics. Scientists have determined that the lifespan of honey bees can largely be determined by the amount of protein stored in the fat body, hemolymph, and hypopharyngeal glands. The most notable and scientifically relevant type of protein is the high-density glycolipoprotein vitellogenin. It is loosely described as a female-specific, hemolymph storage protein, or more specifically, an egg yolk protein precursor. However, since worker bees rarely lay eggs, this protein is stored in fat bodies for future use. The relevance of this specific protein is largely based on its abundance in honey bee hemolymph as well as its high zinc concentration which regulates many functions within the honey bee. Vitellogenin is also thought to be a powerful anti-oxidant which significantly slows the effects of aging.

Now, getting back to the importance of reducing mite populations. Higher mite populations going into Fall, (and the viruses associated with them), coincide with the production of these Winter bees. Research has shown that mite infestation during the pupal stage has a negative impact on the bees because they are unable to accumulate the necessary hemolymph proteins, including vitellogenin, to the same extent as in non-infested bees, thus reducing their ability to overwinter. In order for the colony to have a chance of overwintering successfully, it is imperative to reduce mite levels before the production of these Winter bees. And to step back even further, the bees rearing the Winter bees need the proper nutrition and development as well. They must be healthy enough to rear the Winter bees, and the bees rearing those bees need to be healthy, and so on.

Managing mites is the most important and difficult task for beekeepers since it is the number one reason bees die. If mite loads are high or if you are new to beekeeping, we recommend that you treat immediately for mites, especially if you haven't done so this year. We recommend several products for use this time of year, Api Life Var or Apiguard, both using essential oils as the active ingredient. There are temperature restrictions for this product, so follow all directions while using these or any products in your colonies. There are other miticides available, but we have the most experience using the ones with essential oils. Next issue, I will discuss our research results using oxalic acid and vegetable glycerin to combat mites.

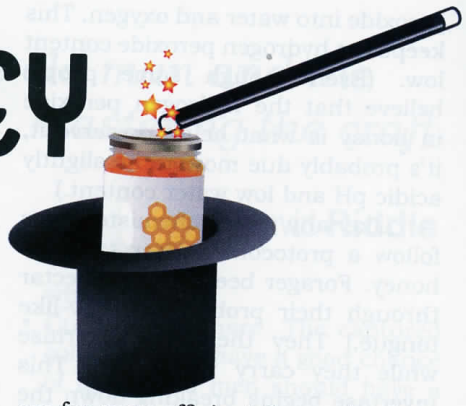
Re-queening, appraising honey and pollen stores, checking for mites and disease, inspecting equipment (while keeping robbing at bay) will help the colonies do what they want to do, survive! By storing honey for energy and pollen for protein, European bees have evolved to survive long Winters. But unfortunately, with introduced exotic parasites, diseases, viruses and a whole host of other non-indigenous species, "we" have thrown this whole process out of kilter. Now "we" the beekeeper must be better stewards of our bees or face the consequences of finding more and more of our hives devoid of life.

Take care of you and your bees!

ALL ABOUT HONEY

It's Almost Magic!

Sharla **Riddle**



Honey bees are chemists. Using enzymes and dehydration, these scientists of the natural world are able to change the sugar in nectar into a supersaturated power food. It's no small feat-honey is composed of at least 181 components. Its unique taste is a result of complex chemical processes, which is why sugary syrup substitutes just can't compare. They can't mimic Mother Nature's chemical know-how. Last year alone, bees in the United States produced a whopping 158 million pounds of honey. That's a lot of chemistry.

Honey is composed mostly of the sugars glucose and fructose. It's what scientists term a supersaturated solution. When sugar is stirred into a glass of water, some sugar is usually left at the bottom. That's because the water (solvent) will only dissolve a certain amount. But, if the water is heated, more sugar can be dissolved. Consequently, in supersaturation, heat, enzymes or other chemical agents can increase the amount of material dissolved. These solutions tend to crystallize easily. Syrup, fudge and honey are all considered to be supersaturated solutions. Because of its supersaturation and low water content (15-18%), honey is *viscous*. That means it is rather thick in consistency and sometimes it's solid. Its main ingredients are carbohydrates (sugars,) but it also contains, vitamins, minerals, amino acids, enzymes, organic acids, pollen, fragrance and flavor compounds.

All honey begins with nectar. Whereas honey is viscous and has a low water content, nectar is about 80% water. It's a very thin solution – colorless and not nearly as sweet as honey. It's also chemically different. Through the use of enzymes, bees are able to convert the complex sugar in nectar into more simple sugars. This is why honey is more easily digested than regular table sugar. Its sugars (glucose and fructose) are simpler than sucrose (table sugar).

Sugars are sometimes called "sweet carbohydrates."

(Carbohydrates are one of the three primary classes of foods, along with proteins and fats.) Some sugars like glucose and fructose are simple, while others such as sucrose (table sugar) are more complex. A honey bee's secret weapon is its ability to change these complex sugars found in flower nectar into simple sugars. This process is called *hydrolysis*. In order to change sucrose (table sugar) into glucose and fructose, heat, acids or enzymes must be added. It's a complicated process in the lab. But, when it comes to honey chemistry, bees (and their enzymes) are far more efficient than scientists.

Because 95 to 99.9 % of the solids in honey are sugars, in order to understand honey, it's necessary to understand sugar. Pure cane sugar is almost all sucrose. It's called a disaccharide and is formed when two simple sugars are joined. That's why it's sometimes called a "double sugar." Sucrose, which is found in nectar, is made of the simple sugars glucose and fructose. These simple sugars are called *monosaccharides*, which means "one sugar." Even though fructose and glucose have the same chemical formula ($C_6H_{12}O_6$), they're two different sugars. That's because their atoms are arranged differently. This difference in atomic arrangement, makes fructose taste much sweeter than glucose. Honey is also slightly sweeter than table sugar, because honey contains more fructose.

Honey bees don't just gather the nectar, they change the nectar chemically. They produce an enzyme called *invertase* in their salivary glands. Enzymes are organic compounds that speed up a biochemical reaction. These enzymes are not used up in the reaction, so they can be used over and over again. After the nectar is gathered by the bee, invertase is added. This enzyme helps change sucrose into equal parts glucose and fructose. It's the beginning of honey. Other enzymes also help honey taste better. *Amylase* is an enzyme that helps break down amylose into glucose. Glucose is easier to digest and it's what makes honey sweeter. Another enzyme, *glucose oxidase*, then breaks down the glucose and stabilizes the pH of the honey. *Catalase* changes hydrogen

peroxide into water and oxygen. This keeps the hydrogen peroxide content low. (Even though some people believe that the hydrogen peroxide in honey is what helps preserve it, it's probably due more to its slightly acidic pH and low water content.)

Like any good chemists, bees follow a protocol in order to make honey. Forager bees draw in nectar through their proboscis (straw-like tongue.) They then add invertase while they carry the nectar. This invertase begins breaking down the sucrose into glucose and fructose in the honey stomach (crop). The foragers then transfer the nectar to the house bees, where more enzymes are added. This enzyme-adding process continues each time another bee picks up the nectar. House bees regurgitate and re-drink the nectar over a 20 minute period, which further breaks down the sugars. When the nectar is about 20% water, it is deposited on the honeycomb, where the bees fan it to speed up the evaporation process and further condense the honey. The bees stop when the water concentration is between 17-18% and move it to its storage location. Thus, through the use of evaporation and enzymes, a supersaturated solution has been formed.

Like any supersaturated solution, honey tends to crystallize. Crystallization occurs when long chains of glucose (polysaccharides) in the honey are broken down. The glucose molecules start sticking to one another usually on a speck of dust or pollen. These glucose crystals then Fall to the bottom of the jar. The problem with crystallization is that when the glucose is separated from the honey, the leftover liquid contains a higher percentage of water. Yeast, now with enough water and sugar causes the honey to ferment. That's why honey that crystallizes may ferment more quickly than non-crystallized honey. Temperature can affect crystallization. Honey is best stored above 50°F. Researchers have also concluded that honey removed from the comb and processed with extractors and pumps is more likely to crystallize than honey left in the comb because of the fine particulate matter introduced for crystals to begin on. Other factors that contribute to crystallization are dust, air bubbles, and pollen in the honey. Crystallization isn't always bad. Creamed (spreadable) honey depends upon controlled crystallization. While natural crystallization creates grainy crystals, controlled crystallization creates a smooth and creamy product.

Heating honey can cause chemical changes, as well. Sometimes, honey darkens due to a process known as the Maillard Reaction. Because honey is slightly acidic with a pH of about four, browning can sometimes occur over time. This is because the amino acids in honey begin reacting with the sugars. Caramelization, the browning of sugar, is caused when heating begins breaking the molecular bonds in the honey. When these bonds are broken and then re-form, caramelized sugar is the result. Heat can also affect both honey and high-fructose corn syrup. When fructose is heated, HMF (hydroxymethylfurfural) can sometimes form. HMF is deadly to bees. HMF can form at relatively low temperatures (110-115°F.) If honey bees are fed high fructose corn syrup that's been stored or transported in hot conditions, it might kill them.

Heat and crystallization can also affect the color of honey. Crystals in honey will cause it to appear lighter in color. That's why creamed honey is lighter in color. In nature, the color of honey is usually due to the type of flower nectar from which the honey derived. Consequently, honey collected in the Fall will usually differ in color than honey collected in the Spring. That's because different flowers are in bloom. The USDA classifies honey into seven color categories: water white, extra white, white, extra light amber, light amber, amber and dark amber. Light colors of honey most often have a milder flavor than darker honeys.

Honey is *hydroscopic*. That means it collects moisture. If it's left uncovered, honey will begin to collect moisture from the atmosphere. This extra moisture in the honey will allow the yeast to begin the fermentation process. Normally, honey has a low moisture content which helps in preservation. If, however, its moisture content rises above 25%, it will begin to ferment. That's why collecting capped honey from a beehive is a good idea. It has a lower moisture content and is much less likely to ferment.

Honey is produced in every state of the U.S. The USDA estimates that there are over 266 million colonies in the U.S. with the average colony producing 59 pounds of honey. What makes these numbers most remarkable is that honey isn't manmade. It's only guided by man. The true chemists in the production of honey are the bees. Their ability to seek out and convert nectar into honey has resulted in literally hundreds of different floral varieties of honey. Those are some sweet statistics.

Sharla Riddle is a retired educator and freelance author. She has been named a Huddleston Scholar, Tandy Scholar and RadioShack Science Chair. Her previous articles have appeared in Bee Culture, Teaching Today *and* Gifted Child Today *magazines.*

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OLD MAN

The old man and the bee, mastering the craft

David **Riddle**

In Hemmingway's story an old man catches a big fish and battles the sea and the creatures therein to bring the fish home and show it off. The reviewers sometimes say it is a battle of mankind with nature or mankind with the ocean. Perhaps it is a battle with the old man and himself. The irony is that in the end there is nothing left, but the old man still won the battle.

The old man in my story (myself) started his adventure with the bees at 65 years of age. He was and still is able to lift a 90 # deep box, but how long that will be the case is in doubt. Already over shoulder height supers are a problem. Learning about bees originally was believed to be an intellectual enterprise. Dead bees proved "that just ain't so". Becoming a NC Master Beekeeper doesn't seem to impress those ladies either.

A couple of friends and I took a beginner beekeepers class that lasted nine weeks. After that and a lot of time on Bee Source I knew almost everything there was to know about bees except how to get honey and how to keep them alive through the Winter and a couple of other minor things. Bee school taught that there should be two colonies to start with. Experience teaches that there should be at least three. At least with three a frame of brood can be robbed from one colony to help a queenless colony. Resources are just too scarce with two colonies. The addiction feature of beekeeping has gotten my colony count up to over 30.

Fortunately medium nucs were available locally. Mediums seemed like the best way to go. That is another of those things that changed with experience. The bees had a wonderful Summer. They took the sugar water they were given and made lots of beautiful honey that was only good for bees. Treating with chemicals was something that an organic gardener would never do, so in the Winter, the bees went the way of that other old man's fish. They did leave a lot of sugar honey and drawn comb though.

The best thing about bee school was getting a mentor. In this old man's case, there were two mentors, Karen Bryzki and Dietlinde Zipkin. There was also a bonus in the form of their mentor Frank Clements. The mentors and the dead bees helped me learn how much I didn't know. Karen and Dietlinde are still performing that function.

So here comes year two. More bees were ordered. Before they came an exterminator friend ran across a swarm. It was a great introduction to swarm catching. They were hanging off of a bush about two feet off the ground. A homemade bee bucket and a pair of loppers caught the swarm which was happy to take up residence in the backyard. Three hives made 30# of honey. Oxalic acid came to the rescue for *Varroa* and two of the hives made it through the Winter. The old man had caught the fish, or maybe the fish had caught the old man.

In the Meckbees club, mentoring at bee school earns one the privilege of being on the swarm list on the web page. Catching swarms took the apiary size up to 14 colonies. It also taught some lessons about swarms.

- Don't stand under the swarm when shaking the branch on which it rests.
- Cut outs are hard. The captured colonies don't have a good chance of living. Old men should have a young assistant. This old man doesn't want to do them anymore.
- Trap outs are easier and more profitable. The bees still don't have much chance of surviving though. The old man likes trap-outs.
- Bait hives are the best way to catch swarms other than scooping them off of a low hanging branch.

A cheap, easy to install, and effective bait hive was finally developed after studying the bait hives that others had built and making a few changes in designs. It was so successful that a workshop for building it was developed and presented at the NC/SC joint Spring meeting in 2017. The workshop was a raging success and had to be moved to a larger room in the convention hall. Two of the attendees have asked for the presentation to be made at their local bee clubs.

While year three was a success in the number of colonies, the honey yield was a bust. 10# was hardly worth extracting. The swarm hives did not survive well either. Year four started off with only three colonies of the 14 peak after swarm season. Two more colonies were obtained as nucs from someone who had

brought them home from the almonds. Those colonies were fantastic and helped in the production of 200 + #s of honey. Becoming NC certified helped the honey sell for top dollar.

Four packages were also purchased that year. Two were from Texas and two were from a local source. Each set of two packages consolidated to become a single colony. Friends suggested that they had been "poured" from the same colony. The two colonies that remained were transferred to Brown Mountain on the edge of Pisgah National Forest with the hope of making sourwood honey. They did not make honey that year. They did survive the Winter.

One would think than an extremely mild Winter would improve over-Wintering. There's a catch there. Another bite taken from the fish. The bees did not stay inside watching soap operas and eating bonbons. They went out flying around on every pretty day. There were almost no sources of nectar so they ate up most of their stores. The sugar bricks prevented starvation but still left empty honey frames when Spring came.

The nectar flow came early and wet. There was a lot of pollen and sugar water was fed to boost brood rearing. It was very late in the season when the bees started putting up surplus. Seven new colonies were purchased from the eastern part of the state. They had been on the almonds, but the provider had blueberry contracts to fulfill before the nucs could be released. Only one of these colonies is producing honey this year.

The NC Master Beekeeper program has been a real help. The program requires a great deal of learning but the real focus is on service. Almost every bee club in the state has some kind of beginner training that culminates in the certified beekeeper written test. In Mecklenburg the students are assigned mentors who administer a practical test and help the new beekeepers learn to get along with their bees.

The Journeyman program requires service requirements and a higher level of knowledge on the test. There is also a practical test that is administered by a journeyman or master level beekeeper. After one becomes a journeyman he can learn enough administering the test to new journeyman candidates to make passing the practical test for masters a snap.

The Master's certificate requires a lot more service events and some specialty items. These can be fulfilled by getting certified to administer epi-pen injections or be an insecticide applicator. So why would one want to apply insecticides. The beekeepers goal is to keep the girls alive. The old man did that one because it looked like low-hanging fruit for a specialty. It wasn't as easy as it appeared. It does give a new appreciation of the role of pesticides in agriculture and indirectly helps keep bees alive.

To be a "real" beekeeper one must learn to graft and raise queens. I think this is one of those thing that is easier than it appears. It is not easy in that requires learning and persistence. It is extremely satisfying. There are several ways to make queens without grafting. Once one learns grafting these methods are less attractive. Grafting really does require a lot of resources. Woodenware, bees and time are the main items.

Brian Fischer taught a really good class on queen rearing. The old man tried a little grafting and determined that he was just too old. The NC state association started a new program called "Born and Bred" to teach queen rearing. That class taught a formula method of queen rearing. The two old mentors, Dietlinde and Karen teamed up with the old man and provided young eyes and confidence. Making queen cells wasn't easy but we did it. A solution was found for the old eyes. Just don't look.

So the queen rearing adventure began. The first two sessions with about 40 cups yielded 100% – failure. The third session yielded five queens. The excitement was fantastic, but the next three sessions yielded nothing. Little methodical changes did not help. There were wild queen cell in the cell builder every week so the cell builder technique was changed to exclude young larvae. Success – 18 queen cells.

The first five queen cells graduated from the queen castles. Four of them had successfully mated and had really nice laying patterns. These were placed in nucs. The bees from the unsuccessful castle were given a new queen cell. Although this year was intended to be for practice and building up resources, people have been wanting to buy the queens and the small colonies. The dollar return on time has been low, but all of the out or pocket costs have been covered with a small surplus.

The old man feels like a real beekeeper now even though he didn't get honey this year.

MONITORING FOR MITES

Phil **Craft**

With all the challenges facing honey bees and beekeepers today, *Varroa* mites are still the greatest threat. In a past Ask Phil column, I answered a question about why monitoring for mites is so important. This month I am devoting an entire article to how it's done and specifically how to use the *Varroa* Easy Check, made by Véto-pharma, to monitor more simply and accurately.

About Véto-pharma: Véto-pharma is a honey bee pharmacological company headquartered in Paris, France. It is best known as the maker of Apivar, the only amitraz based *Varroa* control product registered for use in the United States. It also distributes ApiLifeVar (a thymol based miticide), HiveAlive (a feed enhancer for honey bees), and *Varroa* Easy Check. Those products, and others, are distributed worldwide, in 35 countries. (Full disclosure: I work part time for Véto-pharma as the company's U.S. technical consultant.)

Varroa: Remember, the purpose of monitoring is not to determine whether or not your hives contain mites; they do. All hives in this country do. The purpose is to provide a snapshot of how many mites are present on the bees at a given time, and how dangerous the level of infestation is. As much as 70% of a colony's *Varroa* population can be present unseen in a colony's brood cells. After a worker or drone egg laid by a queen bee hatches, an adult female *Varroa* enters the cell and lays her own eggs. As the immature bee develops, the newly hatched *Varroa* mites develop faster and begin feeding, first on the larval bee and then on the pupa. When the young bee emerges from the cell, the female mites – already mature and mated – leave also, looking for a suitable place to begin the cycle again in a brood cell. Both in brood cells and on adults, mites feed on the bees, weakening them and spreading viruses and other diseases in the process.

Monitoring: When we monitor, we are not actually sampling the number of *Varroa* mites in the colony, but only those on the adult bees, technically called phoretic mites. We express these numbers as percentages – ratios of mites found per 100 adult bees. Through research and observation of colony dynamics, scientists have developed thresholds, short for *Varroa* control thresholds. A mite count percentage below the threshold is considered acceptable; one at or above it indicates the need for some form of mite treatment. It's a laudable attempt to help beekeepers quantify their level of risk based on objective data, and it is a useful tool.

Unfortunately, thresholds vary depending on region and season. For example, if you have bees in Florida, where honey bee brood production (and therefore *Varroa* mite reproduction) takes place throughout most of the year, infestations can develop rapidly year round. Thresholds for treatment there are lower than in Michigan or Maine which have much shorter seasons for rearing honey bee brood. I keep my bees in Kentucky, not far from the Ohio River. Here, as I write this in late February, my colonies are starting to increase brood production, and *Varroa* reproduction is also increasing. My threshold will be somewhere in between Florida and Maine.

Interpretation of the *Varroa* count varies with time of year as well. In the Spring, or prior to the onset of strong seasonal nectar flows, we use lower thresholds when making decisions about treating. That is because a colony's brood production is ramping up and *Varroa* populations can explode suddenly. It's better to be fore warned and treat, if necessary, before honey supers go on and monitoring becomes much more cumbersome. I recommend considering control measures at levels of just one mite per 100 bees early in the Spring build up. By control, I mean the use of a registered miticide; homemade remedies are not effective. Later in the season, after the honey flow ends, is the other critical time for *Varroa* monitoring. At that period I use a threshold of three mites per 100 bees to indicate the

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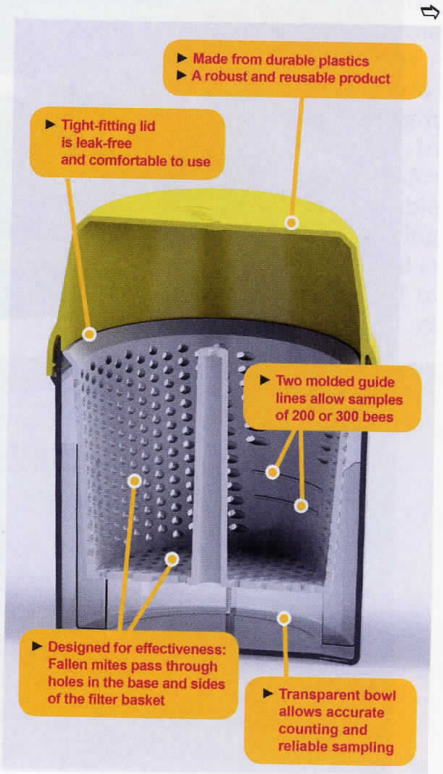

need for immediate treatment. I'm comfortable with these suggestions for the mid-eastern U.S., but I strongly urge beekeepers to consult with their state bee inspectors or university extension specialists for thresholds in their area. As I've mentioned before, the Honeybee Health Coalition website (**https://honeybeehealthcoalition.org/varroa/**) is another excellent source of information about protecting your hives from *Varroa*, and other health concerns.

Methods: The most accurate method of monitoring is an alcohol wash. It involves collecting a sample of adult bees and placing them in a liquid (normally alcohol) which causes the mites to release their attachment to the bees and float in the liquid. The bees are then separated from the mixture making it easier to count the mites which remain behind. Traditionally, beekeepers have used various devices, some commercially produced, but mostly homemade, to conduct alcohol washes. Windshield wiper fluid can be substituted for the alcohol, though a low suds, Winter solution is best for visibility. I always use the most inexpensive alcohol I can find.

Keep in mind that this process will kill the bees, and be careful to ensure that the colony's queen is not in your sample. Carefully check the frame, or frames, from which you will collect the bees for testing, and make sure she is not there. Even better, locate the queen before sampling, and isolate that frame. I prefer to find her and place her with the frame she is on in an empty nuc box while taking the sample. The recommended sample size is 300 bees, or ½ cup. It doesn't seem possible that that many bees will fit in such a small volume, but it's a pretty good estimate. Take my word for it, or count the dead bees individually if you will. Some beekeepers hesitate to kill 300 bees, but 300 from a colony of 20,000 or more adult bees is a tiny percentage of the colony's population, and well worth the sacrifice to gain accurate results. If the colony is weak, you can take a smaller number, though 300 bees is the optimum number for accurate results.

There are alternative monitoring methods which do not kill bees, but an alcohol wash is the most efficient. Other options include sticky boards and powdered sugar rolls. I discussed these alternatives in an ***Ask Phil*** column in June 2015, if you are reading this article in an electronic format, you may click on the accompanying link, or contact me for a copy of the column. As I described in more detail in that article, sticky board monitoring can yield some information, but the results are more difficult to interpret because

they don't take into account the population of the colony. By expressing results as a ratio of mites to bees, both alcohol washes and powdered sugar rolls eliminate the variable of colony size. However, because some *Varroa* fail to release in a powdered sugar roll, an alcohol wash is more precise. It's also quicker and simpler to perform, so it is the method of choice for most beekeepers. For those who prefer to conduct powdered sugar rolls, please note that, whereas this method does not kill bees, it is still better to find and isolate the queen to avoid injuring her.

Using the *Varroa* Easy Check: Most beekeepers understand the importance of monitoring for *Varroa* mites, but many still don't do it – maybe because they don't know how, because they don't have the right equipment, or because it's messy. In 2016 Véto-pharma saw the need for a reliable, easy to use, and durable tool to simplify the monitoring process. The product that resulted is the *Varroa* Easy Check, designed to

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be used for *Varroa* alcohol washes.

The Easy Check is made up of three parts: a clear plastic bowl, a white basket with holes, and a tight fitting lid. Step 1) Start by pouring just enough fluid into the bowl to cover the bottom of the white basket. You can use denatured (rubbing) alcohol purchased from any retail store or Winter windshield washer fluid (with contains alcohol) as described above. Step2) Find and isolate the queen, or carefully check for her on the frame or frames from which you intend to take your sample. Step 3) Take your sample. The basket contains two lines on its interior surface between the rows of holes. It takes 300 bees to fill the basket to the top line; 200 to the lower one. Scrape the basket down the surface of brood frame being sampled as shown in the photograph. Be sure to scrape the frame down, not up. As you pull the basket along the face of the brood frame bees will Fall into the basket. For best results, fill it all the way to the top line. You could also sample the bees by shaking them from the brood frame or frames into a plastic tub, and scoop them out with the basket. Step 4) Twist and shake. After you have collected enough bees, secure the basket in the bowl and quickly twist the lid on to prevent the bees' escaping. Shake once to immerse them in the liquid. This will kill both the bees and any mites on them. Remove the lid and add the washing fluid to the fill line on the transparent bowl. (The fine line is marked inside the bowl). Re-secure the lid and shake the EasyCheck for 60 seconds. You can shake vertically, from side to side, or rotate it to optimize separation. (If you're in a remote beeyard it's OK to sing out loud while you bust a move. Use discretion in more populated areas.) Tip: Keep the Easy Check upright. You may be tempted to turn it upside down to dislodge the mites from the bees, but that could jam the *Varroa* in the lid and prevent them from falling though the holes. Step 5) Counting. The transparent bowl makes it easy to count the mites, either before or after removing the basket of bees. After noting the number, you can filter the liquid through a very fine sieve or cloth into a collecting container and reuse it on the next hive. Step 5) The numbers. To calculate the percentage of infestation, divide the number of *Varroa* counted by 3 (if 300 bees are sampled), by 2 (if 200 bees sampled) or adapt the formula according to the size of your sample. This gives you a *Varroa* count per 100 bees.

For more information about the Varroa Easy Check, go to **http://www.veto-pharma.com/61-varroa-easycheck.html**. An instructional video may be viewed at: **https://vimeo.com/174841012**.

Those of you who read my column in *Bee Culture*, or have heard me speak, know my philosophy of beekeeping: that we have an obligation to the honey bees in our care just as farmers do for the health and well-being of their livestock. To fulfill that obligation it's vital that we make ourselves aware of what is going on inside our hives. The purpose of the Varroa Easy Check is to encourage beekeepers to monitor by making the procedure more convenient. The important thing is to inspect your hives frequently and monitor, monitor, monitor.

YEARS 2 & 3 WHAT HAVE YOU LEARNED?

Larry **Connor**

Quite frankly, if not done during the first season of keeping bees, the second and third year are the years that set the course for many beekeeper's success or failure. Once the first year is completed, beekeepers are either challenged to start over for a variety of reasons: package bee failure, queen failure, general colony neglect, ignorance of basic bee management practices, failure to recognize problems with queens, diseases and mites, and countless other issues. Or, through a combination of luck and good training and self-study they have managed to keep their colonies alive and are ready to grow their colony numbers or increase production through better management.

At the end of a beekeeper's third year, we would expect that he or she will have mastered all of these areas and perhaps dived into queen rearing, specialized honey and hive products, teaching beekeeping, equipment-bees-queen sales, and more – If they did not start some of these activities in their first season. It is always amazing to see inexperienced beekeepers jump into something others consider too technical and come out smelling of great success.

There are beekeepers that take the minimalist approach to doing as little as possible with their bees during the first three years, so I need to say that it has been my experience that this is somewhat risky for their overall success in long-term beekeeping. Without a solid basis of knowledge, it is harder for beekeepers to sustain themselves over the years using their good luck as their primary asset.

It is often repeated that a second year beekeeper is the most dangerous beekeeper in the apiary and classroom because they have all the answers. Certainly those who were blessed with positive experiences and good luck with their bees are quite often adamant about their 'proficiency' as a beekeeper. They have often not learned the challenges of a difficult beekeeping year, of growing mite levels, and exposure to pesticides and the growing threat of disease infestation. While we do not want to minimize the importance of second year beekeepers as teachers of first year beekeepers – they are closest to the experience – they still require monitoring by more experienced beekeepers. Therein lies the conflict, finding a balance between learning and growing with bees versus a large area of inexperience.

What should a second and third year beekeeper be able to do?

Here are some of my thoughts of the many areas they should master during the first three years of keeping bees:

Bee Anatomy – Full knowledge of the parts of the bee, both internal structures and internal anatomy, coupled with a good understanding of what each part of the bee does in the life of the individual bee and colony function. They should be able to teach this to other beekeepers.

Floral Anatomy – They should be able to identify the parts of common flowers, how nectar and pollen are produced, the keys to pollination of key plants for their region, and be able to teach this to neighbors, growers and other beekeepers.

Bee Venom and Stings – More experienced beekeepers should be able to recognize a local reaction as compared to life threatening anaphylactic shock. The experience of these beekeepers is critical when working with both new and established beekeepers, as we all hear of those who have suffered a major scare following a bee sting. Second and third year beekeepers should always error on the side of caution, but be able to determine if a bag of ice is the best treatment, or when to phone 9-1-1 with a possible emergency.

The Beekeeper Annual Cycle – Starting either in the later Summer or in January, a beekeeper should be able to review in some detail the key changes that take place during each month of the year in the area where they keep bees. They should be able to show how different seasons produce different results in pollen and nectar production, and how this impacts colony management. This cycle should be broken into several themes:

Population Cycle – Following the Winter/early Spring decline, beekeepers should be able to discuss the increase of brood and bee populations as the seasonal buildup leads to stronger hives and robust

forager populations. In his writing Dr. Dewey Caron reminds beekeepers that the key to successful bee colony management is through proper bee population management, and all teachers and mentors need to remind their students of this.

Swarming Cycle – These beekeepers must attempt to master the Spring and late Summer/early Fall swarming cycles, adapted for the regional area where the beekeeper keeps bees. Methods of swarm prevention and swarm control should be strongly established within the beekeeper's skill set. Methods of swarm capture and management are suitable at this or an earlier level. While not all beekeepers should be able to perform colony removals – it requires non-beekeeping skills not all beekeepers possess – but the second and third year beekeeper should be able to work with a well-protected carpenter or another beekeeper to remove a colony using various techniques, and be able to tie up combs into empty frames or onto top bars (in frameless management systems).

Honey Cycle – Know when to super, when and how to harvest honey, and how to deal with honey processing-storage-bottling-sales. I am always amazed at the number of two to three year beekeepers who are overwhelmed when their colonies produce surplus honey and they do not know what to do with it. Excuse me, why did you start a dozen colonies of bees?

Disease Cycle – The use of the word cycle applies mostly to *Varroa* mites, as true diseases follow a more random pattern of infection based on contamination exposure. But chalkbrood and nosema are both known to follow certain highs and lows as influenced by the weather and seasonal influences. *Varroa* mites will increase in numbers as related to levels of mite tolerance, mating accuracy, drone production and other factors stimulate mite development within colonies in an apiary. Depending upon the region where a beekeeper keeps bees, the mite population cycle may take a year or more to be fully expressed.

Disease, Pest and Pesticide Detection – Every third year beekeeper should be able to determine if a colony, or a sample from it, should be checked by a qualified laboratory, like USDA-Beltsville, for American foulbrood, European foulbrood, chalkbrood, nosema, tracheal mites, *Varroa* mites and pesticide damage. The best of all beekeepers will be able to do much of the recognition work at this stage, but all third year beekeepers should be able to determine if they should have a colony sample checked by qualified individuals or services.

American Foulbrood – By this time a beekeeper should be able to inspect old beekeeping equipment to look for AFB scale left from a previous dead out from American foulbrood. The beekeeper should be able to perform a field exam for AFB killed larvae in the late larval stage by checking for a strong sour odor and ropiness.

***Varroa* Mites** – Using a standard sampling method using powdered sugar, ether, or a full screened bottom board and powdered sugar, a third year beekeeper should be able to measure the mite level in each colony in a small apiary and compare that data from colony to colony and apiary to apiary. This should become a preliminary aspect of determining if the colony needs to be treated for mites, using any number of treatment options.

Miticide and Chemical Use – Beekeepers should be able to read the label of any chemical and examine it for its risk to honey bees and other pollinators. Apiary pesticides should be carefully studied before being selected for use. The beekeeper must follow treatment procedures and safety concerns. If a residual strip or artifact remains after treatment, its correct removal and disposal should be followed. All efforts should be to provide safe application to the bees without causing bee mortality and contamination of honey and hive products.

Equipment and Terminology – Take the glossary from a good beekeeping book and see if you can identify at least 80% of the terms and items of equipment listed there. Know the key leaders in the development of American beekeeping, and study global beekeeping development as well. Using that 80% standard, you should be able to identify most items in a commercial or sideline beekeeping operation, even those producing package bees or queens. Much of this will come with normal curiosity with bees and beekeeping.

What is Honey? – Does filtering convert honey into

non-honey? Does heating at 160° do the same? This is a fuzzy, grey area for a lot of beekeepers, and all must know what the law and marketing rules say about putting Pure Honey on a jar, as compared to Funny Honey or some other label. While there is a great deal of misinformation out there, get the facts and follow them. Is there a legal description of Raw Honey? More to the point, every beekeeper should be able to look at a container of honey and point out any mislabeled items, such as lack of weight, location of source and producer.

Comb Analysis – Third year beekeepers should be able to identify the content of each cell on each frame in a hive. This includes ALL stages of brood, stored nectar, stored honey (sealed and open), loose pollen, new bee bread, water and propolis-covered cells. The beekeeper should be able to rearrange a set of frames into the natural position that the bees would produce without beekeeper interference.

Other Hive Products and Handling – Third year beekeepers should be able to produce honey, pollen, beeswax and propolis. They should know the best practices to use for the harvest, processing, storage and marketing of these products. Knowledge of labels, limits on claims of product properties and general legal issues concerning these products fits the third year level. They should have submitted at least one of these items of their own production in a local fair, honey judging event or have their product evaluated by a trained professional.

General Entomology – By third year, beekeepers should be able to identify common non Apis bees, wasps (including yellow jackets and hornets), flies and bee mimics typical to the area where the beekeeper operates. They should understand the system of naming insects, starting with a common name, and followed by the Latin name. They should be able to identify regional pollinators and stinging insects and their mimics by common name.

During the fourth and fifth year of keeping bees, most beekeepers perfect their skills, and be actively involved in honey and hive sales, pollination, and teaching new beekeepers.

Why Do You Keep Bees?

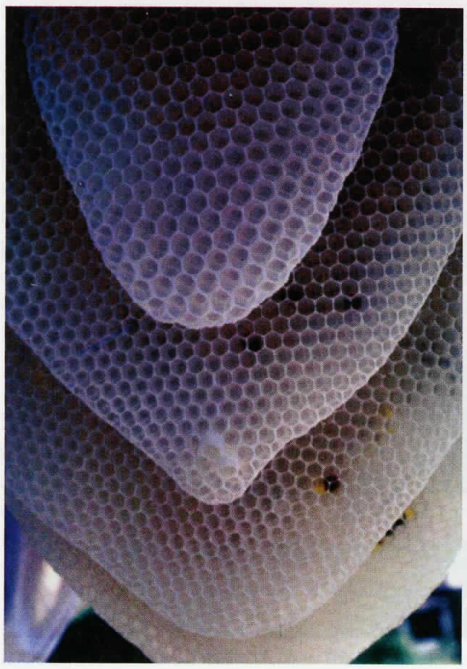
The Smell, The Look, The Taste?

Michael **Krummel**

Why do I keep bees? Why do you keep bees? Despite the apparent simplicity of the question, it is an interesting question not often given much thought. The reasons, it turns out, are as many and varied as are beekeeper's solutions to a problem.

Is it to "save" the bees from extinction, a noble gesture but of questionable impact if only a hive or two. Maybe we keep bees to protect the bees from man (my painful and swollen experiences say they can protect themselves much better than I can!). Maybe we are working to protect them from the environmental issues (is that easier than working to improve the environment so it is not a danger to the bees?). From a psychological perspective we know humans, as a specie, aren't big on maternalism, but score high in protectionism; is it their tiny size but large work ethic that make us want to protect them? I've heard many reasons about why people keep bees but I seldom hear the words "fun" and/or "educate kids" in a response to the question, so why do we keep bees?

Do we keep bees because of the sensory – smell, sight, hearing, touch, & taste – pleasure they give? Maybe it's the smell of a healthy beehive? A healthy hive has been described as smelling like "round like cotton and nebulous like sea foam" (Honey Bee Suite, 2018). Most would agree it is earthy, warm and complex, but well-loved by beekeepers. We know it is a combination of honey, pollen, wax, propolis, pheromones, different amino acids, and life. A non-beekeeper may not understand what they are smelling – may not even like the smell – but it is comforting and distinctive to those that are keepers of bees.



New Comb

Surely we keep bees (or do they keep us . . .?) because we can see their growth in the hive: the fast Spring growth and pure whiteness of new comb, the whole "business and size" of the colony, watching them fill the comb with honey, the new growth in the form of eggs, larvae and pupae that "we" managed, or maybe it's the delight in a successful "Where's Waldo" search for the queen. Oh, and don't forget that to a beekeeper every bee around the homestead is "our" bee on "our" flowers in "our" yard. Maybe we keep bees because we enjoy seeing the "ownership" we have? Maybe we vicariously "share" the rewarding production outcomes of our busy little bees with their perfect work ethic?

What about the "touch" of beekeeping? Could it be the reason why we choose to be beekeepers? It might be the heft of a full honey super, or the weight of a comb full of honey, especially when compared to the almost no-weight of an empty frame or bar when we put it into the hive. Could it be the tickling of a bee walking across our skin, or the prickly weight of a living bee-beard? I'm sure it isn't the hot pain felt from a sting, but it too is part of beekeeping.

Might we keep bees because of how we feel when embraced by the sound of the hive, the steady buzz that we can almost feel in our bones? This is very different from the higher pitch of a flying worker bee (250 Hz) (Hord & Shook, nd), which tends to make people automatically duck and look around in concern or fear. According to Dr. Chang at the University of Colorado School of Music, the sound from a healthy hive is an "E3 about 165 Hz with a variance that goes down a perfect fourth and up around a half step." Huh? What this means is 165 Hz is the average tone of a healthy beehive (it is the E below middle C), and has a variance between 124 Hz (B below middle C) and 175 Hz (F above middle C) (Solheim, 2018). From another perspective, it's basically the lower frequency range of an average adult woman's voice (165-255 Hz), so maybe it's a maternal comfort we feel when we hear that tone. Or, from even another perspective, at that frequency (165 Hz), if it was a drum or otherwise pulsed, it can affect our coordination and we would feel the urge to dance or otherwise move to it (Tomatis, 2005). Whether maternal or the desire to find rhythm, for beekeepers it is a comforting sound. Even non-beekeepers seem to like it, once it is explained to them what they are hearing.

We can't forget to consider the "taste" of beekeeping as a potential reason for keeping bees. Taste, one of our chemical-based senses, happens in the mouth (unlike smell, which happens in the brain). Our taste buds are DNA-coded to recognize the five taste categories, and sweetness (think sugar – our brain alone consumes a quarter pound of it a day as energy) is an important one ⇨

Honey Comb

(Gritzer, D., 2018). With the close relationship between smell and taste, add honey to the mix and we have a sweet reason to keep bees. Honey, being a little denser than sugar, tastes sweeter than sugar due to the fructose

Honey Jar

not being bound to the sucrose (Dreifke, 2018). We know honey can be floral, smoky, woody, spicy, nutty or earthy; fresh like grass or as pungent as aged cheese, a flavor for everyone. The end result of beekeeping usually culminates in a taste of honey, making it worth all the work and waiting involved by both bees and beekeepers to get there. Is that delicious sweetness enough to warrant the cost and efforts of beekeeping? It very well might be, it sure is for me.

Why do commercial beekeepers keep bees? They have to love it to do it. Commercial beekeepers probably see beekeeping as a job and a source of income, but maybe their beekeeping started because of a romantic encounter, or started because they like growing things, maybe because their work equates to food on our tables, or even because they can meet the best of people as they travel with their bees. They believe they know why they keep bees, but might it also be because of the same sensory connections we make with our bees? I think so.

Why am I a Keeper of Bees? – I started out of curiosity and the science of it. However, I quickly became enamored with all of the sensory (or sensual) aspects I discovered as I spent time with my hives. The taste of honey is wonderful and always changing, but the other senses soon competed for attention. The smell of my hands after working in a hive, wearing a bee-beard for the first time, the lulling drone of a healthy hive, and the sight of a healthy, growing hive because I provided them a safe place and they took advantage of it. My world of sensory perceptions would be poorer without me and the bees keeping each other.

Different reasons for different people. So why do you keep bees?

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Have you lit it yet?

Chappie McChesney

A Look At Mentors and Mentoring

When you ask most beekeepers this questions they have their smoker come to mind. Most have lit their smokers many times – some of us just about every day. But that is not what this question is about. It is about lighting a fuse. Why a fuse you may ask. Well, if you look up the word fuse in a dictionary you will see a definition like this – a safety device for protecting an electrical system which contains a material that will melt if too much electricity passes through the system. Now before you blow a fuse thinking what this is about let me explain.

Fuse also is described in the dictionary as – a cord or tube along which a flame moves to light fireworks or a bomb. Now we are getting to what I want to share – lighting a fuse that burns to get an end result like an explosion of fireworks lighting up the sky is a good thing. Lighting a fuse with a new beekeeper is also a good thing when it leads to an explosion of knowledge for that person.

In my experience dealing with new beekeepers it seems that when we attempt to mentor the beginning beekeeper it is like lighting a fuse. Sometimes it is a slow burning fuse and it takes a long time to teach the mentees what they need and want to learn. Other times it does go off like a bomb and the new beekeeper explodes with information overload and ends up quitting the art of beekeeping altogether.

Mentoring is an art form in itself. You have to paint a picture with words and deeds to help interested students see the big picture. How can we do that? Well, first off you have to let everyone know that you are available to help them. You can do this by joining a beekeeping club or starting a new one if needed in your area. Lots of curious folks will come out to a meeting and listen to the information presented and then decide if they want to continue or not. This is where mentoring begins. Share information but do not overload them with things that they should not be involved in for a few years after they have become a basic beekeeper. A basic beekeeper does not need to know how to raise queens but should be taught how queens are made. By teaching basics you help them see the need to work their hives slowly and to be aware of what the queen is doing in the hive. As the fuse burns they learn to look for eggs before they learn to find the queen. They learn to pull frames slowly so they don't roll the queen and kill the hive.

That is what a new beekeeper is looking for – ways to keep their hives alive. When you light a slow burning fuse it will take a year or two to get to the end result of having a newly dedicated beekeeper in your area that can light up the sky with honey bees.

Remember when you mentor that not all people learn the same way. Some are more visual and like to get their hands into the hive and work the bees to learn. Others would rather lay in bed at night and read a good book on bees. And sadly, many today will spend hours on the internet watching videos, reading blogs, and soaking up lots and lots of bad information that is out there.

No beekeeper is perfect in his/her beekeeping skills and if they say they are; be careful as they may lead you down a dead end where you may find your hives have died out (bomb) and you are left wondering what went wrong.

I have seen this so many times with well-meaning folks that mentor new beekeepers when they themselves still need a mentor to guide them. Egos can make folks do some very interesting things as we all know just from living in the human race. Some beekeeping mentors will mentor club members only, some write articles and books, some are scientists, some are professors at universities or researchers, and some do public events to help educate the public on ways to save honey bees, and some do it all.

These are all good things but there needs to be a way of filtering out the imposters that do more harm than good. These are the folks that will mentor folks until a problem arises and then they will abandon the mentees and their bees as they don't know how to solve the problems that arise; and problems will arise in today's beekeeping world.

How do they teach you to control diseases and pests

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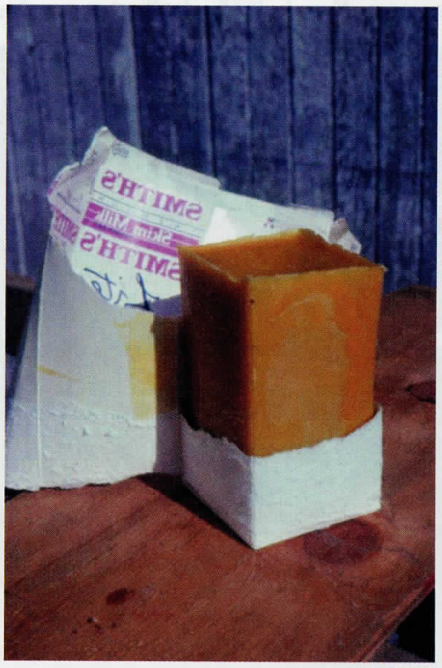
in your hives? Do they go the natural route that so many "experts" claim does not work or do they go the chemical route that so many "experts" claim does not work. Are all "experts" the same? Of course not; but so many folks will believe anything they say.

One way to separate the wheat from the chaff is to get to know your mentor. Visit their apiaries and see the fruits of their labors. If they have strong healthy bees that are producing every year there is a good chance they are doing something right.

If on the other hand you find their hives are not really that strong and they lose lots of hives every year you might want to seek someone else to help you become successful.

This is where egos get in the way many times. Don't be afraid to stand up for your bees. Remember, you are responsible to keep them alive if you want to be a beekeeper. Don't be afraid to tell your mentor you have doubts after seeing his/her bees. Ask questions and expect good answers and not just opinions. We all have opinions but they are not worth very much to a weak hive of bees. A bee haver has bees but does not know how to help them flourish and grow from year to year. A word of caution here – telling a mentor you doubt his/her mentoring because you can see their bees are not healthy is lighting a quick fuse to a bomb. Many will blow up as their egos will be hurt. But if everyone would do this we might help the mentors improve as well and save more honey bees.



There are good sites online produced by universities, long time beekeepers, supply companies, and others that want to help. Again, it is a case of let the buyer beware. Do some research to see where their loyalties lie? If a large chemical company gives huge sums of money for research you can expect the end results will be in favor of that company. That is not opinion but fact. Of course those receiving the funds will deny this as they want you to believe they are fair and unbiased. We are dealing with human beings and we all have our faults. Many times we cannot see our own and it takes others to help us see where we might improve. Believe me, I get lots of input from so many others and again you have to consider the source and put whatever weight you need on any suggestions.

Bees do not do what book authors and scientist tell them to do. They do what they were created to do and they do it well if we stay out of their way. By trying to reinvent the wheel or make a new bee to suit our needs is not helping in the long run. The bees are constantly trying to adapt to the environment that man is creating that is full of so many deleterious things to bees. Just like humans they want to find good food to eat and clean water to drink. Where can they do that in this polluted world?

Even bee's wax cannot be found that is not full of chemicals that have been brought into the hives from treated crops and contaminated water supplies or the chemicals beekeepers dump into their hives.

I expect the next few years we will be seeing more and more information being disseminated that condemns using chemicals in the hives and on crops. Of course the companies that make billions producing these killing agents will spend millions on good public relation experts to put a good face on their products.

No mentor can teach common sense to any other person. You either have it or you don't. Good common sense should tell you that everyone has opinions on every subject and many have told me that my opinion is not any better than theirs. I agree that opinions are like fingers – most people have at least 10 on most subjects.

However, if you are willing to listen to your bees they do more than hum or buzz. They will tell you that they have survived a very long time without man's intervention in their lives. Stealing their honey was the worst man would do until recent times when our great intellectuals decided we can improve the honey bees and make them produce more for mankind with all kinds of manipulations. We aren't happy enjoying the sweet delightful honey or making candles from the bees wax. No, we want to make improved bees that will produce hundreds of pounds of honey each season without fail, feed themselves from the chemical laced crops that we pollute the earth with and not get weak or sick and die out. We want them to pollinate crops all over the world and not pick up any diseases while mixing with bees from all over the country that carry so many diseases and parasites. We want them to kill any pests in the hives with the help of more poisons dumped in on them, and the worst of all is we want bees to continue to communicate through their pheromones in the hive when they can't smell brood or queen pheromones at all anymore because of the reek of the chemicals put in to "help" them and that contaminates the wax. It doesn't make sense to me and it lights my fuse which is short when it comes to the welfare of honey bees.

I have heard mentors teaching the value of chemicals and how they save hives. I have heard mentors teach that if you do not treat your hives for *Varroa* mites the bees will die out in two years or less. I have heard mentors teach that queens should be replaced every six months as they only live for a year anyway. I have heard respected scientists and speakers quote Einstein saying that if the honey bees disappeared, all humans would die in four years.

That is pure ignorance as Einstein never said that and it is not true anyway. Those opinions do not match up with what common sense and the honey bees teach me.

I have bee colonies living in trees for many, many years without any treatments that are healthy and give

me lots of worker bees every year. *Varroa* mites are in these colonies but the bees are surviving without any chemical help in spite of all the hazards they encounter every day.

My queens live for many years and produce very well. If folks want to replace queens it is their business but I wish they would give the unwanted queens to bee clubs to help new beekeepers instead of killing them. Some older queens produce quite well in spite of what the books and "experts" say.

So now I hope I have lit your fuse so you will make an effort to rethink what you have heard about honey bees. Sure the haters are getting ready to blow off at me which is welcomed. I take it all in and see if there is any value in their attacks that might help me learn more about saving the bees.

The problem is most of the haters are just duds when it comes right down to it. There fuses are short and they make a lot of noise when they go off but then they are usually gone like a puff of smoke.

And for those of you that say I should not be negative and keep everything on the happy, everything is rosy, up beat type of discussion I say this. If you can't face the negatives and address them, how do you ever expect to change them to positives?

Try to let your fuse burn long enough to see that we all need to make some changes if we want to keep the pollinators alive. Can we save them all? Of course not but we can make an effort to do so if we are willing to make some changes.

My fuse is burning brightly for the bees and I hope to continue to do my part to help them for future generations. If you disagree with me it is ok. I expect you to go off on me but that is your problem and a premature detonation.

Sometimes You Win, Sometimes You Learn

Ann **Harman**

2 & 3 YEARS HIVE TASKS

Wax moths are attracted to comb that has been used for brood

- August is important for *Varroa* control!
- Harvest honey by early August, depending on climate, nectar flow and mite treatments.
- Monitor mite levels. If over three mites per 100 bees, take action!
- If using *Varroa* treatments, read the label and follow temperature guidelines.
- If in small hive beetle areas, when removing supers, extract immediately.
- In SHB areas do not put wet supers back on hives for bees to clean.
- Put wet supers well away from hives for a few hours for bees to clean.
- Store supers so all sides of the frames are exposed to light and air
- Wax moth is attracted to comb that has been used for brood.
- Protect stored supers from mice.
- Control small hive beetles in colonies.
- Bees will use between one to two gallons of water during hot Summer days. Monitor water source.
- Maintain good ventilation.
- Keep grass and weeds cut in beeyard to give bees easy flight.

Requeen if necessary

Monitor water source

- Protect yourself from ticks!
- Robbing can be a problem, especially during a dearth of blossoms.
- Feed all hives at once to prevent robbing and feed inside hives.
- Requeen if necessary.
- Combine a weak colony with a strong one and eliminate weak hive queen.
- Plan for Winter. Begin feeding 2:1 sugar syrup in September, depending on climate.

Cooking With Honey

Ann **Harman**

Everyone who grows zucchini always has an overly successful crop. Here are two delicious recipes to help you use your garden's bounty.

SWEET AND SOUR ZUCCHINI

4 small zucchini, thinly sliced
½ to ¾ cup honey
½ cup white wine vinegar
1/3 cup vegetable oil
¼ cup chopped green pepper
¼ cup diced celery
1 tablespoon chopped onion
1 teaspoon salt
1 teaspoon black pepper

Combine all ingredients in large glass or ceramic bowl. Cover and refrigerate overnight. Drain and served chilled or at room temperature. Makes about two quarts.

FRESH ZUCCHINI TOSS

1/3 cup vegetable oil
1/3 cup white wine vinegar
1 clove garlic, minced or pressed
1/3 cup honey
½ teaspoon seasoned salt
¼ teaspoon black pepper
2 cups zucchini, coarsely shredded
6 cups mixed greens or lettuce torn into pieces
½ cup red onion, thinly sliced
1 cup seasoned croutons
1 cup grape tomatoes or tomato wedges

Combine first six ingredients thoroughly in blender or shake in a jar. Pour over zucchini. Chill 30 minutes or more. Place greens or lettuce in large salad bowl. Add zucchini mixture and toss lightly. Garnish with onion, croutons, and tomatoes.

Both recipes from National Honey Board

HONEY APPLE CHOPS

4 pork chops
¼ cup lemon juice
1.4 cup honey
½ teaspoon pepper
1-1/2 cups apple cider
¼ cup soy sauce
1 teaspoon garlic, minced or pressed

Combine all ingredients except pork chops and mix well. Put chops in shallow pan or in plastic bag. Pour marinade over chops. Refrigerate for two hours. Grill chops to desired doneness, turning once.

Suebee Honey Collector's Edition Cookbook

Some tips for cooking with honey: The contents of a 12-ounce squeeze bear equals one standard measuring cup. A one-pound jar of honey is 1¼ cups. Lightly coat measuring spoons and cups with cooking oil or spray; the honey will slip out easily. Honey scorches easily so be careful when grilling. Crystallized or granulated honey, as well as creamed honey can be used in cooking but you may wish to liquefy it first so that it will easily mix with other ingredients.