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If There Is A Label It's Removable

Features . . .

. . . The Rest

Farm Bill

After three years of wrangling, the United States has a new five-year farm bill.

As president of two regional bee associations, I have watched as the leaders of the richest nation on Earth have grappled with price supports, food and heating assistance, as well as country-of-origin labeling restrictions, market stabilization policies and other complex policy issues.

The $956.4 billion package eliminates billions in direct-subsidy payments to farmers and $8 billion in Supplemental Nutrition Assistance Program funding. In place of direct subsidies, a comprehensive crop insurance program will be adopted.

There is focus on conservation programs, including habitat programs for pollinators. There are mandatory research funds for which beekeepers may apply. These are all good things.

Organic food and vegan advocate Elizabeth Kucinich, writing for the *Huffington Post*, said, "Ultimately, food safety, animal welfare, sustainable agriculture and environmental communities united and achieved progress this year."

But here is what is bad – insidiously and eerily bad – about the new law. There is virtually no mention of pesticide regulation.

The take-home message from the 2014 farm bill is that I have to accept that my nation's specialty-crop and big agriculture growers will kill my bees.

I know this: Every single bee now brings in, on average, six different pesticides in the pollen.

I know this: 2013 is recorded as the worst year – ever – for honey production.

I know this: In 2013, the Environmental Protection Agency fined a Florida citrus grower $1,300 for spraying pesticides in broad daylight to prevent citrus greening, thereby causing 1,300 hives to die.

That's basically $1 a hive. Census records from the 1890s valued hives at $4 each, by way of comparison.

My only recourse, if I don't want to be bankrupt, is to buy crop insurance and start over.

I'm being asked to accept the fact that my nation will kill my bees, if not in the short term, then most certainly the long term.

Furthermore, I am being asked to pay for that by buying an insurance policy to cover bees about to die – year after year after year.

The 2014 farm bill ignores one of the most beautiful and basic of plot lines taken from Disney's *Wings of Life* movie: "Among the billions of intersections with insects and plant life, life generates itself over and over again. This is the ultimate love story, the story that feeds the world."

I wish the law would have started with that premise; instead, it ignores it.

Tammy Horn
President, Kentucky State
Beekeepers Association

Partnerships For Bee Wellness

One of our planet's quality gurus, Ed Deming, always suggested that we thoroughly understand the process before tinkering with it to solve a problem. Maintaining or improving bee health is an extremely complex process. If we focus on the processes of bee health, and understand the root causes for bee wellness and "un-wellness", we might begin to identify the what, where, when and why of bee "un-wellness". Once we understand the processes and the causes of problems we might then begin to cooperatively research potential solutions. *This kind of quality mission requires purity of common intention, honest will to collaborate respectfully with equitable sharing of the solutions, freely, for the good of all.* Parties of this partnership must commit to this ethic. Why?

The wisdom of the First Nations might tell us, "No one owns the soil, the air, the water or the heat of the sun. They belong to us all". "No one owns the bees, the pollen, the nectar, the flowers that produce them or the seeds produced; they belong to us all". Tinkering with this concept of every human's right to living soil, pure air, clean water, and natural sunshine is unwise. Tinkering with the concepts

of ownership of nature in the form of bees, pollen, nectar, flowers, or seeds is unwise also.

Rudolf Steiner predicted the bee problem a hundred years ago as a result of domestication of bees, an act of man to control nature. Obviously man has been tinkering with bee-nature without understanding the entire process and the results are clear. On a greater scale man has been tinkering with nature, genetically modifying rapeseed for canola oil, and the results are clear. The demise of bees in Manitoba Canada years ago, is believed to be a result of genetically modified rapeseed, an act of man to own nature.

Before we enter a process, even a partnership, we might learn more not just about our personal and capitalistic missions but about our partners.

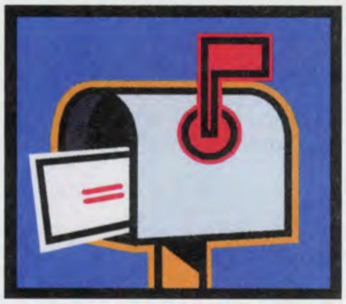
Joseph C. Fields
Northport, MI

Invasive Plants Have Value

I have just sealed up a letter to *Bee Culture* about *Invasive Plants* by Jim Hess.

I would like to continue my thoughts on this subject. So maybe Jim can tell me where I'm wrong.

I was a new beekeeper in the Pacific Northwest in the 50s and knew very little about which plants the bees were working. But I wanted to, so after several years I found out which plants and blossoms produced the nectar. Pollen never interested me at this time. The earliest source was pussy willow, then alder catkins and hazelnut, salmon berry, Indian plum, thimble berry,



soft maple, vine maple cascara, wild blackberry, then came Himalayan and evergreen blackberry. After these bloomed very little nectar came into my hives. The season was over by the end of June. This is in Washington state.

Then in the 70s I noticed bees coming in loaded in July. *Lotus major* was introduced then comes the 90s. I'm getting a real dark honey and lots of it. In August and September. I at first thought my bees were working the fruit of the invasive blackberry, as on warm days I saw them working them. But after awhile I realized it had to be Japanese knotweed – it was. Now there was nothing for bees to work on this time of year in the 50s that would produce a surplus. Aster and goldenrod didn't.

We do have a native plant that grows in swampy land called touch-me-not or Jewelweed. It competes with knotweed, and seems to be more now than in years past. It was interesting trying to figure out who was *painting* my bees on their thorax. It seemed like every other bee coming into my hives was painted. Upon searching around I found them enter and exit this plant's flower. Upon plucking a blossom, lo and behold there was a small white pollen sac directly on the top side of this blossom. You could paint your whole finger with this sac. Lots of pollen – mystery solved. But I don't know what kind of honey they produce because it's coming in the same time as knotweed.

Getting back to Jim's thoughts "when these invasive plants take over they become a monoculture" – whatever that is? You see these plants bloom when all of our *native* plants are all done. Knotweed gets a lot of new swarms through the Winter. At least it gives them enough food.

Jim Cowan
Aberdeen, WA

TAKE THE SURVEY

Be Part Of The Solution

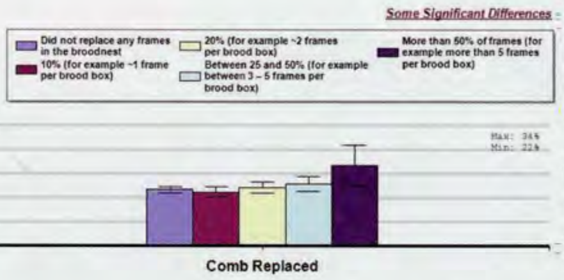
The Bee Informed Partnership

Going Live! **The Bee Informed Partnership is kicking off its 4th annual Winter Loss and Management Survey on April 1st and the survey will remain open until April 30.** The Bee Informed Partnership (**www.beeinformed.org**) is a five-year extension grant funded by USDA/NIFA to reduce colony mortality. One way we are trying to do this is to determine which management practices work and which do not. You can find results from past years surveys by visiting our site's "Results" section.

We also have been working hard to develop and deliver new and innovative services to help beekeepers, small and large, keep their colonies alive. This year we are offering **Real Time Disease Load Monitoring**, meant for sideline beekeepers or bee groups, so they can get near real-time understanding of *Varroa* mite and nosema spore levels in their colonies. For those experiencing unexpected and unexplained high levels of loss, we offer **Emergency Response Kits**. Both of these services can be found on our website's home page.

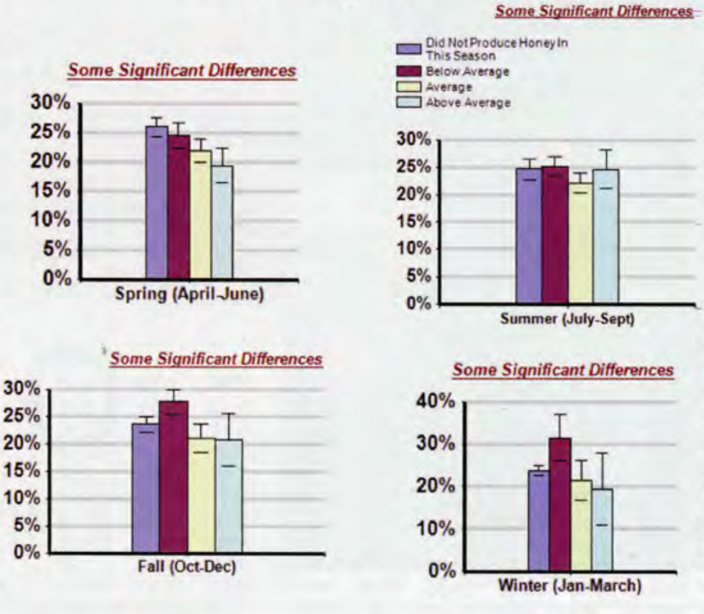
Our technical transfer teams are another targeted area of effort. These teams work directly with large, commercial beekeepers to enable them to make **informed management decisions in near real time. This approach effects change immediately while working in parallel with the best of traditional research to get information and results to participating beekeepers quickly.** The concept of tech teams has received considerable traction in the commercial beekeeping community and, using various private (including Project *Apis mellifera*!) and public funding, has expanded to include other teams serving all aspects of beekeeping. As a result the Bee Informed team has developed and tested **comprehensive hive assessment and sample collection protocols; rapid, efficient, and economic disease diagnostic capabilities; and beekeeper-friendly report generation.** Our teams have grown and spread. We now have a northern CA and a Hawaii team working with queen breeders, a Midwest team working with migratory and honey producers, a Florida and Georgia team working with migratory beekeepers and queen producers, and starting late spring of this year, a Pacific Northwest team based out of Oregon State University that will work with beekeepers who pollinate fruit, nut, oil and vegetable seed crops. **Also beginning this year will be a 'Remote Tech Team" training session for those who want the analysis of what we can provide but do not live near one of our traditional tech teams. If you or someone in your operation would like to attend this training, please contact us at askbeeinformed@gmail.com.**

Degree of Comb Replacement



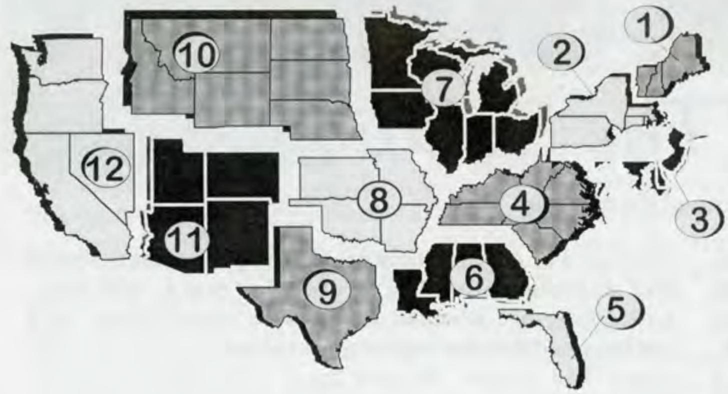
Using epidemiological tools, we hope to find which management strategies are working and which ones are not. In short, we believe the information collected from these larger operations will not only have value to the specific beekeeper, but to the wider beekeeping community. **Please visit our website and read our blogs for new and exciting results!**

Honey Production



You've seen the Winter Loss reports, and some of them are thought provoking and will drive future applied research. Your data is having an impact and the results grow exciting each year. **Please be sure to participate this year – the survey opens April 1 and remains open until April 30. Go to our website and sign up to participate now. This is your chance to stand up and contribute to a collective cause – we need you and the bees need you!** BC

APRIL – REGIONAL HONEY PRICE REPORT



We surveyed our reporters this month on first look at winter losses. Our reporters represent a fairly good cross section of American beekeepers – 8% are commercial, with 1000 colonies or more, 28% are loosely considered sideliners with between 100 and 1000 colonies, and the remaining 64% are backyarders, with 10 or fewer colonies.

The graph below summarizes the data we collected. A word of explanation on the numbers. Look at the first two boxes on the commercial line. The L, M, and H, denote low, medium or high losses, according to the beekeepers. For the commercial beekeepers then, there were 50% who felt they had low losses, 25% felt their Winter losses were moderate, while 25% felt their losses were high. To the right of the box labeled Commercial are listed eight problems that may have caused colony losses overwinter. Under each are two boxes for each size beekeeper, L, M, and H. Look for Commercial, and skip to the right until you come to the column labeled Disappeared. There you will see that 25% of the commercial sized operations lost colonies to this cause . . . disappeared, and that on average those who lost colonies to this problem, lost about 30% of their bees to this problem. Moving over one column to Starved, you'll note that 50% of the commercial operations lost bees to starvation this winter, and on average of the bees they lost, they lost 53% to starvation. The same calculation are present for the rest of our Commercial operations, those that are sideliners, and the backyard reporters as well.

	Losses	Pesticides		Nosema		Disappeared		Starved		Varroa		Diseases		Pests		Queenless		???	
Commercial	L 0% M 25% H 75%	% Who Lost	0	% Who Lost	0	% Who Lost	25	% Who Lost	50	% Who Lost	25	% Who Lost	0	% Who Lost	0	% Who Lost	75	% Who Lost	0
		Avg. % They lost	0	Avg. % They lost	0	Avg. % They lost	30	Avg. % They lost	53	Avg. % They lost	15	Avg. % They Lost	0	Avg. % They Lost	0	Avg. % They Lost	83	Avg. % They Lost	0
Sideline	L 41% M 32% H 27%	% Who Lost	0	% Who Lost	27	% Who Lost	13	% Who Lost	67	% Who Lost	40	% Who Lost	7	% Who Lost	0	% Who Lost	40	% Who Lost	27
		Avg. % They lost	0	Avg. % They lost	28	Avg. % They lost	30	Avg. % They lost	61	Avg. % They lost	39	Avg. % They lost	25	Avg. % They lost	0	Avg. % They lost	18	Avg. % They lost	30
Backyard	L 50% M 30% H 20%	% Who Lost	9	% Who Lost	3	% Who Lost	21	% Who Lost	62	% Who Lost	24	% Who Lost	15	% Who Lost	6	% Who Lost	26	% Who Lost	21
		Avg. % They lost	25	Avg. % They lost	20	Avg. % They lost	21	Avg. % They lost	75	Avg. % They lost	51	Avg. % They lost	40	Avg. % They lost	40	Avg. % They lost	36	Avg. % They lost	39

REPORTING REGIONS

	1	2	3	4	5	6	7	8	9	10	11	12	SUMMARY Range	Avg.	$/lb	History Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS																	
55 Gal. Drum, Light	2.20	2.45	2.20	1.85	2.25	2.13	2.27	2.20	1.80	2.25	2.10	2.46	1.80-2.65	2.17	2.17	2.05	1.97
55 Gal. Drum, Ambr	2.07	2.25	2.07	1.78	2.05	1.97	2.20	2.07	1.60	2.07	1.98	2.29	1.60-2.60	2.04	2.04	1.99	1.84
60# Light (retail)	209.00	191.67	175.00	179.80	180.00	185.00	180.75	165.00	140.00	171.00	165.00	220.00	136.00-240.00	182.70	2.61	183.97	167.66
60# Amber (retail)	224.50	185.00	175.00	175.00	180.00	180.00	164.75	165.00	152.50	150.00	166.50	220.00	130.00-240.00	178.24	2.97	180.58	161.90
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																	
1/2# 24/case	88.16	89.98	73.80	69.13	77.65	77.65	65.87	77.65	77.65	51.84	84.00	96.00	45.60-108.00	78.50	6.54	76.36	68.01
1# 24/case	121.18	105.73	119.40	93.00	96.00	113.04	93.00	108.00	84.00	106.32	109.60	117.50	60.00-156.00	106.53	4.44	108.19	103.64
2# 12/case	109.84	98.36	110.70	78.67	90.00	94.14	80.84	105.00	84.00	97.44	96.00	100.50	70.00-144.00	93.80	3.91	97.21	94.06
12.oz. Plas. 24/cs	102.16	86.63	66.00	80.80	74.40	72.00	71.20	103.20	72.00	74.40	101.40	88.00	48.00-118.80	83.20	4.62	85.20	79.11
5# 6/case	147.06	111.74	93.00	98.88	114.00	119.98	95.48	112.50	90.00	102.30	102.00	116.00	83.10-176.00	110.41	3.68	111.13	102.84
Quarts 12/case	160.00	153.72	125.36	107.60	144.00	111.51	137.25	120.00	125.36	125.64	128.70	139.33	60.00-186.00	127.72	3.55	131.34	122.20
Pints 12/case	107.25	86.95	102.00	83.67	96.00	67.20	87.07	81.82	66.00	81.82	78.00	84.00	40.00-121.20	83.03	4.61	80.54	76.40
RETAIL SHELF PRICES																	
1/2#	5.13	4.98	3.65	3.62	4.49	4.00	3.18	4.49	4.49	3.80	4.83	6.00	2.50-7.25	4.11	8.22	4.15	3.70
12 oz. Plastic	6.25	5.30	3.59	4.28	4.50	5.00	3.87	4.50	5.09	4.73	5.46	6.10	2.50-8.25	4.80	6.40	4.96	4.65
1# Glass/Plastic	7.10	6.14	6.50	5.72	6.50	6.90	4.94	7.00	5.50	6.20	5.75	10.00	3.00-10.00	6.09	6.09	6.23	5.86
2# Glass/Plastic	13.25	9.69	11.20	8.42	11.00	10.00	8.74	12.00	8.50	9.70	9.59	18.00	4.00-18.00	9.93	4.97	10.30	9.93
Pint	10.00	9.95	10.75	8.04	12.00	7.31	9.36	8.93	6.00	9.33	8.31	8.40	5.10-13.50	8.56	5.71	8.95	7.89
Quart	16.50	14.15	20.00	13.92	24.00	12.68	12.35	20.00	15.66	15.13	14.52	17.60	7.49-26.00	14.58	4.86	14.68	12.93
5# Glass/Plastic	28.50	21.69	20.19	22.65	24.06	24.06	21.00	28.00	17.00	23.90	18.99	30.00	14.99-36.00	22.63	4.53	22.73	21.20
1# Cream	10.00	7.05	9.63	6.75	7.95	7.95	5.86	7.95	7.95	7.99	6.99	10.00	4.90-12.00	7.45	7.45	7.21	7.20
1# Cut Comb	9.83	6.00	9.63	6.30	8.32	5.50	6.87	8.32	8.32	12.00	10.00	10.00	3.00-14.00	8.15	8.15	8.36	8.67
Ross Round	10.00	7.48	8.25	6.58	8.12	8.12	7.00	10.00	8.12	8.12	6.75	8.12	5.00-12.00	7.75	10.33	7.65	7.69
Wholesale Wax (Lt)	6.50	6.08	6.00	4.38	3.20	4.18	4.88	6.00	7.00	6.00	3.73	4.50	2.95-10.00	5.08	-	5.30	5.01
Wholesale Wax (Dk)	5.83	5.63	6.00	4.09	3.15	4.53	4.67	5.75	4.82	4.82	2.25	3.90	2.00-8.00	4.64	-	4.65	4.29
Pollination Fee/Col.	96.67	62.50	88.33	60.80	60.00	52.50	58.83	85.00	94.52	94.52	109.00	146.11	35.00-185.00	79.05	-	84.26	80.78

INNER COVER

When California's drought was beginning to attract attention last Fall I asked Joe Traynor, a pollination broker and crop consultant out in Bakersfield CA, about almonds and water. Because almond trees are a multi-year crop you can't just stop watering them for a bit and start up again later – it's enough water all the time (sound familiar?), unlike annual crops like cotton or vegetables. With those, you can simply let the land lie fallow for a year or a decade and begin again when the rains come. Orchard crops are a long term investment.

Because of this I wanted to know how much water it took to produce a single almond. He sent along some stats on water use and I filed them away, figuring I'd get to them for this issue. What he sent and what I found was:

- A good crop produces about 900,000 individual almonds per acre (at an average 2600 lbs./acre, with an average 375 nuts per pound)
- Almonds require between 3.5 and four acre feet of water per year to sustain good production (an acre foot of water is how much water it takes to cover an acre of land a foot deep)
- There's 325,000 gallons of water in that acre foot, so an acre of almonds uses between 1.14 and 1.3 million gallons of water per year
- This year there's 820,000 production acres of almonds to cover 3.5' – 4' deep in water
- The life of an almond orchard is between 25 and 30 years, and every acre needs that much water every one of those years, so between 28.5 and 40 million gallons of water are needed for that one acre of land over the life of the orchard. For comparison, that's a square column of water 70 yards on a side, and between 30 and 40 yards tall.

Put all these together and you need between 1.25 to 1.4 gallons of water for every almond harvested. Every one!

So this got me to thinking, again, about water in general. Not where it comes from but how much it takes to produce things like a single almond. Of course others have had the same questions, and recently I uncovered data produced by The Brallia Center For Food & Nutrition published in *Eating Planet 2012*, available from Amazon.

They take a global approach to nutrition for humans, and they, too, fuss about water. But they use a different approach to how much water is used to produce, for instance, that single almond. Virtual water is their measuring cup. Think of it this way. How much water does it take to grow all the grass a cow eats in her life, plus all the water she consumes in her life time? That's virtual water. They also look at the Water Footprint of food. That is, how many gallons of water are required to produce a pound of food or other agricultural commodity?

One good example of virtual water is that it takes a whopping 440 gallons of water to produce a quarter pound hamburger. That'd be 525 gallons if you want it with cheese, and another 10 gallons if you want fries with that. I'm not sure how much more if you add a fountain drink and catsup. But then, add another 10 gallons for the bag and the box the burger is in and the napkins you use (the water for the trees for the paper, and especially for the processing).

Interestingly, when you look at the information they provide, it seems that the foods that require the least amount of water are those that, according to my doctor, are the healthiest for you. Figuring gallons of water required to produce a pound of food, vegetables come in the lowest at 40 gallons/lb, most fruit at 120 gals/lb. but it's 200 gallons of water to produce a pound of honey. Milk, 250 gallons per pint, and it's 615 gallons for a pound of olive oil. And you saw what a quarter-pounder with cheese and fries costs in water used.

So why does this matter? Well, again according to the Brallia Center report, there's about 370 million trillion gallons of water on the planet of which only 12 million trillion gallons are useable, and only about three million trillion (about .01% of the total) acceptable for human use due to quality and cost. About 64% of all the useable water on the planet is found in just 13 countries and it takes a minimum of 700 gallons per person per day to live an essentially normal life. Agriculture uses 70% of that available fresh water, with industry using 22%, and domestic use drinks and washes and flushes the remaining 8%. The bare minimum needed dribbles out to between five and 12 gallons a day, just to survive. Where, do you suppose, will all those gallons come from, tomorrow? And it really is getting warmer.

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You may have noticed. Last month and again this month we're looking at ways to insure that our bees have enough good food all of the time. We deal with mites using IPM, resistant bees and even miticides. We can isolate bees from harm's way, and we can manage them so that the common pests and diseases remain minimally disruptive.

Water And Food.

But we can't give bees enough good food if there's not enough good food growing where the bees are. Yes, we can feed them carbohydrate and protein alternatives. In fact, we absolutely must feed them if the environment isn't providing the essentials they need. But that's only a fast food solution to a nutritionally deficient predicament.

But just as we can provide supplemental feed to our bees in the form of sugar and assorted protein diets, we can also provide first rate nourishment in their environment. I started this conversation last month talking about buying inexpensive Soil and Water Conservation plants and getting them established in your area. We've pretty much wrecked their world, I think it's time we began to fix it.

A couple of years ago I wrote a book entitled *Better Beekeeping.* I looked then at what I thought to be the greatest challenges and opportunities to staying in and even expanding a bee business. I looked at diversifying your business into pollination, honey production, raising queens, nucs or selling supplies. Because of the difficulty in finding good queens we looked at raising your own and I explored efficient colony management techniques focusing on pest control and swarm management, and I went way overboard on good wintering techniques. Basic and advanced honey bee husbandry has been totally neglected the past 30 years because of our focus on dealing with *Varroa*, and I felt it was time to revisit some of those skills. Another aspect that's been completley overlooked was also on my agenda, so I went in-depth on intentionally growing your own honey crop.

This isn't for everyone but it is for some, if only some would look at it as a possibility. I explored leasing land, using short, medium and long term crops that could serve both bees and beekeepers, and I looked at using all the space a piece of land took up. Plus, I looked at the equipment needed, the production of particular crops, constructing temporary storage buildings that could be moved, and how many colonies could sit on how much land and never, ever have to leave home to find enough food or be safe.

The lessons taken from that chapter, however, transcend a 40 acre plot and beekeepers with hundreds of colonies. These tidbits can be adapted to a vacant urban lot, a half-acre plot in the suburbs or a five acre plot on the edge of the country. Planning a honey crop on a piece of land, large or small, requires you to think in three dimensions.

First, there's the piece of land itself. How big is it, and what can you do with a piece of land that size? A half-acre isn't going to give you more than a bale or two of alfalfa hay, but it can give you three crops of White Dutch clover over the course of a summer that will produce about 150 pounds of honey if it's managed correctly. And those management techniques are readily available. Plant science didn't stop when *Varroa* came. It didn't even notice.

So you can use what land you have or you can buy, rent or lease land. All work in modern day farming – and that's what this is – farming. You are growing a crop. Like forage for dairy cattle that produce milk that is harvested, this is forage for honey bees that produce honey that is harvested. It's the same thing. **The first dimension then is area.**

So once the amount of land is determined you have to decide what to grow, and even though it's old information most of the honey plant books – ummmm – that would be both the honey plant books have pretty good data about where plants grow and how productive they are where they grow. Plus, you probably have a pretty good idea of what works where you are, too. Use what you can find and what you know. And then think ground covers, low shrubs, medium shrubs, tall shrubs and trees. Use the space you have to its full advantage. *Don't shade the ground covers but use the sun, the edges and the middle the best way you can to get as many flowers per cubic foot above that land as possible.* **That's the second dimension, volume.**

The third dimension then is time. Design a list of plants such that you have bloom from just before last frost until after first frost... all season long. There should be as many blossoms as possible all of the time. Depending on where you are, ground covers can be managed so some portion of the plants are always blooming, early maples, willows and such come in strong, followed by fruit bloom and then all the Summer plants into the Fall with the last hurrah of the season. There are several seed companies that actually provide seed mixes to accomplish this. The smart ones are talking to beekeepers right now. So think of it this way – Some Bloom All Of The Time provides Enough Good Food All Of The Time.

So there are the three dimensions – area, volume and time. The management elements have to be addressed of course but they are a factor of how intense the land is farmed. Is it a working farm with crops, or an on-its-own meadow? This can be done on some scale by every beekeeper, whether it's a handful of seed bombs in a vacant urban lot, five basswood seedlings on the edge of an unused field, or 100 pounds of clover seed, a 100 different shrubs and a 100 different trees on your own land all at once or over time.

Do you remember The Whole Earth Catalog published in the late 60s? Stewart Brand, the founder, made available the tools and skills to change the Earth and make it a better place. He said then, "We are as gods, and might as well get good at it." But we didn't I think. We have pretty much made worse what the world has given us. Now, says Brand, "We are still as gods, and HAVE to get good at it."

I'm not sure if we are gods but it's come down to you and me. We have to get good at this to make a better Earth for bees and birds and people because it's become quite obvious that science, government and business are not looking out for us.

Kim Flottum

It's Summers Time –

More About The Chickens

Over the last year and a half every meeting Kim and I have gone to at least one and most times several have commented on my articles. People have started calling me the chicken lady. I'm actually OK with that. There are worse things a person could be called. I'm so glad that people enjoy what I write about. It gives me great pleasure to share little parts of our lives with you. So thank you.

Can you believe the chickens are two years old? And they are doing just fine and they are laying on average eight or nine eggs a day – 11 chickens. Just to recap we started two years ago with 15. We lost three that first Summer to some kind of predator – I'm pretty sure it was a raccoon. I didn't get home until late one Summer night to get the coop door closed and something got in there. Then this past Summer we lost one more – not sure what happened. We got home about dusk, went in to take a head count and close the door – only 11 chickens. So we counted again, looked in the pen, looked all over the yard. Still only 11 chickens. A day or so later our neighbor found some brown feathers back in the field where she walks her dog. I suspect the chicken became airborne and ended up out of the pen and something got her. So we have 11 now.

Last week one of the Golden Buffs was acting a little strange. Nothing obvious, no wounds, no missing feathers. She just seemed to want to be left alone. She was on the end of perch with her back to us facing the wall just kind of hunched over. Didn't want worms, didn't want scratch, didn't want to be bothered. So we watched her closely for a couple of days. She would still eat and drink, but just not much energy. And now she seems fine. Sunday I spent time cleaning the coop and picked her up, checked her over, talked to her, held her. Couldn't find anything wrong.

So what do you think, just having a bad day, tired of Winter, tired of being cold. Because actually that's what it seemed like. She reminded me of how I've felt some of the time this Winter. Enough is enough.

One of the Winter activities that Kim and I have come to enjoy is feeding the wild birds on our deck, and we've gone through a lot of birdseed this Winter. We have sliding glass doors and it's like a big screen TV for our two cats, and I have to say for us also. I always thought bird watching would be a boring activity, but I can see now how folks get hooked on it. We have cardinals in Ohio, in fact it's our state bird. They are gorgeous. We have woodpeckers, different kinds of finches and lots of birds that I have no idea what they are. But I've bought a couple of books and I'm working on identifying some of them.

I marvel at how they can survive in this kind of weather. If we didn't put this seed out for them what would they do? They'd manage somehow, but it seems an impossible task when there is snow everywhere for something so small to able to get what they need.

A few days ago Kim went to the feed store and they already have the chicks and ducks. I'll make my visit this weekend. We've been debating about getting more this year and incorporating them into the flock. It's early March as I write this and we're finally getting a little bit of warm weather. If we do get more chicks we'll head more towards the end of March and hope that it is a little warmer.

Baby chicks are so cute and almost irresistible when they're just a few days old. We were in the feed store just after we'd bought our chicks two Springs ago and a young lady with two small kids came in. Of course they have the chicks right in the front door in this particular store, so you really can't avoid them. These kids got so excited and the mom got just as excited as they did. We were there for a while buying supplies and just looking around. After about 20 minutes the mom and kids walked out with some number of chicks and I think some ducks. Now you could tell by the conversations she did not come there to buy chicks or ducks – but with no preparation at all they went home with chicks and ducks. I've often thought about her, and what she did with them when she got home. And what do you suppose Dad's reaction was?

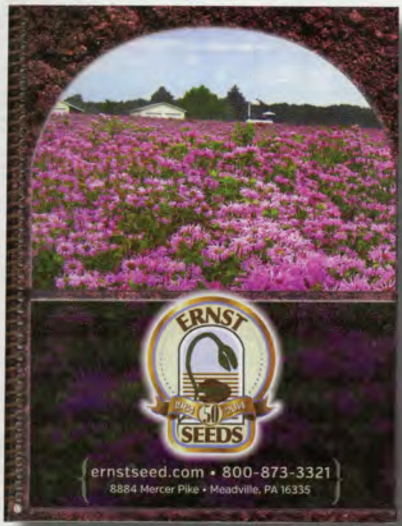
Chickens, like any other pet or livestock, take preparation if you're going to do it right. Kim and I took this activity very seriously, because we plan on having chickens for a long time. Our coop is built right onto our garage so in the Winter we don't have to slop around in the snow. That was mostly for our convenience, but it turned out quiet nice for the chickens also, because that whole side has a nice wind block.

Water has probably been the most difficult thing to figure out with the chickens. There are several fancy systems on the market that hook right up to your plumbing. Our house and garage are not conducive to that kind of a set up. We've probably tried almost every kind of waterer available on the market. There are plastic ones and there are metal ones and none of them are perfect. I've found that it's mostly just diligence in emptying it often and keeping it clean. It is amazing how fast the water can become stagnant. And they need clean water and lots of it, especially in the Summer. Kind of like the bees, right?

When you get this issue surely Spring will have arrived – somewhere for some of us. I hope you have a wonderful Spring. I can't wait to get the tiller and the wagon out and just be outside.

Kathy Summers

What's New For You –



Ernst Seeds. **www.ernstseeds.com**. 8884 Mercer Pike, Meadville, PA 16335. 800.873.3321.

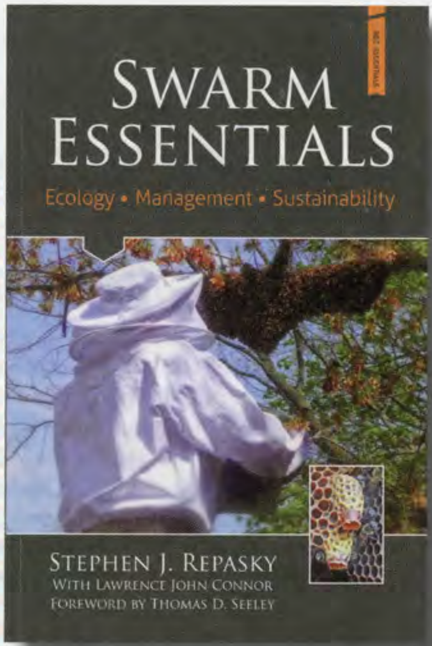
This isn't a new product, per se, nor is it a book review, per se, but it's a bit of both, plus an introduction to a fascinating company. Ernst Seeds sits on 8,000 some acres in NW PA, producing an amazing collection of seeds and plants. They've been at it for over 50 years, are still family owned and run with nearly 100 employees. They started small, on five acres, and today have acres in PA and other locations and work with a variety of other seed companies.

They produce seeds for upland meadows, wildlife food plots, pollinators, riparian sites, disturbed and steep slope sites, well and pipelines, wet meadows and wetlands, woodland openings, partially shaded and storm water management sites, and seeds for SE U.S. And then, they tell you how to make those seeds perform the best they can, with offerings on The Life Of A Meadow, Q & A on anything, and pages and pages on biomass production. They have plans and plants for bioengineering materials, and dozens of seed mixes...grasses and grass-like species, herbaceous flowering species, woody trees, shrubs and vines, and wildlife food and biofuels – each with hundreds of species in the mix. And then, they show you how to prepare a field for planting a mix like these. Weed control, fertility, maintenance over several years – they do it right by their customers.

Plus, you can custom blend a mix if you want to exactly meet the requirements you might want. Their catalog is online or they'll send you a free CD and it'll take you a couple of days just to get through it. Take a look, and now you can plant enough good food for your bees.

Kim Flottum

NMC-WOLLARD, Inc., manufacturer of the Super Bee, announces a new name for their rough terrain fork truck. The new name is "NMC Super Bee" (formerly Swinger). Along with a new name, the smooth-operating hive handler features a transverse mounted 48.1 Kubota diesel engine, a new set of ergonomic controls, shift-on-the-go hi/lo hydrostat, a heavy duty articulation/oscillation joint, planetary reduction drive axles and 4-wheel drive with limited-slip capability for sure traction. Other features include hive clamps, single foot pedal forward/reverse, 4-in-1 gauge display and 1,600 lbs. (SAE rated) operating capacity at full mast extension. Contact: Mark Brown at 800-656-6867, ex 7246 or e-mail **mbrown@nmc-wollard.com**. or **www.nmc-wollard.com**.



Swarm Essentials. Ecology. Management. Sustainability. By Stephen Repasky, with Lawrence John Connor. Published by Wicwas Press. 6" x 9" 128 pages. Color throughout. Soft cover. ISBN 978-1-878075-32-1. $23. Available from the publisher and most bee supply catalogs.

Tom Seeley wrote the forward for this book, and he summed it up this way: In the following pages, the authors present a guided tour of what we humans have learned so far about the biology of swarming honey bee colonies. Given the wonders and mysteries of honey bee swarms, it will be extremely useful to all keen beekeepers.

Chapters include the Biology of Swarming, Methods to Prevent Swarming, Swarm Control (managing a colony so it does not swarm), Swarm Management (are they really swarming), Swarms and the Ecosystem (yes they did, now what?, and methods to catch swarms. The authors pretty much cover it all, plus a bit...swarm stories, specialized equipment, traditional techniques used to stop, or fool a colony, and, the thing I found most useful, a beekeeper's decision chart to be used during swarm season. It's an "If, Then" chart that spells out what you should be doing when you examine a hive and find – what you find in a colony in swarm season.

This is one more you need on the shelf.

Kim Flottum

NOT Your Grandfather's Beekeeping Course

A Master Beekeeper Program worthy of the name.

Candice **Merrill**

If your grandfather kept honey bees, chances are he didn't read trade journals, attend conferences or keep up with the latest developments in honey bee research. He didn't have to. The methods he used were likely passed down to him from his forebears, and they worked perfectly well to keep his hives healthy and productive. In recent years, by massive die-offs, honey bees have reflected back to us the complications of the world we live in now. Bee health problems have prompted a flurry of activity in all things bee-related. In addition to a scramble for news stories that implies panic is the only reasonable course of action, there has been an upset in the industry with many professionals getting out of the business, and a notable resurgence of interest in beekeeping as a pastime. New beekeepers – both hobbyist and commercial – are needed and welcomed with one caveat: your grandfather's methods are not sufficient. Beekeeping must evolve to survive as a livelihood and to help honey bees survive.

Jerry Bromenshenk, Phillip Welch and Scott Debnam.

Bee health is a more complex issue than the sensational news stories would have us believe. Honey bees are threatened with starvation, extreme weather, predators, along with more pests and more diseases than ever before. They and billions of their colleagues are packed together tighter than is probably healthy and transported from one side of the country to the other several times a year. They are exposed to herbicides, mono-culture food crops, pesticides and any number of man-made substances, purposefully and accidently. In short, bees, like the rest of us, are *stressed.*

There are a plethora of proposed (right and wrong) solutions to the honey bee health issues that have been brought about by new developments in this world we inhabit, and more issues still to be addressed. As we know all too well, even experienced beekeepers can do what seems to be all the right things and still lose bees. Traditional beekeeping practices are no longer sufficient to keep bees alive, much less producing at full capacity. It calls for well-informed approaches that are up to today's challenges. Meanwhile the media is fairly bursting with opinions, information and insidious misinformation. Wild theories, confusion, misuse of terminology, and sweeping generalizations abound in the news, on the Internet and in a multitude of beekeeping courses taught by self-proclaimed experts that have popped up since the advent of the term "CCD."

Some google-able information and some beekeeping courses are decent and serve their purpose as far as they go, though most don't reach beyond rudimentary-level. Other sources tout methods that range from incorrect to downright damaging. Sick bees don't keep to themselves; they travel out into the world and mix with healthy bees, spreading disease as they go. Thus, misinformation that leads to poor beekeeping practices can damage not only an individual backyard hive, but the bee population as a whole. Unfortunately, those new to beekeeping are usually left to their own devices to sort good information from bad. And how is a newbie to know the difference?

Faculty and Research Staff at the University of Montana (UM) sought a way to cut through the barrage of misinformation and bridge the information gap by making the latest in honey bee research widely available to hobbyist and commercial beekeepers. The result is a unique three-part online program of study, led by Jerry Bromenshenk, Scott Debnam and Phillip Welch. UM's Apprentice/ Journeyman/ Master Beekeeping program, now entering its third year, has participants from around the globe queued and eager to proceed into their next course, which will be offered this Spring. Former students from North and South America, Australia, New Zealand and Great Britain tout the program for the unparalleled opportunity it provides to study with, as one student stated, "one of the most widely renowned honey bee research teams in the United States."

Dr. Jerry Bromenshenk's 40 year research career has focused on insect behavior, ecotoxicology, population dynamics, and environmental chemistry. He has trained bees to locate land mines and tracked their location using laser technology. His research has had the added benefit of years of in-depth observation of bees, leading to a deep understanding of their behavior. Scott Debnam has more than 14 years' experience managing the research of honey bee colonies for the University of Montana. He has extensive expertise with honey bee behavior, ailments and pests. For the past 19 years, Phillip Welch has participated in honey bee research at Sandia National Labs, Bee Alert Technology and the University of Montana. The team has not only dedicated their lives to studying bees, they are *passionate* about them, as is evidenced in their facial expressions and body language as they discuss their subject and their approach to teaching.

With so many less costly beekeeping courses available and so much information freely available on the internet, prospective students generally ask what makes UM's Master Beekeeping Certificate program worth the investment. In a single word, the unique quality of this program is "*why*." After many years of studying bee biology and of observing – *really observing* – bees inside and outside the hive, Bromenshenk, Debnam and Welch understand and teach not only what the bees do in each season and in every stage of their lives, but why they do it. They teach not only the best practices of how to manage and treat them, but why they should be handled and treated in a particular way. The secret to success, they believe, is in the understanding of "why."

UM's Beekeeping Certificate Program is academic, comprehensive and based in sound scientific principles. In addition to the support of two deans, and the expertise of program faculty, a small army of technicians, instructional designers and graduate students in a variety of media arts disciplines have come together to lay out the courses using methods most conducive to learning. The content is king, and the delivery is a thing of beauty. The team has been able to replicate the organic approach to teaching, about which the instructors have been adamant. Debnam and Welch agree that "What we've got here is a course of study that can make an impact on the world of beekeeping."

Anyone with high speed internet access can take the program, regardless of geography, because it is online. While this may seem an unlikely way to study such an eyes-on, hands-on process as beekeeping, it works. Each course is comprised of carefully crafted lessons that allow students to learn using multiple intelligences. Indeed, some concepts are more easily demonstrated in this format. Thanks to the work of photographers, videographers and animators, it is possible to see things that can't be seen with the naked eye.

Participants choose to take the courses for academic credit through the University of Montana or for Continuing Education Units for a slightly reduced fee. In either case, the course requirements are the same. The instructors feel very strongly that, regardless of credit/non-credit status, students must pass each level before they be allowed to proceed to the next.

Although the courses are rigorous, they shouldn't be intimidating to participants who have at least entry-level experience handling bees. Those considering enrolling in the program should have an awareness of current honey bee health issues that impact bee populations, and a commitment to learn what they can do in an effort to be a part of the solution. An open mind is the most important prerequisite. Other prerequisites include being prepared to work at the college level, having reliable internet access, and enough time to dedicate to the assignments. (It is recommended that students spend at least three hours per week in addition to every hour of class time.) Students need to have access to textbooks, basic beekeeping clothing and equipment. A microscope is required for the Journeyman and Master-Level courses as the instructors believe it is an indispensable diagnostic tool for any beekeeper.

Each course is only a few weeks in length. However, the program in its entirety is structured to give students a full year of practical experience in between, and so the entire program takes three years to complete. The class meets online – and it is a true "meeting," as interacting with beekeepers from various parts of the country and the world is an important part of the experience. The dynamics of the group creates a network in which students learn from each other as well as from the instructors. Course discussions are notable for their sharing of perspectives from one part of the world to another. This kind of learning literally opens a world of possibility. Typically, at the conclusion of the course, students want to keep up the connections they've made, and so the discussions continue via email and Facebook.

Bromenshenk, Debnam, and Welch guide the lessons, participate in discussions and are available to answer questions. There is a hands-on aspect to the study as well; students usually arrange to complete the practical component in an apiary near their home with a pre-approved proctor and forgo a trip to Montana.

The program begins where you would expect it to begin, with the basics of handling honey bees. It then takes students through diagnosing pests and diseases, including microscopy, pollination, reducing the risk of loss due to pesticides and honey production. It concludes with the business of beekeeping: optimizing for production at the hobbyist or commercial level. Each course builds upon knowledge gained in the previous course and the hands-on practice gained in the interim. At completion of the program, students will have earned the title of "Master Beekeeper." More importantly, they will have joined a community of informed beekeepers - a network that will serve as a resource for years to come.

Current pressures on honey bees call for approaches that are more consistent with today's challenges and a teaching method that makes up-to-date information easily accessible and widely available. The beekeeper's job is to optimize conditions for bees, giving them the best possible chance at survival. The University of Montana feels that its job in this context is to give beekeepers the best chance at success.

Knowledge is power and more knowledge is more power. As Dr. Bromenshenk has said, "No beekeeping program can guarantee your success with honey bees – our program will give you the strongest possible foundation and therefore the best chance at keeping healthy, prosperous hives."

This is not your grandfather's beekeeping course. BC

A Closer LOOK

POLLEN SUBSTITUTES

Clarence **Collison**

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

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

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

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

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

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

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

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

The effects of changes in Spring pollen diet on the development of honey bee colonies were examined in a three-year study (2002-2004) (Mattila and Otis 2006a). Pollen supplemented and pollen-limited conditions were created in colonies every Spring, and brood rearing and honey yields were subsequently monitored throughout the Summer. In all three years, colonies that were supplemented with pollen or a pollen substitute in the Spring started rearing brood earlier than colonies in other treatment groups and produced the most workers by late April or early

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May. In 2002, these initial differences were reflected by a two-fold increase in annual honey yields by September for colonies that were pollen-supplemented during the Spring compared with pollen-limited colonies. In 2003 and 2004, differences between treatment groups in the cumulative number of workers produced by colonies disappeared by midsummer, and all colonies had similar annual honey yields (exception: in one year, productivity was low for colonies supplemented with pollen before wintering). Discrepancies between years coincided with differences in Spring weather conditions. Colonies supplemented with pollen or a substitute during the Spring performed similarly in all respects. These results indicate that an investment in supplementing the pollen diet of colonies would be returned for situations in which large Spring populations are important, but long-term improvement in honey yields may only result when Spring foraging is severely reduced by inclement weather.

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

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

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

Pollen substitute palatability tests were done in commercial apiaries in early Spring 2004 (Saffari et al. 2010). In this trial, three different feeds, FeedBee, TLS Bee Feed and Bee-Pro® were fed to 153 colonies in 12 beeyards for six weeks (March 25th- May 6th) in southern Ontario. Two methods of feeding were used: 1) No-choice feeding, where each yard received only one of the three feeds, and 2) Choice feeding, where each yard received all three experimental feeds. The mean feed intake (g/colony/six weeks) of FeedBee was 960 g and 883 g for the first and second feeding methods, respectively. These amounts were significantly greater than for the other two feeds. The amount of Bee-Pro® consumed (g/colony/six weeks) in the two feeding methods was 224 g and 106 g and for the TLS Bee Feed, 115 g and 52 g, respectively. These results indicate that FeedBee in powder/dry form is highly palatable to honey bees. The results show that it is well accepted by bees during the shortage or absence of natural pollen.

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

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

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

For several years scientists and commercial companies have been trying to formulate protein substitutes that are as good as or better than natural pollen diets. Numerous studies have shown that adding 5-25% natural pollen to a protein substitute often increases its attractiveness, palatability and consumption rate; however brood development and colony reproductive rates still are not equivalent to natural pollen diets. A pollen mixture from various floral sources provides the ten essential amino acids, minerals, lipids, and vitamins required for growth and hypopharyngeal gland development. In an effort to enhance the impact of feeding pollen substitutes, numerous new pollen substitutes are now available in the marketplace. In addition to a standard protein source that has been micro-milled, these new substitutes now contain probiotics, Pro-Health feeding stimulants, organic essential oils, a complete amino acid profile, beneficial vitamins, lipids and minerals. Unfortunately, to date these new diet formulations have not been adequately tested to determine if they in fact improve colony health, growth and development over the standard diets that have been used in the past. BC

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The Pollinator Stewardship Council

COSTS & RISKS NOT CONSIDERED

In the case of sulfoxaflor, EPA's own staff scientists concluded the pesticide poses "a potential for risk to honey bees."

Earthjustice, a non-profit environmental law firm, filed suit last year in the U.S. Ninth Circuit Court of Appeals on behalf of the Pollinator Stewardship Council, American Honey Producers Association, National Honey Bee Advisory Board, American Beekeeping Federation, Thomas R. Smith, Bret L. Adee, and Jeffery S. Anderson and against U.S. EPA regarding the registration of sulfoxaflor, the latest pesticide in the family of neonicotinoids.

The lawsuit (Case No. 13-72346) challenges EPA's registration of sulfoxaflor as not complying with the legal requirements for pesticide registration under the Federal Insecticide, Fungicide and Rodenticide Act ("FIFRA") because it ignored evidence about dangers to pollinators and failed to properly assess the costs and risks to the bee-keeping industry and agricultural crops that rely on bees. FIFRA requires EPA to assess whether a pesticide poses an unreasonable risk to human health or the environment. If it does, EPA may not register the pesticide for use unless EPA determines the benefits of the pesticide outweigh the risks. Any analysis of the economics of the costs and benefits associated with the conditional registration of a new pesticide with potential to cause both acute and sublethal poisoning of honey bees must account for the value of pollination services to the agricultural economy. Under federal law, an agency decision must be supported by the evidence in the record before the agency and be driven by an agency's proper judgment based on that evidence.

In the case of sulfoxaflor, EPA's own staff scientists concluded the pesticide poses "a potential for risk to honey bees," based on numerous laboratory toxicity studies. EPA staff further determined that the limited studies involving the use of sulfoxaflor under field conditions "were unable to preclude risk to developing brood or long-term colony health . . . due to limitations associated with their design and conduct." Consistent with FIFRA and EPA regulations, staff therefore recommended that the agency require adequate field testing prior to approving sulfoxaflor.

In keeping with the conclusions and recommendations of its staff experts, EPA initially proposed to "conditionally register" sulfoxaflor under FIFRA, pending the timely submission of valid field studies demonstrating that use of the pesticide will not pose a risk to bees. But less than four months later, having received no additional science and without further public process, EPA suddenly reversed course and registered sulfoxaflor unconditionally. In lieu of the requisite science, EPA claimed that a handful of "mitigation measures" would reduce the acknowledged risk to bees. EPA declared that the remaining risk to bees is "outweighed by the benefits of sulfoxaflor registration." EPA's decision to register sulfoxaflor unconditionally in the absence of adequate field studies is contrary to both FIFRA and the agency's own regulations. Moreover, there is no evidence that EPA's arbitrary – or, in some cases, entirely voluntary – mitigation measures will address the risk to bees. Nor does the record support EPA's claim that the risk to bees is outweighed by sulfoxaflor's benefits. Instead, the record shows that EPA improperly and artificially constrained its risk benefit analysis, narrowly considering only sulfoxaflor's purported benefits as an alternative means for killing insect pests. EPA failed to account for the devastating impact that sulfoxaflor will have both on the beekeeping industry and on the multitude of important crops that must be pollinated by bees if they are to bear fruit or seed.

Earthjustice is asking the Court to set aside EPA's ill-informed and illegal decision to register sulfoxaflor in its entirety and to remand the matter to EPA for reconsideration in accordance with the law. This type of case is decided by the Court of Appeals on written briefs. The briefing process concluded in March and an oral argument before a panel of three appellate judges will likely be held later this year. Although there are no specific time requirements, a written decision in the case would be expected three to nine months following the oral argument. If the bee industry is successful, the court will remand the decision to EPA for reconsideration. The Court typically does not tell EPA what that decision must be, only that it must reconsider it in light of what the court says about the law.

Honey bees are dying at rates that are unprecedented and unsustainable. The U.S. Department of Agriculture ("USDA") and EPA agree that "[a]cute and sublethal effects of pesticides on honey bees have been increasingly documented, and are a primary concern." Whether bees ultimately survive and recover is a matter of great consequence not only to professional apiarists, but also to all of us. According to EPA: "An estimated one-third of all food and beverages are made possible by pollination, mainly by honey bees. In the United States, pollination contributes to crop production worth $20-30 billion in agricultural production annually. A decline in managed bee colonies puts great pressure on the sectors of agriculture reliant on commercial pollination services."

The Pollinator Stewardship Council is working for beekeepers. Help us protect your bees! *Your financial support of this nonprofit is the key to our success.* Together we can make a difference for beekeeping operations, for pollinators, and for a sustainable and affordable food supply. To report a bee kill email us at info@pollinatorstewardship.org. For more information about the Pollinator Stewardship Council or to schedule a presentation to your bee club, visit our website at www.pollinatorstewardship.org. BC

Do Bees' Feet Have Suckers?

Ian **Stell**

The short answer is: no, they do not. So how do they hold on to completely smooth vertical surfaces?

To answer this question we will need to look at their legs in detail.

Figure 1 shows the 12 components of a bee's rear leg. The number of segments in other legs is the same, although their shapes and functions are slightly different. From left to right the segments are: the coxa, trochanter, femur, tibia, basitarsus, three tarsomeres, pretarsus (foot), two pairs of claws (ungues) and the arolium. Only the first four contain the muscles which move the leg joints.

Figure 1 *– The segments of a rear leg, separated out.*

Figure 2 *– Scanning electron micrograph of the last segments of a left rear leg.*

In considering the bee attachment to surfaces, we must focus on the last part of the leg, the thin part containing the three tarsomeres, the foot and its appendages. In figure 2 we see that the leg ends with quite substantial claws (known as ungues), and between these an upturned structure, the arolium.

The claws each have a joint with the top of the pretarsus (foot) so that when the single tendon (the unguitractor tendon), running down to the foot is operated by its muscles in the femur and tibia the claws are pulled downwards (flexed) and their points hit the surface (figure 3). If they fail to gain a grip they continue to move outwards and the arolium pivots around the lower end of the manubrium, and flattens out onto the surface. If we observe this happening under magnification we see that

Figure 3 *– Movements of the claws and arolium – a simplified diagram showing the main structural components only. Legend: Arolium 1, Claws 2, manubrium 3, unguitractor plate 4, planta 5. As the unguitractor plate is drawn into the pretarsus by the unguitractor tendon, the claws are pulled down onto the surface. If they do not grip then they continue to move backwards and sideways. The unguitractor then pulls on the planta attached to the base of the arolium. The arolium then pivots around the lower end of the fixed manubrium, spreads out and grips onto the surface.*

Figure *– Highly magnified surface of the arolium (x10,000). These ribbed structures provide the 'grip.'*

the flattened arolium attaches to the surface strongly, providing a strong anchoring point for the leg. So how does it grip on?

We only need to look at the surface of the arolium at high magnification to see that it is not a 'sucker' (figure 4), it is not the right structure to create a cup shape and rely on a 'vacuum' to grip on. Instead it has a number of ribs with a fine raised network running over them. Recent work on geckos, small lizards capable of running across ceilings, has shown that their club-ended toes actually hold on using Van de Waal's forces rather than suction. These are electromagnetic forces produced between molecules close together. A similar process has been described in jumping spiders. It is likely that the same forces are at work when bees hang on surfaces. The size

Figure 5 *– Bees' feet gripping on glass. This image is taken through a sheet of glass and shows two feet of bees hanging upside down, suspended by the grips from arolia.*

Figure 6 *– Bee gripping onto a wooden hive wall with its claws.*

of these adhesive forces is small (figure 5). In attempting to quantify them, the adhesive pressure must be at least about 2 kPa for a bee to hang upside down by all six legs (a vacuum cleaner, by comparison, produces a suction; a negative pressure, of about 20kPa). However it is likely that the maximum adhesion pressure is somewhat greater than this as one bee can easily support several others hanging from it.

Although the ability to grip to smooth surfaces using the arolia is enough for one bee to support its own weight and one or two others, this is far less than the attachment that the claws are capable of. If the surface is rough enough then bees will grip using their claws (figure 6) and the entire weight of a swarm is supported by the claws of those at the top gripping to a branch, and other bees gripping to each other. BC

Ian Stell is an MD from the UK. He is an accomplished author, photographer, beekeeper and artist and the author of Understanding Bee Anatomy: A Full Color Guide.

Future Opportunity In Honey Bee Health

What is RNAi and why is it a great addition to the toolbox of ag solutions?

Gregory **Heck**

Although I didn't grow up on a farm, my parents came from farming families and a number of my relatives still work on family farms and even maintain a few beehives. At some deep level this perhaps helped inspire my interest into the science of how living things work. As I considered careers, I could have chosen a path that sent me into a purely academic route of teaching and doing research at a university, but instead I chose the route of trying to find practical ways to make science useful in agriculture. This led me to a job at Monsanto over seventeen years ago. I saw them as innovative leaders in creating products that farmers wanted to use and that was where I wanted to work.

Since I began working at Monsanto, I have had a chance to participate in a variety of basic research efforts, from understanding how seeds germinate to working on weed control, that have moved me closer to my goals of developing practical solutions that make a difference. For the past 10 years or so I have worked in the exciting field of RNA biology, building on the Nobel Prize-winning discovery by Dr. Andrew Fire & Dr. Craig Mello of RNAi. (**www.nobelprize.org**). When I ventured into this line of research, it became clear to me that RNAi could help agriculture in numerous ways, including protecting crops from pests and disease, improving nutritional qualities of plants, and even newer non-GMO applications now being investigated such as addressing the health of honey bees.

So just what is RNAi and why do I think it is a great addition to the toolbox of agricultural solutions? Let's start first with the process of RNAi itself. I often get the question: "is it something new?" The answer is "no." RNAi has been around as long as plants, insects and other animals have been on Earth. What *is* relatively new is that we now understand how the RNAi process works, thanks to the work of Fire & Mello (Fire et al, 1998). Specifically, they learned cells have a great way to control how the information in their genes is used.

It has been known for quite some time that information in DNA is converted to the "messaging molecule," RNA, which carries that information around the cell to where it is needed. The insight Fire & Mello reached was that cells can fine-tune this information flow with the help of a different type of RNA molecule that specifically reduces the activity of RNA messages. Essentially, cells can "turn down" specific information and the researchers named this process RNAi.

The beauty of RNAi is that it requires a very specific sequence match between the RNA molecule carrying information and the RNA molecule assigned to "turn down" that information – any RNA molecule without a precisely matching sequence will be "ignored." Without this degree of precision, the cell could not function because it wouldn't be able to tell one RNA from another and so wouldn't be able to control how it sends instructions from DNA to different parts of the cell. In turn, the exciting thing about this specificity is it could allow scientists, such as myself, to invent a product that might control a pest in a very targeted way, but not affect other living things around it.

RNAi is used by plants, animals and fungi to read the information stored in their DNA and use it to develop actual physical characteristics, called "traits." Our early farmer ancestors saw some of these traits as valuable and bred plants for those desirable qualities - without knowing, needless to say, that RNAi at the cellular level made those traits possible. The process of RNAi can be seen in some visually recognizable traits like the color of soybeans (wild soy species have dark pigment genes in their seeds that are turned down by RNAi in modern soybeans, Tuteja et al., 2004) or the star-like color patterns of petunias (the white star pattern results from turning down pigment genes, Koseki et al., 2005). Numerous other examples of RNAi's role in living organisms are now known.

Because we now understand how RNAi works, we can use it directly to turn down a gene. There are two main ways this kind of directed use of RNAi can improve agriculture.

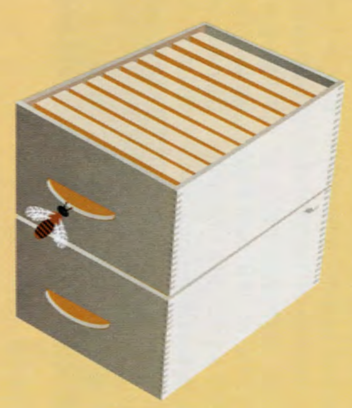
One is to create a plant that can produce the specific molecule that initiates the RNAi process and turn down a specific gene (reviewed in Frizzi & Huang, 2010). This approach is being used successfully today. For instance, when papaya plants were threatened by the deadly ring spot virus, scientists created a papaya with a gene that helps it use RNAi to disrupt the virus. These plants have been grown commercially for 15 years, and they are widely credited

AGRICULTURAL BIOLOGICALS

How an Agricultural Biological created with BioDirect™ technology could help protect honey bees.

Monsanto is dedicated to developing new agricultural biologicals solutions, and we believe in the positive impact that these discoveries can have in creating a more sustainable future. Through our BioDirect™ platform, we are researching and studying new innovations that will precisely focus the power of naturally-occurring processes to protect plants and beneficial species. While we are only in the initial stages of this research and there is much more to be done, we have a vision for how this technology could help honey bees and keep them protected.

AGRICULTURAL BIOLOGICAL MADE WITH BioDIRECT™



HONEY BEES AND FOOD SUPPLY

Honey bees are essential to our ecosystem and impact the food people buy every day. Over one-third of our food supply relies on honey bees for pollination, so crops can reproduce and grow. As colony collapse threatens millions of bees, the future of our food supply are at risk. Viruses pose a significant threat to honey bees and may contribute to the death of millions of colonies worldwide.

VIRUSES IN THE BEE HIVE

These viruses are often present in the hive as a result of varroa destructor parasites, and if a bee becomes stressed or compromised, the virus begins to replicate and weakens the bee's immune system. There are no vaccines or medications for these viruses, so beekeepers often use chemicals to control the parasites that make honey bees more susceptible.

BIODIRECT™ SOLUTION

We are working to create an agricultural biological with BioDirect™ technology, which would enable us to provide beekeepers with a chemical- free option to protect honey bee colonies. Beekeepers currently feed their honey bees a sugar solution to provide access to carbohydrates, and this non-GMO agricultural biological could be added to the solution or introduced into the hive in another manner.

DEFEATING THE VIRUS

Similar to an anti-viral in humans, an agricultural biological would deactivate the virus for honey bees and leave bees without the virus unaffected. The virus would be unable to replicate, and the agricultural biological could help bolster the bees' immune system and health overall.

HEALTHY HONEY BEES

While viruses are one threat to honey bee health, a colony protected from viruses is one step closer to keeping honey bees healthy and preventing colony collapse. Through a healthy colony, honey bees can thrive and continue to play their essential role in pollination and food supply.

HONEY BEES AND VIRUSES

with saving the Hawaiian papaya industry. Similarly, squash created to be resistant to mosaic viruses thanks to RNAi has been commercially available for the same length of time. Other applications are available or in development such as soybeans that use RNAi to produce soybean oil that has less saturated fat, and corn protected from the devastating corn rootworm pest (currently entering the regulatory approval process). In each case, specific sequence matches enable the naturally occurring process, RNAi, to work and deliver the desired crop protection or improved quality.

The science is also demonstrating some promising early results to help honey bees and beekeepers. In this approach, the RNAi process is initiated by feeding, does its work to turn down the intended gene in a sequence-specific manner and then quickly breaks down and does not become a permanent part of any organism. The treatment with the RNA sequence specific to a *Varroa* mite, but not present in the honey bee genome, could be supplied to the hive in the form of a sugar solution – the RNA would ignore the honey bee, but be absorbed by the mite with the matching RNA sequence. The RNAi process would work against the mite, turning down a critical function in their life cycle and thus providing protection while leaving the honey bee unaffected, in contrast to some of the effects miticide chemistry can have on bee health. This RNAi approach is part of our BioDirect™ Technology R&D platform (Figure 1), and it is a component of our larger agricultural biologicals effort to bring new and sustainable tools to agriculture.

"How can we be confident that this technology won't have unintended consequences on species we're not targeting, including humans?"

I sometimes get the question, "How can we be confident that this technology won't have unintended consequences on species we're not targeting, including humans?" My response is that there are many virtues to choosing RNA as a molecule that can do something useful. First, RNA has a history of safe use (reviewed in Petrick et. al, 2013), meaning we all routinely encounter RNA in many forms just by consuming food. Pretty much all unprocessed foods contain RNA, and a typical daily diet can contain a gram or so of RNA in the form of fresh fruits and vegetables, grains, meat and dairy. So why doesn't that RNA initiate the RNAi process in our bodies? In part because processing, cooking and other food preparation techniques break down RNA. But perhaps more importantly, our digestive systems contain multiple barriers that break down and block the RNA we eat. Several recent studies of these digestive barriers in mice, monkeys and humans using sensitive detection methods failed to find any significant presence in our cells of RNA from food sources (Dickinson et al., 2013; Snow et al., 2013; Witwer et al., 2013).

Second, RNA is a natural organic molecule like sugar or protein, and it breaks down quickly in the environment because microbes (bacteria, yeast and other fungi) are everywhere, ready and waiting to utilize it as a nutritious food source. Our own studies show that microbes attack and eat RNA so quickly that it lasts less than a day in non-sterile soils (Dubelman et al., PLOS ONE, in press), and less than 72 hours in hives.

Third, RNAi is specific and precise, since it requires two RNA molecules to match each other. With research and testing, it's very possible to choose an RNA molecule with a sequence that matches a gene sequence in a *Varroa* mite, but not the honey bee. Making sure the sequence doesn't match a sequence in honey bees or another useful species is an essential step – and as we try to find those sequences we do more than just computer searches through genome sequences. The best way to test for unintended effects on other organisms is directly through feeding of high doses of the RNA to those species, and then monitoring for adverse effects. For instance, we fed honey bee larvae 25,000 times the amount of RNA found in a corn plant created to resist the pest and it had no negative effect when looking at multiple assessments including survival, development, emergence, and behavior (Bachman manuscript in preparation). Sixteen additional species that are key indicators in the environment, like ladybird beetles and earthworms, were similarly evaluated and we found that the corn rootworm-targeted RNA had no effect on the non-rootworm species (Bachman et al., 2013).

In summary, the future is exciting to me as I continue working on my initial goals of trying to develop safe and practical solutions for agriculture. I like to get up and go to work every day because achieving my goals matters to me and my family. Many tools will have to come together as we face increasing population, limiting resources and challenges like climate change. RNA-based technology is one of these tools that with appropriate testing and evaluation can deliver more specific and sustainable approaches to protecting bees and crops. BC

Dr. Greg Heck has been with Monsanto for over 17 years and is currently the Weed Control Platform Lead in the Plant Biology Program. His team is engaged in developing next generation weed control systems including the potential to use the specificity of RNAi to target weeds. Greg has been conducting research to use RNAi for agricultural improvement during the last 10 years.

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Selling Nucs

Jennifer **Berry**

It seems that with most beekeeping chores, what you face today is a direct result of what you did or didn't do in the preceding months or year. For instance, if you picked up the phone last year and ordered nucs or packages, you are probably anticipating their arrival this April or May. If you didn't order nucs, packages, or early queens, good luck finding them now! Each year, I sell nucs, and, usually, I'm sold out by Christmas. Yet, it pains me when an enthusiastic newbie calls in February, so very excited to have made the decision to start her own beehive, and I have to be the one to shatter her dream: "I'm so sorry, Sarah. I've been sold out of nucs for months now, and the back up list to my back up list is overflowing. But, don't give up. Keep looking. If you don't find anything now, there will hopefully be late season nucs and packages available in the Summer."

If you want bees or queens, the earlier you order them, the better, especially if you want a March/April delivery. At the UGA lab, when we know that we'll need bees or queens for a research project much earlier than we're able to produce them, I order in March of the previous year to ensure a delivery in the following March. Crazy? The delivery of bees in early Spring takes planning from several months to a year ahead.

When I first decided to start selling nucs, I thought about how easy it would be. Bees make more bees. So, each year, I'll just sell off the surplus to pay for my hobby and, as long as I'm dreaming, that mansion in the mountains, overlooking the ocean, with a crystal-clear waterfall flowing in the backyard, surrounded by a tropical lush forest . . . Ok, I'm back to reality now. But, in the beginning, I truly thought that a self-sustaining enterprise wouldn't be that big of a deal, and, in theory at least, it isn't. However, I quickly learned that selling nucs isn't the cakewalk that I expected.

In the beginning, I had to buy equipment. So, I ordered the woodenware for my first 100 hives from Brushy Mountain Bee Farm. To save a little money on delivery, I decided to drive my F-150 the five-hour trek north to Moravian Falls, NC. Just outside of town, Steve and Sandy Forrest have built their bee supply empire over the decades with a lot of sweat and tears. They are now known worldwide. I was lucky to have a few friends along for the journey: Bill Owens, the Georgia Master Beekeeper Program's only Master Craftsman, a firefighter, and the owner of a honey bee removal company, as well as the one and only, Kim Flottum, who needs no introduction. Bill just wanted to visit with our Brushy friends, Steve, Sandy and Shane, and Kim, of course, wanted to tag along in the hopes that there might be a story for *Bee Culture* magazine.

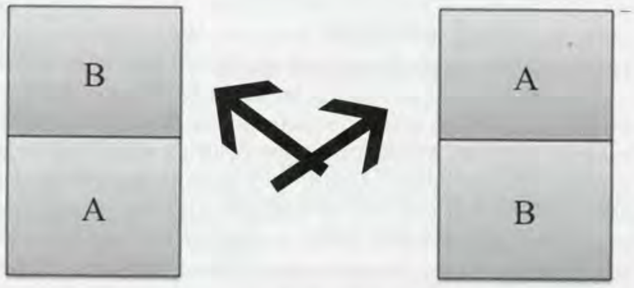
It was late Winter, and the forecast was for continued cold and snow. I had had the questionable judgment of attaching my F-150 to a 13' trailer that had no axle brakes. The trailer belonged to Bill, and I was just grateful to have something to accommodate the load from Brushy. As we were about to pull out of Athens, I asked Bill if he had any rope. He assured me that there was plenty. "Are you sure, Bill?" I asked, "Shane said there are going to be four pallets of stuff, and they will need to be secured for the journey down the mountain." Once again, he reassured that there was plenty of rope and no need to concern myself.

We headed north. Now, I've been to Brushy several times before. Steve and Sandy have been gracious hosts over the years. But, for some reason, I made a wrong turn going up the mountain this time. I could've sworn that we were on the right road because I thought that I recognized certain hairpin turns and cliffs. So, we continued up and around the mountain until, all of a sudden, the pavement disappeared. We found ourselves on a single-lane, mud road with a steep mountain cliff rising straight up to our right and a 1,000 foot drop to the left. As soon as the truck and trailer slid in the mud trying to get up the mountain, it became crystal clear that we were not on the right road.

It was extremely desolate in this neck of the woods. We knew that we needed to turn around, but, before we could find an adequate space to do so – boom! We were confronted, head to head, by a huge cement truck coming the other direction. Where in the world did this guy come from? We're up here in the middle of nowhere! I thought for sure we were about to tumble our way down the side of the mountain as we crawled past each other with barely an inch to spare. But, we made it. As my companions began to loosen their white-knuckled grips on the arm rests, I decided that now was a good time to call Steve. "Oh yeah, you guys turned onto the wrong mountain," Steve explained, "Just turn around, come

Steve and Sandy Forrest, and Shane Gebauer of Brushy Mountain with the author.

Hive Reversal



back down, and, at the creek, take a left, not a right." Oh sure, turn around, I thought to myself, but where? A Segway couldn't turn around up here, let alone a pickup hauling a 13-foot trailer. Eventually, we came across a small house and were able to maneuver the reversal by backing the trailer into the driveway. I suspected that Kim, being a Yank and all, was a bit uncomfortable in the backwoods of the Appalachians. Bill must have had the same idea when he joined me in a whistling rendition of "Dueling Banjos" from Deliverance. In retrospect, that might have been a little bit insensitive. Sorry about that, Kim. *wink*

After a few days among friends, it was time to drive back down the mountain and head home to Georgia. Four heavy pallets of equipment were loaded onto the truck and trailer. When I asked Bill for the rope to tie down the load, he pulled out a section of lightweight rope no more than six feet long. Ok, maybe I'm exaggerating a bit, but it was in no way close to being long enough or strong enough to hold three pallets on a flat bed trailer. I think everyone but Bill stood there looking at that pitiful rope and laughing for at least five minutes. Bill was not amused. After gaining our composure, Shane disappeared for a few minutes before reappearing with several serious ratchet straps. The load was securely tied down. In the photo, on the ground left to right, there's Steve, Sandy and Shane Gebauer, the Brushy Mountain general manager. I am on top, celebrating the first load for my business, and Uther, my red and white dog, is just always happy. At this moment though, I was completely unaware that it was about to be a very long ride home.

Finally, we were on our way. According to the radar, we were definitely going to hit some rain. Thankfully, though, there would be no snow. I'm sure you've seen what happens when the south gets an inch of snow. It ain't pretty! Now, if you've ever driven a trailer this size, loaded down, and without brakes, then you may understand this next part. As we were coming down the mountain, there was a stop sign. I was driving pretty slowly, but as I pressed down on the brakes to stop, the weight on the trailer just pushed us right through the intersection! I was on the edge of my seat for the rest of the way home, but we made it without incident.

As I mentioned earlier, beekeeping is a yearlong process. We must always be one step ahead of the bees if we want to be successful beekeepers. Anticipation and planning are very important. It's the same when making nucs.

We begin preparations for the next year's batch as we watch the last of this season's nucs ride off into the sunset with their happy new owners. Our first order of business is picking up the pieces by assessing the mother colonies. Queen quality is the first thing we look at. Queens that didn't make the cut are given one more chance, but, if they don't pass muster, they will be replaced with queen cells. Other important goals during the spring are to grow colony populations and to have hundreds of frames of new comb drawn. In my area of Georgia, we have about a three-month window during which the bees draw comb; so, we have to be ready with plenty of assembled frames with foundation, or we will miss the boat.

The only frames in our operation that are over three years old are the shallow frames used to collect honey. As new deep frames are introduced to the colonies, the current year is written on the top bar. This helps us to know when those frames were drawn. We keep an eye on the dates and cull frames after they've been in service for three years. We used to put the date on the frames as we built them, but that didn't always work because some frames didn't get used that year. Then, we would forget to scratch out the old dates. As testimony, I have frames of foundation in my bee barn with drawn comb dates of 2010, 2011, and 2012 that have still not been corrected. We have tried other methods, such as dating the frames once they've been drawn, but, on a busy day in the apiary, we tend to forget, not have a permanent marker, or not remember what year it is. Plus, top bars quickly accumulate waxy build up that often makes writing on them, after the fact, ineffective. But, it is a good practice to date frames – especially brood frames – so you know how old they are. Why do we use a three year window? Well, over time, wax comb sequesters all sorts of contaminates: pesticides, heavy metals, and fungal and disease spores. Plus, if the comb is used to rear brood, the cells become darker and smaller over time due to foot traffic, as well as fecal matter and cocoons deposited by developing larvae. If you're interested in reading more about this, my masters research paper compared old comb to new comb: **www.ent.uga.edu/bees/publications/effects_comb_age.pdf.**

Evaluating colonies in early Fall.

Business partner Bob Luckey

Once Spring turns into Summer, we just let the bees be bees. We continue to evaluate queens, make splits, collect data on breeder and drone mother colonies, determine mite populations, and rear queen cells to replace poor quality queens. Nectar flows are coming to an end. So, any undrawn frames are removed. Drawn frames are inspected along with brood patterns. Weak colonies with poorly performing queens are combined and requeened.

To ensure proper mating for any late rounds of queens in the fall, drawn drone foundation is placed into drone mother colonies at least 50 days prior to when the virgin queens will be flying. Again, you have to be thinking in May about what you will be doing in August. If not, there may be an insufficient drone density in the environment for optimal mating. Poorly mated queens have crappy patterns and are susceptible to erratic supersedure, which can result in a queenless nuc.

Now, as Fall rolls around, the number of nucs that will available for sale next year are determined. Therefore, plans consequently solidify for how many colonies are going to be necessary to fulfill those orders. I always include a 20% surplus of colonies going into the winter to buffer against unforeseen circumstances. Lots can go wrong between August and the following April. To this end, colonies are split and queen cells inserted. Another chore for this time of year is feeding. There are always those colonies that didn't make enough honey.

In mid to late Fall, we do evaluations on the queens, look at brood patterns, and check mite loads one more time.

By late Winter, we are usually still feeding a few colonies here and there, building and repairing equipment, and contacting customers. But, mainly, we're just waiting for Spring to arrive. There are usually days warm enough to start performing hive body reversals. Throughout the Winter months, the bees are slowly moving up into the stored honey supers. And, typically by February, they're at the top of the hive bumping their little heads against the inner cover. Other things have started as well: the queens have been laying eggs, and the brood areas are expanding. These are good things. The bees emerging now will support the plentiful production of bees in April. This is why reversing hive bodies as soon as possible is critical. It immediately provides empty, drawn comb for the queen to move into and lay eggs. Days in the 50s to 60s, with little to no wind, are perfect for doing reversals. I prefer not to work bees until temperatures reach the upper 50s. At lower temperatures, the outer bees in the cluster are still chilled, and, if they fall to the ground, they will be unable to crawl back into the hive and into the cluster.

Reversing hive bodies is a simple yet very effective method of taking empty boxes from the bottom and reversing them to the top just above where the bees are clustered. But, only do this if there is NO brood in the lower box. Otherwise, you will separate (split) the brood into two different locations, and the bee population may not be strong enough to cluster over both areas. Hence, unprotected brood will die (see Figure 1).

Spring time for nuc, package, and queen producers can be extremely nerve wracking; I hear it in their voices – including mine – starting around February. By this point, there is not a bee to be bought. Everyone in the southeastern portion of the country has completely sold out. So, if something goes wrong and you can't deliver, your customers will be without options. They're relying on you to keep your promises from the prior year. Yet, weather can wreak havoc on a timeline. From experience, I know to tell customers that I'll have their nucs ready in April. I've come to realize that promising nucs earlier usually doesn't pan out. By the 2nd or 3rd week of April, the bees are usually ready to move to their new homes.

Every nucleus colony that is sold out of my operation must have three to four frames of brood covered in bees and one or two frames of honey/pollen covered in bees. All combs must be completely drawn with solid brood patterns encompassing most of the frame. Cold, wet Winters, like the one we're having now, really put a damper on brood production. Sluggish Winter brood rearing results in fewer early-Spring foragers, which yields less early honey and pollen stored, which, in turn, extends the handicap of a lower workforce population well into the nectar flow season. Arrrrrgggghhhhh! When this condition is pervasive, calls are made to delay nuc pick-ups for at least another week or two. And, trust me, customers become very anxious. I, too, become anxious to get them delivered. There's a tremendous amount of pressure building each day that the nucs are still in my possession. What if they swarm? What if they're stolen, attacked by bears, or fall victim to tornadoes, falling trees, fires, locusts, or meteorite showers? I'm telling you, it's a minor miracle to even be able to fall asleep at night in such circumstances!

It's February and snowing in Georgia as I write this article. They're predicting more snow and ice for us here in Athens and Atlanta over the next two days. I just hope we don't have the catastrophic ice storm that we did 14 years ago. Some folks were without electricity for two weeks. I also worry about tree limbs falling, knocking over hives, and exposing bees to frigid weather. There's always something to worry about when you're a beekeeper or farmer for that matter. My hope is that all of our preparations taken last year have ensured that the bees are numerous, toasty warm and with full tummies now. Remember, it's all about being prepared.

Be good to you and your bees!

See Ya! BC

POLLEN

Larry **Connor**

Pollens are complex materials required for growth, and health.

All animals, including humans and honey bees, require the same 10 essential protein components, called amino acids. These molecules are not and cannot be produced by their own bodies' metabolism. While humans obtain protein from a wide range of plant and animal sources, honey bees obtain all ten amino acids from pollen. Estimates of pollen collection by honey bees range from 10 to 25 kg (22 to 55 lbs.) per year. Pollen also supplies minerals, fats and vitamins and other elements essential for healthy bee development and growth.

When diverse pollen is in short supply, several serious conditions develop within the hive. Shortages result in reduced worker brood rearing, shorter worker bee lives, low sperm formation and migration in drones, inadequate populations of drones necessary for adequate queen mating and much lower growth of the hive. Extreme shortages of pollen eventually lead to colony death. Hive nutrition depends heavily upon good foraging weather and suitable forage. If bees are restricted from food gathering, there can be an immediate termination of new brood rearing and extensive cannibalism of first drone brood and then worker brood, with the youngest bees consumed or removed first. Poor nutrition has been also linked with increased problems from nosema and *Varroa* mites in the hive. Feeding natural pollen or artificial pollen supplements results in stronger colony growth, healthier bees, fewer disease problems, increased worker and drone bee population numbers, and increased pollination effectiveness and greater honey production.

When I speak to beekeepers, I am often shocked to learn how little they know about pollen and how much of what they do know is misinformed. Some beekeepers see filled frames of stored pollen in their hives and panic, wanting to know how to get rid of it. This demonstrates a failure to understand how important pollen is to the hive and that full frames of pollen occur in healthy hive biology, such as during queen replacement when brood rearing is temporarily halted. Failing to grasp the importance of pollen and protein feeding is a potentially serious flaw in a beekeeping operation. Mastering the process of protein management and supplemental feeding, by contrast, can ensure the successful growth of a colony, especially new increase colonies.

Pollen

Pollen is produced by flowering plants as part of their male flower reproductive system. Evolved from the spore-like structures utilized in plants like ferns, pollen serves the role of transferring male sexual materials within a flower, or from flower to flower, thus providing out-crossing (the mating of two unrelated individuals) and genetic diversity in the plant species. Pollen grains are elaborate, intricately packaged microscopic spheres that alight on a flower's reproductive structure, the stigmas, which then germinate by rupturing the pollen coat and growing a pollen tube down the stigma and style to reach the ovaries. There, male sexual material combines with female sexual materials in the ovule to form an embryo that becomes part of the seed.

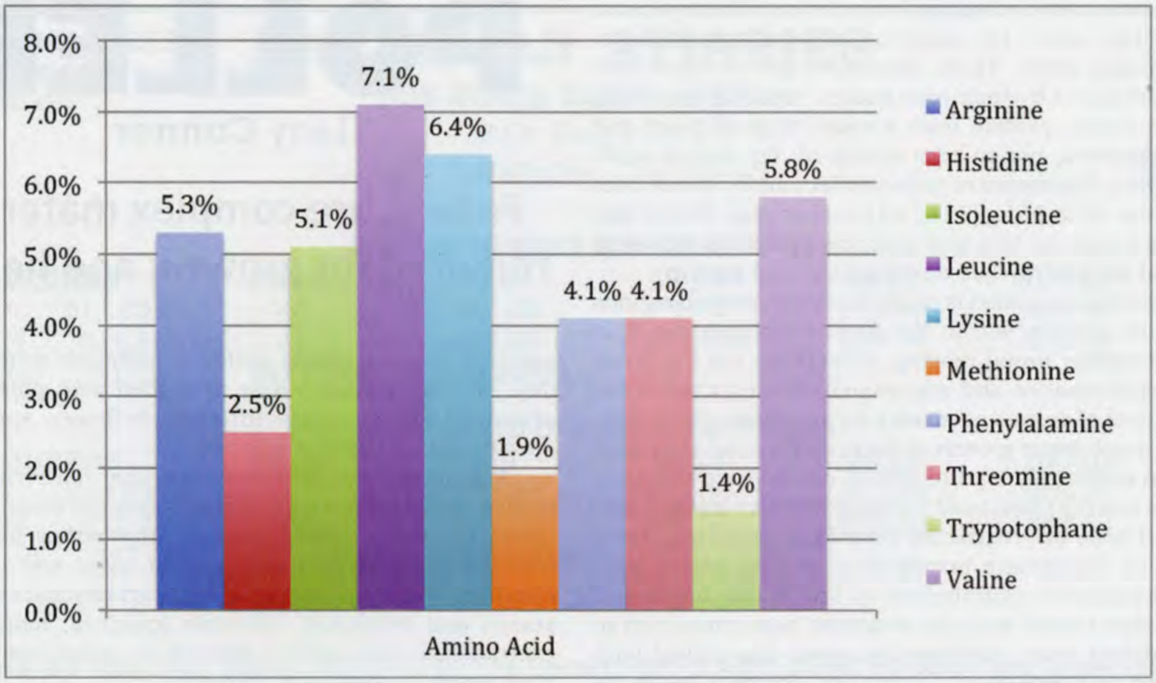
There are endless complexities to this system, and the role of bees as pollinators is only one of the variations that have evolved since the appearance of the first flowers. Every species of flower and every species of pollinator has its own unique tale to tell. Depending on the plant species, flowers release pollen at different times of the day. Morning foragers may be loaded with pollen while afternoon foragers have little. Each flower, each plant species, has its own tale to tell.

Pollens are complex materials. They have a hard protective coating (the exine) that protects the contents from environmental travel and extremes in weather. Inside this coat are the materials required for plant sex: proteins, enzymes, vitamins, lipids (fats), carbohydrates (sugar, starch and cellulose), minerals (calcium, magnesium, phosphorus, iron, sodium, potassium, aluminum, copper, manganese, sulfur) and pigments.

Pollens from different plant species vary in the composition of these components. The most important to the beekeeper is protein levels. Bee collected pollens vary from seven to 35 percent protein. The average crude protein percentages are shown in Table 1. Wind-borne pollen is usually very low in protein, usually under 5%, which explains why bees only gather pollen from wind-pollinated flowers like oak, grasses, and ragweed when there is little else to collect. It is generally thought that bees need a minimum 20% protein level in their own physiology in order to sustain colony growth, so low protein pollens must be consumed in larger quantities than high protein pollens to obtain the same food needs.

Not all bee-collected pollens are nutritionally complete, or balanced, as they lack some of the building block amino acids. Dandelion pollen, for example, has a multi amino acid deficiency and cannot sustain bee growth. Other plant species supply the missing elements. Fortunately, this is what bees do in nature – they collect a highly varied supply of pollen. One analyses of trapped pollen in Michigan showed that the most frequently collected pollen may contribute only five percent of the total volume the bees collected for the entire season. Bees make multiple trips to nature's buffet table and sample everything there, rather than ordering a single dish off the menu. This is of great interest and importance to beekeepers who keep bees in areas of extensive monoculture, either natural or human-created. Orchards and fields of a single plant species, like almonds, must be constantly evaluated for their nutritional status. In Australia, colonies of bees in large natural forests of eucalyptus often need to be either fed protein patties or moved to another location with better protein forage, even though the nectar flow has not finished.

In Arizona studies, scientists sorted pollen by plant species and fed them, independently or mixed, to caged bees. The results supported the need for a diverse (polyfloral) diet of different pollen sources resulted in bees that lived longer than bees fed a single pollen source. Recent work indicates that mixed pollen improved the immune



functions of the bee in regards to glucose oxidase activity and this helps the hive with disease control.

I have seen sellers of honey-bee trapped pollen claim that pollen is nature's "most perfect food." This claim once appeared on egg cartons and, again, may be an overreaching claim. We must honor the fact that, in bee colonies, pollen is the sole source of all nutritional requirements, supplementing carbohydrates from nectar and water. This may be different for other animals, including humans, a subject requiring further investigation.

Pollen collection by bees in the field

During the foraging season, scout bees constantly search for new and richer sources of nectar and pollen and return to the hive with samples to share with their housemates during their dance communication. How waiting bees determine the relative attractiveness of different pollen sources is unclear but we could imagine they discriminate food value rather accurately. Though pollen cannot be evaluated by sweetness like nectar's sugars can, bees apparently evaluate the quality of the pollen by sampling it. Only a few scout bees return with both nectar and pollen, making the evaluation process easier, based on the overall attractiveness of the pollen brought in by the foragers that is evaluated. About five percent of all foraging honey bees gather both pollen and nectar from flowers until their pollen baskets are full or their honey stomach is full, or a combination of both.

Bees that forage solely for pollen carry in their honey stomachs honey from the hive and add it to the pollen as they pack it onto their bodies. Once they use this supply, the bee is running on empty, and must return to the hive. Pollen foragers often exhibit a different set of foraging behaviors than nectar gatherers. They run actively or "scrabble" over the area of the flowers where the anthers are located, and rapidly collect pollen on their bodies. They then fly off the flower and pack the pollen with their legs, adding honey/nectar while packing the pollen into their two hind leg pollen baskets (corbiculae). In pollen rich flowers, the bees attack the anthers with such power that it is surprising to watch. While they hover in front of the flower, they add a droplet of honey from their honey stomach to keep the pollen together in the pellet and to start the pollen fermentation process.

A few flowers have pollens that are repellent to the bees and they discard the pollen by reversing the combing action of their legs while grooming their bodies. They do this with some oil-rich cultivars of sunflowers, after which the pollen will fall onto the leaves of the plant underneath the grooming bees.

Bees may collect a full load of pollen from one large flower, or need to visit hundreds of flowers to get a small load as they collect nectar. To obtain a load of pollen from the following flowers, observers have determined that it takes 346 visits to red clover florets, 84 visits to Bartlett pear blossoms and 350 to alfalfa florets. There should be little doubt as to the significance of honey bees as pollinators based on their pollen collection behavior. BC

Larry Connor has written and published several books. He is the owner of Wicwas Press.

All The Buzzz in...

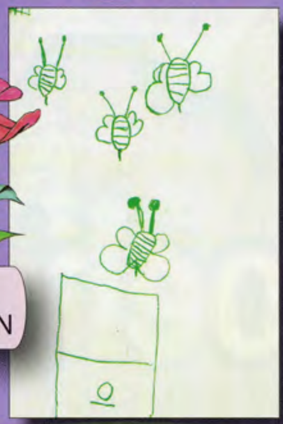
Hello Friends,

I'm sending you warm, spring thoughts.
Remember you are special.

Bee B.Queen

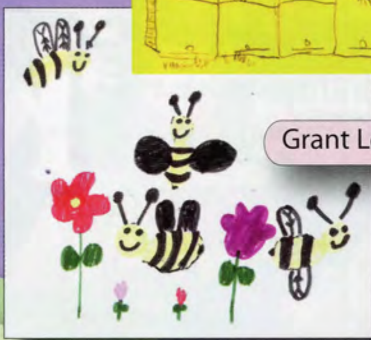
Bee B. Queen Challenge

Grow some bee friendly plants!



Marshall Lengerich, IN

Henry Lengerich, 8, IN



Grant Lewis, 8, CA

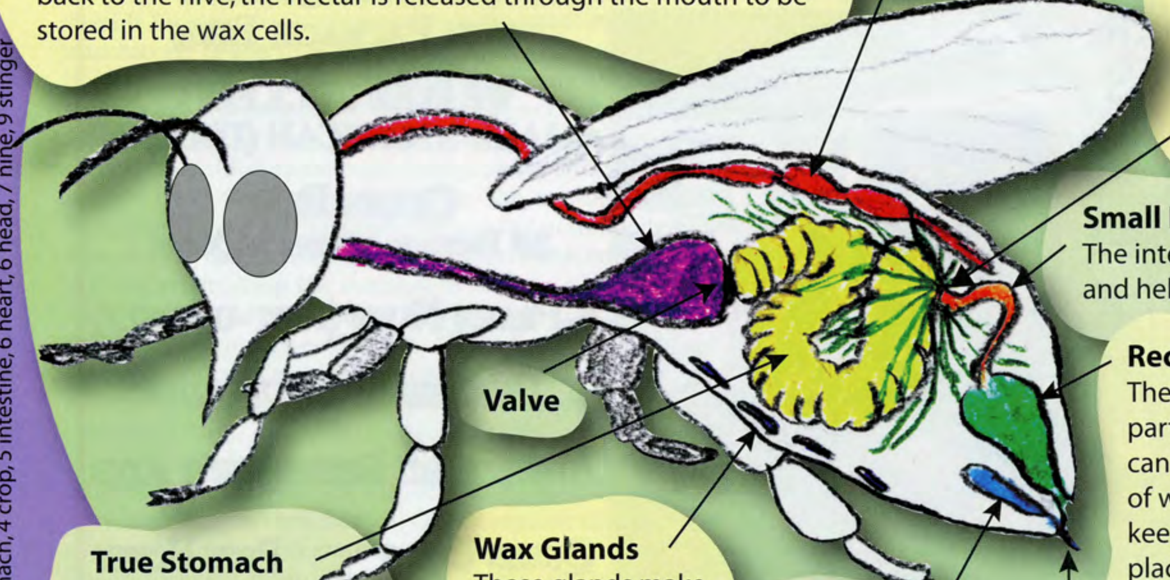
Inside the Abdomen

You know the queen bee has a longer abdomen than the worker bees. But do you know what is inside the worker bees abdomen? Let's find out.

Honey Stomach
The honey stomach is also called the honey crop. Sometimes people call it the honey tank because that is where the worker bee stores nectar she gathered from flowers to take back to the hive. She has a little valve that can be closed to keep the nectar from going into the stomach and being digested. When she gets back to the hive, the nectar is released through the mouth to be stored in the wax cells.

Heart
The heart-like organ moves hemolymph, the bee blood, through the bee's body.

Malpighian Tubules
Bees have over 100 of these tubes that float freely around the abdomen removing salt and wastes from the blood. The wastes leave the body through the intestine.



Small Intestine
The intestine absorbs water and helps to get rid of wastes.

Rectum
The rectum is the last part of the intestine. It can hold a large amount of waste. Bees like to keep their hive clean. In places with long, cold winters, bees can wait weeks or even months to go to the bathroom.

Valve

True Stomach
This is where the bee digests its food and absorbs the nutrients. Believe it or not, the stomach is about twice the length of the bee's body.

Wax Glands
These glands make beeswax which comes out of their body between the segments of the abdomen.

Venom Sac
This holds a mixture of venom (which is made of proteins) and alarm chemicals.

Stinger
The stinger is used to protect the hive.

1 glands, 2 abdomen, 3 stomach, 4 crop, 5 intestine, 6 heart, 6 head, 7 nine, 9 stinger

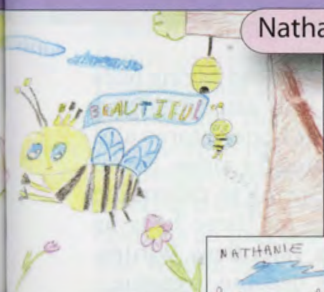
... Bee Kid's Corner

Produced by Kim Lehman -www.kim.lehman.com
www.beeculture.com
April 2014


Dailey Lengerich, 10, IN

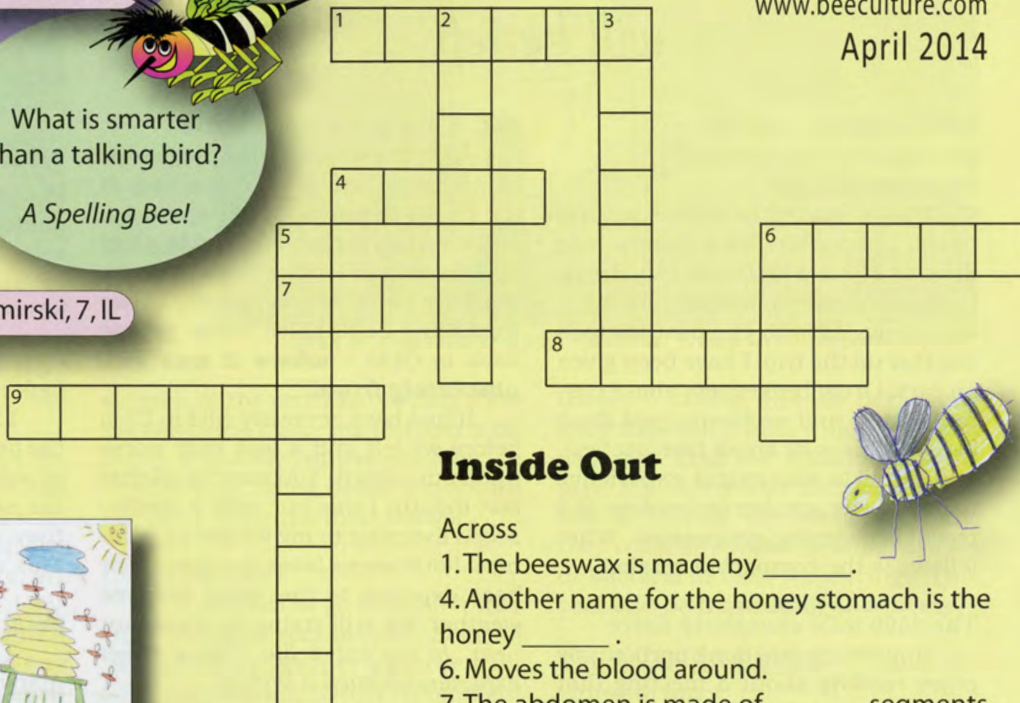
What is smarter than a talking bird?

A Spelling Bee!



Nathalia Wyszomirski, 7, IL

Nathanie, 10, Ontario, Canada



Inside Out

Across
1. The beeswax is made by ______.
4. Another name for the honey stomach is the honey ______ .
6. Moves the blood around.
7. The abdomen is made of ______ segments.
8. The middle body part of a bee.
9. It is at the very tip of a worker bee's abdomen.

Down
2. The bee body part that contains much of the digestive system.
3. Digests food.
5. The hind gut contains the ______ and the rectum.
6. The antennae can be found here.

Bee Buddy

Meet Fijare Plous. She has been on planet earth for almost 12 years. Home is a tiny town in Connecticut. Besides being 100% obsessed with beekeeping, she loves doing gymnastics, reading, and playing outside with her dog. Her family has two strong hives, which they "adopted" in May a year ago. This spring they are looking into getting a top bar hive. When her teacher began talking about colony collapse disorder, Figare created and presented a Powerpoint about bees. Fijare loves the bees and being a beekeeper. Thank you Figare for helping other kids love bees too!

Beecome a Bee Buddy

Send two self addressed stamped envelopes and the following information to: Bee Buddies, PO Box 2743, Austin, TX 78768.

Name
Address
Age
Birthday Month
E-mail (optional)

We will send you a membership card, a prize and a birthday surprise!

Send all questions, photos and artwork to: beebuddies@hotmail.com or mail to the above address.

Thawing My Bees After The Coldest Winter Ever In Ohio

And wondering if any living bee will be left.

Cold weather, a recent meeting and beekeeping's electronic future

I have started this piece several times. I just came back from a long drive and have a lot I want to address. I visited a much warmer climate, and struggled with the past winter's weather on the trip. I have been given an earful from beekeepers about current issues and problems (you don't like pesticides or small hive beetles), and I had a successful experience using off-site speaker technology at a recent beekeeping symposium. What follows is the compacted version.

The 2500 mile roundtrip drive

Apparently you don't particularly enjoy reading about a meeting that has passed. I get that, but let me make a few passing comments about the recent trip I took as it relates to my bees right now.

For the past 19 years, I have been involved in an annual Spring workshop co-sponsored by the Alabama Cooperative Extension System (ACES) and the Alabama Beekeepers Association. Over those years, the participant numbers have grown to more than 650 attendees. All speakers and organizers were on-the-money. It is a one day event that was rewarding, exciting and remarkably stressful. But since this is the winter that just will not quit, add severe weather to the list of concerns that had to be addressed.

Just to get through the remaining effects of one of the southern storms that blanketed Birmingham and Atlanta was a one-of-a-kind of experience for me. My wife and I lingered longer than normal in our hotel room in Tennessee to give Alabama emergency services time to open roadways. Though there had clearly been a weather event and abandoned cars were everywhere along the roads, we arrived at Auburn University in acceptable time and without incident. But, it was not a boring drive.

After few other beekeeping stops in Alabama and a final meeting at the North Escambia Beekeepers Association (**www.northescambia.com**) in Pensacola, Florida, it was time for the drive home. It was just shy of two weeks and 2500 miles before getting back to Ohio – ***where it was still absolutely frigid***.

It had been seriously cold in Ohio before we left and it was only worse upon our return. You may recall that last month, I was out with a stethoscope listening to my wintering colonies. Four weeks later, the same poor bees exposed to the same extreme weather are still trying to crank out heat. *In my entire life, I have never experienced such a Winter.*

I realize that states more northward and all of Canada must deal with significant cold nearly every year, but my bees were not in great shape when they went into Winter and my area is not usually subjected to such relentless single-digit Winter seasons. Last year, there was essentially a mild Winter in Ohio and states south, so I suppose I hoped for such a season again. Wow – that did not happen. Ironically, by the time you read this, it will be Spring in many parts of the United States, but just now, our cold-climate bees are being challenged.

Some bees do this every year

Every year, during Winter months, I get bees that have left the hive, on very cold days, only to drop and die on the snow. As have so many others, I have written about this behavior time and again. Disease, biological confusion, what??? I don't know why some bees leave. When I kept bees in the south, I was never really aware of how many bees – if any – were dying away from the colony, but snow makes these dead bees really stand out. And they are doing this right now. There is no fecal streaking on the hives and the dead/dying bees look normal and fully sized.

I left abundant honey stores and the bees were treated for mites. Stand by while I await Spring to determine the survival rates for these bees as they endure this relentless Winter. This weather has become tiresome.

Small hive beetles

Though somewhat odd to me, many southeastern beekeepers seem to feel that *Varroa* populations are no longer the apex bee pest having been replaced by the Small Hive Beetle (SHB). At the Spring symposium, Dr. Jeff Harris, Assistant Extension/Research Professor, Mississippi State University provided information on the biology and control of the Small Hive Beetle (SHB) in Mississippi. Several speakers contributed to the pool of SHB information, but when the day was done, there were still precious few absolute recommendations for consistently controlling this erratic pest. In no way is this a reflection on the speakers, their information or the SHB issue, but rather it clearly shows that this pest apparently has no owner. What does that statement mean? I suppose it indicates that if one doesn't have the beetle pest, it's just an inconvenience, but if you are one of the unfortunate ones who is really under beetle attack, this thing is a pain and dependable control resources are not readily available. It's not a problem for everyone and that makes it a problem for the few.

It's more like a wax moth

In one instance, the small hive beetle was described as a *"wax* *moth-like opportunist"* that overtakes colonies that are weakened by other issues. I sense that the takeover behavior is real, but I am not sure how to deal with it. The universal recommendation is to keep colonies populous, and don't disturb them any more than necessary. Then the obvious issue becomes splits and queen nucs. How are these small colonies to be managed? "Well, put them in the sun," was the common response.

Put them in the sun

Flying in the beekeeping face of all things Southern, the developing recommendation is to put colonies and nucs in the full sun. I have no basis for saying whether or not the sunlit location is right or wrong, but I can say that is going to be one ***HOT*** location for the beekeeper and the bees later in the Summer.

Regardless of the SHB, I am considering trying to rearrange my Ohio colonies so they are more in full sun. The Winter has been so cold, on the few days when the weather broke; my colonies sat in full shade and did not get much benefit from the sunlight. I don't really know how much – if any – sunlight will help the situation in either location but I am leaning toward more sunlight in my bee life.

Even so, putting colonies in sunlight does not seem to be the final answer for beetle control.

Apply approved chemicals

The few chemical insecticides approved for beetle control and the approved application procedures are available from bee supply consortiums. It's not my purpose to discuss them here. Whether or not you use these products is your call. They don't seem to hurt, but I don't know how much they help. Talk to others who have stronger opinions than mine.

Even so, treating colonies with approved pesticides does not seem to be the final answer.

Use beetle traps

All speakers recommended using some kind of beetle trap. I have them and use them even in Ohio, but I don't have many beetles. Disconcertingly, some early evidence indicates that there is little difference between beetle-trapped colonies and colonies that do not have traps. I don't know enough to draw a conclusion on this subject. At the very least, killing a few beetles could make me feel just a bit better about my control program.

Even so, using beetle traps does not seem to be the final answer.

Bees leaving only to die on the snow. Arrow shows departure point.

Use other stuff

I choose not to go into the "other stuff" category very deeply. Some of the materials are not approved for SHB suppression. Other recommendations – like applying diatomaceous earth – seem to be a simple control procedure, but others say it does not work very well. There is always hope that there is a mystery product out there that will solve the beetle problem. It is not here yet.

So, mystery stuff that is not approved for beetle control does not seem to be the final answer.

Beetles wander great distances

If necessary, beetles can take flight and move great distances – in theory – taking disease pathogens from the colony from which they just departed. That just adds insult to injury. Not only are we not exactly sure how to control the beetle, but now they *could be* spreading other viruses or bacteria in their wanderings. This pest can be frustrating and messy.

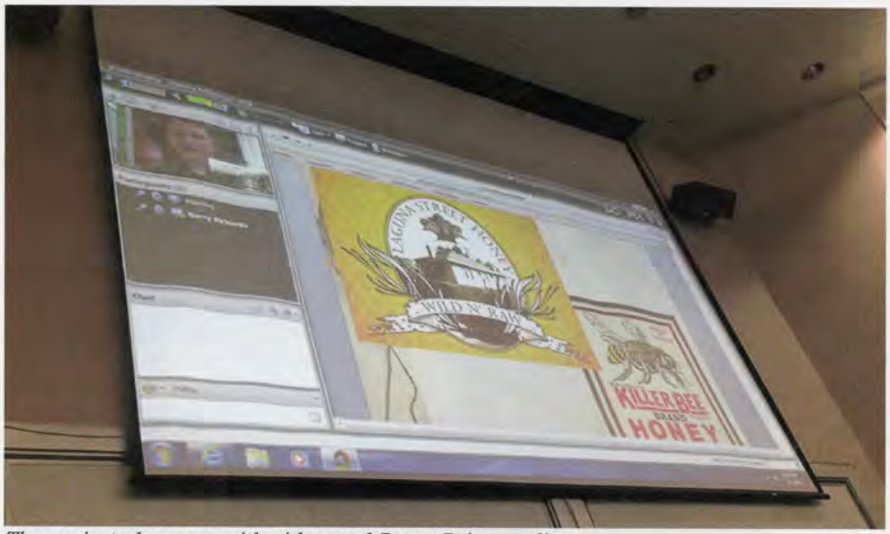
The Small Hive Beetle conundrum

You can see the issue. This pest is only taken seriously by beekeepers who seriously have it. The control recommendations are tenuous and, at times, vague. I suppose it would be wonderful if the cold Winter months actually suppressed populations of this pest? But for now, I don't sense that the perfect control procedure for the small hive beetle is at hand.

Using off-site speakers – the future of bee meetings? (or not?)

Increasingly, other aspects of


Small hive beetle larvae and a single wax moth larva. (C. Pardon photo)



The projected screen with video and PowerPoint media.

typical bee meetings are various electronic components. It is now possible to use various *Desktop Videoconferencing Systems* (Scopia, Adobe Connect) to stream live video and audio beekeeping presentations into equipped classrooms. Depending on competence, experience and equipment, the results can be exciting and futuristic. While the technology is becoming more common, it can still be intimidating.

The off-site speaker this year at the 2014 Symposium was Barry Richards, Tennessee beekeeper and professional video producer who projected from Allen County-Scottsville High School, Scottsville, KY, and was hosted by the Allen County Beekeepers (allencountybees.com). The event was successful beyond all my hopes due to the technical ability of Mr. Richards and Mr. Loc Lee, Internet Technology professional, ACES, Auburn University. Mr. Richards was able to speak – simultaneously – to 135 participants in Kentucky and approximately 120 participants at the Auburn University Symposium separated by 366 miles and a six hour drive. All locations were interactive allowing Mr. Richards to see the Auburn classroom and to interact both via video and audio.

Barry spoke on various marketing procedures to make your honey crop unique and marketable. Not only was the technology impressive, but Mr. Richards' ability to take a common topic and address it in a unique fashion was a nice touch.

While I don't see streaming video routinely replacing the traditional speaker at large meetings, these opportunities are available to make a good meeting even better and could provide stand-alone educational possibilities at smaller meetings.

Though not always live, at other web locations, webinars have been captured and stored for you to watch as you wish. In fact, these stored presentations can serve as programs for local meetings when speakers are not available or specialized topics are to be discussed. Two examples of beekeeping webinars are at:

1. **https://u.osu.edu/beelab/courses/**
2. **http://entomology.ces.ncsu.edu/apiculture/beekeeping-webinars/**

Other captured beekeeping educational videos are posted on YouTube. The quality of these productions will vary. You will need to decide if a particular production is worth your time.

Last year, Ohio Beekeeper John Grafton and I produced a series of short video presentations on various aspects of beekeeping at: **www.ohiostatebeekeepers.org/beekeeping_class/**. They are not interactive, but they do show common beekeeping procedures.

There is still other technology presently available for capturing PowerPoint presentations and storing these files on the web for subsequent viewing. I have posted a captured PowerPoint program for your review[1] at: **goo.gl/zpRnna**. There is nothing special about this captured program as it relates to this article. It is only posted to show the viewing procedure[2].

I'm sorry

I know this is tedious reading and does not actually have much to do directly with beekeeping, but for those of us responsible for conducting programs and setting up meetings, this technology (or some part of it) will be the future of bee meetings. Honestly, I can't say that the beekeeping industry is an innovator in electronic communications, but the new people who are presently streaming into beekeeping are commonly smartphone using, electronically-savvy people. These modern procedures can truly aid in providing a pleasant learning experience. Increasingly, bee meeting organizers need to search for meeting rooms that are Wi-Fi accessible. Don't let your bee world become electronically isolated. BC

Dr. James E. Tew, State Specialist, Beekeeping, The Alabama Cooperative Extension System, Auburn University; ***tewbee2@gmail.com; http://www.onetew.com; http://www.facebook.com/tewbee2; twitter@onetewbee; http://www.youtube.com/user/onetewbee.***

[1] J Tew PowerPoint program URL was shortened to allow easier uploading. If needed, the original long URL is: **http://www.mediafire.com/watch/3ket70mhm2t27tz/Dynamic_Pollination.mp4**

[2] I use MediaFire, a file and image hosting web site for some of my cloud storage.

Got A Question?

Ask Phil

Phil **Craft**

He Knows!

Send your questions to Phil at
phil@philcrafthivecraft.com
www.philcrafthivecraft.com

A beekeeper in New York writes

Our neighbors have a bee tree in front of their house and they would like to get rid of the bees, but save the tree and the bees. Also, the entrance that the bees use is only a one inch hole.

Is there a way we could encourage the bees to move out of the tree and move into a hive?

Thanks for your help.

Phil replies:

Honey bees are valuable and fascinating insects, but when they take up residence in locations where people are uncomfortable with their presence, problems are not uncommon. Usually, these unwelcome colonies are in houses or other structures, but the presence of a bee tree near a walkway or entrance - or anywhere that children play or people spend time outdoors – can be annoying and potentially dangerous. This is especially true if the colony entrance is near the ground. When such situations occur, beekeepers are often asked to assist in re-locating the colony. They are generally paid for their services, though some will conduct removals in order to save the bees, or to help out a neighbor.

When bees make their home in the walls of a building, the only wholly satisfactory solution is the complete removal of the colony, including all bees, comb, and honey. This means removing exterior siding to expose the colony or, if working from inside the structure (obviously more difficult), removing drywall. Repairs must be made afterwards, not only to restore the structure's appearance, but also to prevent swarms from re-entering by the same or a different entrance. The cavity previously occupied by the colony should also be filled with insulation to make the site still less attractive to future, home hunting swarms. Colonies in trees are most easily and effectively removed by cutting down the tree, and then using a chain saw to open up the cavity containing the colony.

An alternative to removal, though not an attractive one to most beekeepers or to those who appreciate honey bees and the important ecological niche they fill, is extermination. Calling an exterminator to kill the colony and then plugging up the entrance or entrances is an effective way to deal with the nuisance and risk of a colony in a tree. It is less satisfactory to the homeowner with bees inside his walls, since it leaves the comb, dead bees, and honey in place. The smell is similar to that of any dead animal; the honey, dead bees, and brood can attract vermin; and there is the possibility of the honey's seeping out into a living area. If extermination is performed in an occupied building, the dead colony should be removed as described above, if possible.

In your case, you and neighbor would prefer to avoid both option one (cutting down the tree), and option two (killing the bees.) Non-beekeepers, upon discovering honey bee colonies in or near their homes, often expect beekeepers to perform as pied pipers, enticing the bees to abandon their comfortable cavity and leading them into a wooden hive. We know that beekeepers do not have magic flutes, but they are sometimes successful in removing most of the bees from a colony, without opening a wall or cutting down a tree, by a method known as a trap out. It involves using screen to convert the colony entrance into a one way door. It can be used on either a tree or a structure, and is especially useful in buildings where opening a wall to expose the colony is not practical – for instance, in one constructed of stone or brick.

To make a trap out, form window screen or #8 hardware cloth into a cone. It will need to be large enough to cover the colony entrance at the base, extend about 18", and terminate in a small opening (about 3/8 inch in diameter – a pencil should just fit in the opening) at the narrow end. This creates a one-way bee escape. Foragers exit the hive freely, but return to the surface of the tree, or wall, and are prevented from getting back in by the screen covering the entrance. They will not be able to reorient to returning to the opening at the point of the cone and going back through the tube. It is IMPERATIVE

A trap out set-up. (photo by Patrick Gaudin) that, if any other openings exist by which the bees could enter, they be found and sealed.

To avoid having thousands of unhappy, homeless bees hanging about around the colony site, you need a method of collecting them. This is normally accomplished by setting a nuc or a small colony, containing several frames of bees and a queen, near the hive entrance. Depending on the situation of the entrance, the nuc can be supported by wood scaffolding, or by screws attaching it to the tree or structure very near the screen cone. The bees, blocked by the screen from entering the site where they have made themselves unwelcome, will enter the proffered nuc and be accepted by the bees in that colony. After several weeks, when activity around the screen trap has dwindled to an occasional bee or two, the nuc can be removed. In the case of a bee tree, at least, the hole should be sealed at once. When trap outs are done on buildings, some beekeepers advocate removing the screen and allowing the bees in the nuc to rob out the honey from the old site for a couple of weeks before sealing. Though it's desirable to remove as much honey as possible, I would be concerned that, while it was being done, a swarm might reoccupy the cavity. Whether or not it's done immediately, permanently sealing the hole is vital in order to prevent a new swarm from being attracted to the presence of the old comb and honey, and re-establishing a colony there.

The downside of a trap out is that it takes time – three to four weeks or longer – to accomplish. The property owner and his or her neighbors will have to put up with the presence of both the original colony, and the nuc, until the process is complete. It is also a lot of work for the beekeeper. In addition, though most of the colony can be collected by a trap out, the queen and a small number of bees are usually left behind, so what the beekeeper gets out of it is additional bees, but not a functioning colony. For these reasons, trap outs are not very common. A decision must be made, by both you and your neighbor, whether saving the bees is worth the inconvenience of putting up with their continued presence for another month or more, and whether it's worth your time and labor to trap them out. If you decide that it is, please let me know how it works out.

A handout on removing honey bee colonies and conducting colony trap outs, can be found at the Ohio State University beekeeping extension webpage: **http://ohioline.osu.edu/hyg-fact/2000/pdf/2079.pdf**.

Note: I must caution readers of *Bee Culture* who live in southern areas of the U.S. (where Africanized honey bees are found) that colony removal, extermination, and trap outs, must be conducted with extreme caution. All feral or unmanaged colonies, in or near areas where Africanized honey bees are found, should be considered as potentially Africanized. Neither beekeepers doing removals, nor people living near the colonies, should be put at risk.

A beekeeper in Kentucky writes:

I am beginning my second year as a beekeeper. I have two hives, which I started from packages last year. They are BOTH still alive! It is getting warmer now and my bees are flying from both hives and I'm seeing pollen on their legs. At my bee club last night they talked about the need to inspect our hives. I'm ready to do that, but can you give me guidance on what to look for?

I did treat for Varroa mites last fall and understand how to check for mites using the mite board under the screen board. But what should I watch for on the frames?

Phil replies:

The bee club members were right! Spring hive checks are important in order to assess the condition of hives so that you can take steps promptly if problems exist. I'm very happy to hear that you treated for *Varroa* last year. As you may have heard me say or write in the past, varroa mites continue to be the cause of most colony losses. Depending on how you treated last Fall, the effect should continue into the Spring, but an early Spring check is still a good idea. That said, when you open your hives and start to remove frames, you should be looking for brood, food, bees, and disease.

Since it has been warm where you live (extended temperatures above 60°F) and the bees have been carrying in pollen, your colonies should be rearing plenty of brood. Check for both larvae (uncapped brood) and pupae (capped brood). Your hives are not likely to be completely full of bees this early in the Spring, and the number of bees is a limiting factor in the amount of brood a colony can rear at one time. What brood there is will be located near the center of the cluster where the bees can keep it warm. If you are seeing a number of frames of brood – say four or more – the Spring buildup in your hives is well underway. I suggest that you make notes for each hive, recording the number of frames on which you see brood. This information will aid you, as Spring progresses, in judging how each hive is growing.

You should also check for food stores, both honey and pollen. At this time of year, I would like to see at least several full, deep frames of honey left over from last Fall's stores, as well as fresh nectar. That should be enough to get the colonies through any cold spells that may still occur, or through extended rainy periods when foragers cannot get out of the hive. Look for fresh nectar (uncapped honey), especially near young brood. You can determine whether the hive has sufficient food by actually counting the frames of stored, capped honey (from last Fall) or from the weight of the top deeps (Do they feel heavy?) as you lift them to check the bottom boxes. Again, make a written note of the hive's food stores, especially for those that you think may be low and

Stored pollen. (photo by Mary Parnell Carney)

Honey, nectar and brood. (photo by Mary Parnell Carney)

in need of feeding. If you are seeing fresh nectar in the cells and several frames of stored honey, feeding is not necessary. In addition to honey and nectar, you should see cells containing fresh pollen. Any pollen left over from last fall is a bonus, providing the colony with a reserve. You can distinguish between them because fresh pollen has a bright color, and will be found adjacent to cells containing fresh nectar near where brood is being reared on the same frames. Older pollen is duller, and may be found on frames outside the brood area. Pollen is a very important part of the bees' diet when rearing larvae, so I always look for stores of it, along with honey reserves, during Spring inspections.

The third thing to check for, though the first that you will notice, is bees. Note the number of frames covered with bees to get an idea of the colony's strength. A hive emerging from Winter with even seven or eight covered frames is in good condition. Here in Kentucky, I hope for full hives by April when the nectar flow is on and the bees begin serious honey production. The time table by calendar varies regionally – beekeepers further north do not need full hives until May or later; hives in the deeper south may already be full of bees – but the progression is the same for parts of the world which experience winter. The typical Winter procedure of the colony's cluster is to consume all the honey in the bottom box during cold weather, then move up into the top prior to early Spring. In your first inspection, you will very likely see all of the bees, brood, eggs, and other activity in the top brood boxes in your hives. The bottom boxes may be mostly empty, with some bees, but no brood or honey – yet. That is normal for early spring, and is not necessarily a negative. It gives the colonies room to expand during the next month, lessens the chances of early swarming (hopefully), and allows the colonies to begin reaching full strength later in the spring as the nectar flow increases. I suggest re-checking your hives again in a couple of weeks, if the weather cooperates. By then, you should expect to see the brood area expanding into the bottom boxes.

A tip, since you are a new beekeeper: when I remove frames in the early Spring, I am careful to put them back in the same order in which I remove them. I don't do this throughout the year. Later, in the Spring I will rearrange or remove frames (replacing them with others) to manage brood production, to TRY to prevent swarming, or for other management reasons. But now, with many cold nights still to come, I'm very careful not to disturb the natural clustering of the colonies, which is concentrated around brood and adjacent frames of food.

You may have noticed that, in my suggestions of things to check for, I did not mention looking for queens. The reason is that there is no need to. The presence of brood (especially that of larvae) tells us that queens are active in our hives. There is no need, even, to look for eggs in these first spring inspections. I sometimes do so, but it is not really necessary, and it takes longer. I am satisfied that my observations of larvae and pupae tell me what I need to know about the condition of the hives. If brood or eggs are not present in a particular hive, that is the time to search for the queen.

In addition to checking for brood, food, and bees, you should be looking for any signs of disease, pests, or parasites. As you mentioned, a Spring check for *Varroa* is most important. Beyond that, it is difficult for new beekeepers to diagnose these problems, and they are, in any case, subjects for additional articles. The best thing you can do is to learn what normal looks like, and keep an eye out for the abnormal. If you see something which doesn't look quite right, ask for help from another beekeeper or from your local bee inspector. BC

Note to Bee Culture *readers: See my August, 2013, Ask Phil column for information on conducting checks for* Varroa *mites using sticky boards.*

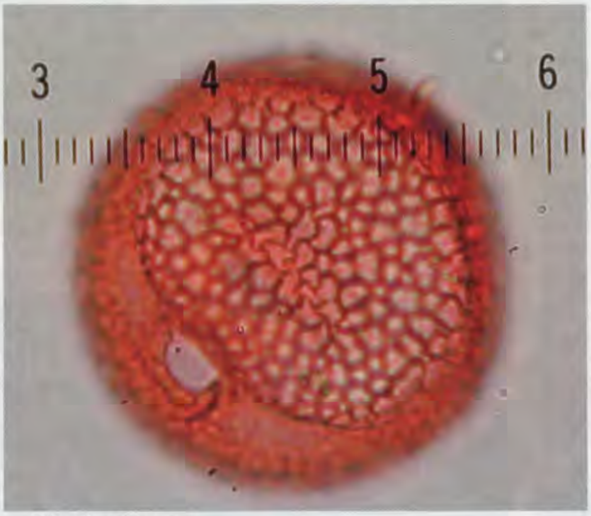
The Basics Of Honey Identification

Vaughn **Bryant**

When asked what type of honey their bees have produced, most beekeepers end up guessing wrong.

Pollen is a honey bee's major source of proteins, fatty substances, minerals, and vitamins. It is essential for the growth of larvae and young adult bees. A honey bee removes pollen from an anther by using her tongue and mandibles. While crawling over flowers, pollen also adheres to her "hairy" legs and body. The honey bee combs pollen from her head, body, and forward legs, mixes it with nectar from her mouth, and transfers it to the *corbiculae*, or "pollen basket", on her back pair of legs. When "loaded" with pollen, she will return to her hive.

Once at the hive, workers pack the pollen into special comb cells located in the central portion of the hive surrounding the brood area. To prevent bacterial growth and delay pollen germination, a phytocidal acid is added to the pollen as it is packed into the comb. Other enzymes produced by worker bees are also added to prevent anaerobic metabolism and fermentation thereby adding to the longevity of the stored pollen. Once it is completely processed for storage, the pollen comb storage area, referred to as "bee bread," is ready for later consumption by the bees.



Citrullus lanatus.

The protein source needed for rearing one worker bee from larval to adult stage requires approximately 120 to 145 mg of pollen. An average bee colony will collect and store about 44 to 125 pounds of pollen each year.

In most cases, the primary foraging sources for pollen are the various insect-pollinated (entomophilous) plants honey bees visit for nectar. However, honey bees will also visit a number of species of non-nectar producing, wind-pollinated (anemophilous) plants to collect pollen. Anemophilous types such as *Quercus* spp. (oak), *Celtis* spp. (hackberry), *Carya* (pecan or hickory), many species of grasses (Poaceae), and the wind-pollinated composites (Asteraceae), such as ragweed (*Ambrosia* spp.), are all important pollen sources for foraging honey bees.

According to the 1868 edition of *Paxton's Botanical Dictionary,* both "melissa" and "melitta" mean "a bee." The scientific name of the European honey bee is *Apis mellifera* L. The word "melliferous" comes from the Latin word *mellifer* (honey) and the suffix -ous meaning, "having, full of, or characterized by." The International Commission for Bee Research defines the word "melissopalynology", to reflect the study of pollen in honey, which is the term that most people now use.

The pollen recovered in a honey sample arrives there from a number of sources. When a honey bee lands on a flower in search of nectar, some of the flower's pollen is dislodged and falls into the nectar that is then sucked up by the bee and stored in her stomach. At the same time, other pollen grains from flowers that are visited become attached to the bee's hairs, legs, antenna, and even the eyes. Later, some of the pollen that was sucked into her stomach will be regurgitated with the collected nectar and deposited into open comb cells of the hive.

While still in the hive that same honey bee may groom her body in an effort to remove the entangled pollen on her body. During that process some pollen can fall directly into open comb cells or onto areas of the hive where other bees may track it into regions of the hive where unripe honey is still exposed.

Airborne pollen is another potential, but often minor source of pollen in honey. Airborne pollen produced by plants not usually visited by honey bees can enter a hive on wind currents. These wind-pollinated types of pollen are usually few in number, when compared to the pollen carried into the hive by worker bees; nevertheless, those pollen types can regularly enter a hive on air currents and can settle in areas where open comb cells are being filled with nectar. Some airborne pollen might also be deposited into ripening honey when beekeepers open the hives for inspection or remove frames for honey extraction. Finally, during the extraction process pollen from some of the pollen storage cells in a comb might be ruptured thereby mixing that pollen in with the extracted honey.

When asked what type of honey their bees have produced, most beekeepers end up guessing wrong. I have been examining honey samples from the United States and many other regions of the world for over 35 years. During that time I have looked at over 2,500 honey samples and I have found that about 60% of the time the beekeeper guesses wrong. Many of the guesses may seem logical to the beekeeper, but they are wrong. What often happens is that a beekeeper will see bees flocking to some plant in bloom and will assume that those nectar sources are the basis for the honey produced in his hives. Some beekeepers will rely on the color or taste of produced honey as the best way to identify and label their honey, but sadly, even these guesses are often wrong.

It turns out that the easiest and safest way to verify the type of honey being produced is to extract and examine the pollen. That system has been used effectively for nearly a century and it remains the least expensive, fastest, and usually the best way to provide certainty to the identity of a honey sample. Nevertheless, just identifying what pollen types occur in a honey sample doesn't tell the whole story about the honey being tested or about the importance of different nectar sources used by the bees to make the honey. The key to the correct identification of specific honey types is much more complex.

The story begins during the early 1940s, when two California scientists working for the USDA, Frank Todd and George Vansell, decided to examine the relationship between the pollen in the floral sources visited by honey bees and the later recovery of those same pollen types in the honey the bees produced (Todd and Vansell 1942). First, they wanted to calculate the number of pollen grains that one would expect to find in one cubic centimeter (cc) of nectar collected from each of over 2,000 different plant types in California. They discovered that for some major nectar sources very little pollen is trapped in the nectar and therefore very little of that pollen type is collected by visiting bees. The result is that those pollen types are rarely found in honey samples even when the honey is made primarily from those nectar sources. At the other extreme they found that the nectar of some plants contained thousands of pollen grains per cc. For example they found that for premium honey made from the nectar of black locust (aka, acacia) (*Robinia pseudoacacia*), the nectar of that plant contained only about 1,670 pollen grains per cc of nectar, but for willows (*Salix* spp.), the nectar contained about 80,000 pollen grains per cc of nectar. For most species of citrus plants (*Citrus* spp.) the nectar contained about 25,000 pollen grains per cc of nectar. Their study was the first to produce a table of data showing that not all nectar sources are created equal in terms of the amounts of pollen they contain, and by inference it means that the amount and types of pollen in honey will also vary accordingly.

Knowing that each nectar source contains different amounts of pollen answered only the first part of the problem. The second part of the problem focused on how much pollen from each nectar source could a honey bee remove during the return trip to the hive. Todd and Vansell knew that earlier research by Whitcomb and Wilson showed that a bee's honey stomach can remove unwanted debris, including pollen and fungal spores, which might germinate and spoil the gathered nectar being converted into honey.

To test how efficient honey bees were, they fed a caged hive only diluted honey that contained 5,200 star thistle (*Centaurea* spp.) pollen grains per cc of fluid. Later, the sealed honeycomb cells produced by the caged honey bees were removed and examined. They found that instead of the original 5,200 amount, the newly produced honey contained only 1,200 star thistle pollen grains per cc. Those results surprised Todd and Vansell because they expected the pollen concentration of the newly produced honey to be higher, not lower, than the amount they were fed. The only logical conclusion was that the significant reduction in pollen concentration was the result of the filtration ability of a bee's honey stomach, which was apparently far more effective than most researchers had realized. They also discovered that the amount of pollen a bee can remove from the nectar she collected depends on the amount of time between when the nectar is collected and when she deposits the nectar in the hive. The longer the interval, the more pollen she can remove from the collected nectar.

Plant Pollen Type	Pollen Coefficien Value per gram
Asclepias syriaca, milkweed	0.3
Epilobium angustifolium, willowherb, fireweed	0.3
Oxydendron arboreum, sourwood	1
Acacia dealbata (type), mimosa, wattle	5
Lamiaceae, thyme, rosemary, sage, mint	5
Medicago sativa, alfalfa	5
Cirsium spp. (type), thistles	10
Erica spp., heaths, bell heathers	10
Helianthus annuus, sunflower	10
Robinia pseudoacacia, white acacia, locust	10
Tilia spp., lime tree, basswood	10
Calluna vulgaris, heather, ling	12
Nyssa ogeche, tupelo	20
Liriodendron tulipifera, tulip poplar	20
Citrus spp., orange, lime, grapefruit, etc.	25
Ligustrum, privet	25
Lotus spp., birdsfoot trefoil	25
Prunus spp. and *Pyrus* spp. (type), peach, plum, pear	25
Trifolium incarnatum, crimson clover	25
Trifolium pratense, red clover	25
Vicia faba, vetch, field or broad bean	35
Ilex spp., holly, gallberry	50
Rubus spp., chokeberry, raspberry, dewberry	50
Trifolium repens, white clover	50
Burseraceae (*Bursera, Canarium, Protium*, etc.)	75
Eucalyptus spp., gum	75
Fagopyrum esculentum, buckwheat	75
Melilotus spp., sweet clover	75
Mimosa pudica, sensitive plant	75
Onobrychis, sainfoin	75
Brassic spp., oil-seed, rape, canola	150
Echum spp., viper's bugloss, blueweed	250
Leptospermum scoparium, manuka	250
Castanea sativa, sweet chestnut	1000
Eucryphia lucida, leatherwood	1000
Myosotis spp., forget-me-not	5000

Table 1 *– One set of pollen coefficient tables published by Rex Sawyer in 1988. Values under 50 indicate pollen types that are underrepresented in honey; values over 50 indicate pollen that is over represented in honey.*

Although Todd and Vansell did not find answers to all their questions, they discovered that not all plant species contribute pollen equally to the nectar they produce. They also demonstrated that because of the filtration ability of bees there is not a 1:1 relationship between a honey bee's collection of nectar and the percentages of pollen from that nectar source in the produced honey.

Their research was important because it laid the foundation for others to search for the true relationship between pollen in nectar and the pollen recovered in honey. After decades of additional research, scientists began to realize that what was needed was a list of *pollen coefficient values* that could be used statistically to derive the true value of each nectar source by

Sourwood Honey Pollen Taxa	Sample	%	PC	CV	TN %
Acer (maple)	1	0.4%	50	0.01	0.1%
ASTERACEAE (dandelion-type)	1	0.4%	50	0.01	0.1%
Cirsium (thistle)	2	0.8%	10	0.08	0.8%
Liriodendron (tulip tree)	1	0.4%	20	0.02	0.2%
Melilotus (clover)	205	81.7%	75	1.09	11.3%
Nyssa (gum)	3	1.2%	20	0.06	0.6%
Oxydendrum arboreum (sourwood)	20	8.0%	1	8.00	83.3%
Parthenocissus (Virginia creeper)	10	4.0%	25	0.08	0.8%
Plantago (plantain)	1	0.4%	50	0.01	0.1%
Quercus (oak)	1	0.4%	50	0.01	0.1%
RANUNCULACEAE (buttercups)	1	0.4%	50	0.01	0.1%
Tilia (basswood)	6	2.4%	10	0.24	2.5%
Totals	251	100%		9.61	100.0%

Table 2:
Honey sample from Virginia containing 205 clover pollen grains (81.7%), which most would call a Unifloral Clover Honey. However, by dividing the percentage of pollen by a pollen coefficient value (PC), the result shows that the true nectar (TN) source of this honey is actually sourwood (83.3%), not clover. The pollen concentration value of this sample is 20,000 pollen grains per 10 grams of honey, which also confirms that this is a sourwood honey. One should expect low pollen concentration values when examining honey produced from the nectar of plants with underrepresented pollen types.

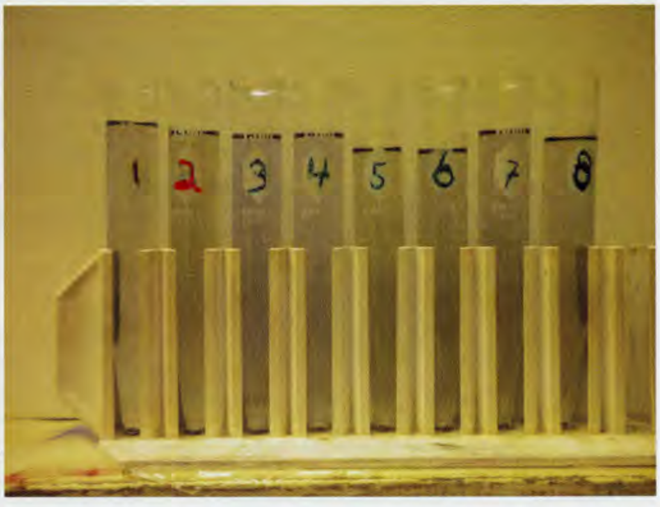
correcting the pollen results for over or under representation of each pollen type in a honey sample.

Although there were a few others after Todd and Vansell who experimented on trying to establish pollen coefficient tables for honey, it was the multiyear effort by Polish scientist, Z. Demianowicz, who finally provided the best data on pollen coefficient values (Demianowicz 1961, 1964). To develop the data for each major nectar source, she used caged hives of only 300-400 workers bees and one queen. She then brought fresh flowers twice a day for the caged bees to use for gathering nectar. She continued this effort for each new plant type until each group of caged bees had produced honeycombs from the flower nectar they had been fed.

Based on this research, she developed 19 different categories of plants, which she ranked according to their expected pollen concentration value in a unifloral honey. Those data then became the basis for developing her list of pollen coefficient values for those same plants. Others, such as Rex (Sawyer, 1988) in England then summarized some of her data and added some of his own data to create a list of PC values that he published in his book *Honey Identification* (Table 1).

Ricciardelli d'Albore's was the next person to conduct an extensive study of PC values as they applied to Mediterranean honey types, which he found were either over or under-represented in honey samples (d'Albore 1998). For example, he discovered that the pollen amounts from plants that produce large pollen grains (>40 im) is normally significantly under-represented in honey samples because bees are more efficient at filtering out large pollen grains during their return flight to the hive. He pointed out that the opposite is true for tiny pollen grains, which are usually significantly over-represented in honey. He noted that the smaller the pollen grains are in diameter, the greater the over-representation. Pollen grains from plant types such as *Echium* spp., *Eucalyptus* spp., *Amorpha* spp. (indigo), *Castanea* spp. (chestnut), *Mysotis* spp. (forget-me-not), and *Tamarix* spp. (salt cedar), are very small and are usually produced in large amounts. Because of their small size and prolific numbers, rarely is any of the pollen filtered out in the honey stomachs of bees returning to the hive. Finally, d'Albore also listed other plants that he determined are either over or under-represented in honey samples by the amount of their pollen mainly because of other factors such as: 1) flowers that produce only small amounts of pollen (i.e., *Citrus, Robinia, Salvia*); 2) plants that produce both male and female flowers and therefore only the male flowers produce pollen (i.e., *Citrullus* spp. [watermelon], *Cucumis* spp. [cucumber], *Cucurbita* spp. [pumpkin or gourd], *Bryonia* spp. [bryony]); 3) some species that produce nectar but have flower anthers in positions that make it difficult for pollen to become trapped in the nectar (i.e., *Asphodelus* spp. [affofill], *Epilobium* spp. [fireweed], *Abutilon* spp.[mallow], *Datura* spp. [jimsomweed], *Digitalis* spp. [foxglove]); and 4) flowers from some plant species present special pollen and nectar gathering problems for honey bees or have flowers that are difficult for bees to open and enter (i.e., *Agrostemma* spp. [corncockle], *Cestrum* spp. [cestrum], *Nicotiana* spp. [tobacco], *Medicago* spp. [bur clover, alfalfa]).

As early as the mid-1960s Anna Maurizio and J. Louveaux were working on formulas that would identify unifloral honey types (Maurizio and Louveaux 1965). They noted that when a honey sample contains 45% pollen from a single plant type, the honey is generally considered a unifloral type from that nectar source. They did point out, however, that there were exceptions because the pollen from some plant species can be over or



Samples being processed.

under represented in a honey sample. The problem, however, is recognizing which pollen types tend to be over or under-represented in honey and then determining what percentages of pollen are needed to confirm that a honey sample is unifloral and produced mostly from the nectar of only one plant type.

The use of pollen coefficient (PC) tables is one way to solve that problem and to explain why some premium unifloral honey types, such as fireweed, blueberry, sourwood, thyme, sage, orange blossom, and acacia are not dominated by the pollen from those sources even though the honey is dominated by the nectar from those plants. For example, a recent honey sample of honey I examined from a beekeeper in Virginia is shown below (Table 2). Note that based on the relative pollen percentages it would appear that this honey is a good unifloral clover honey with a percentage of clover pollen in excess of 80%. However, because clover pollen is highly over represented and sourwood pollen is highly under represented, we find that by applying pollen coefficient values to the original pollen count we get a completely different interpretation of the honey. In reality, the honey is an excellent example of a nearly pure sourwood honey containing over 80% of its nectar origins from sourwood blooms. This is just one example of how pollen coefficient values need to be applied to honey samples in order to determine their "true" nectar sources (Bryant and Jones 2001).

But, not everyone accepts the use of PC values because of questions about the techniques used to generate those tables and values. Some of the PC research was conducted more than 50 years ago using techniques and standards that were adequate at the time, but are not as good as similar studies could be today. The current problem, especially in the United States, is that few academic centers teach techniques related to beekeeping and the United States Department of Agriculture, although interest in honey bee research, spends most of their funds and efforts on searching for causes of colony decline.

Developing new and valid PC standards would not be difficult or expensive, but the research would require time and effort on the part of those working on the problem. So far, there appears to be little interest in

Some of our many honey samples.

trying to develop new sets of PC standards that could be adopted universally as guides to identifying unifloral honey types, which could be based on their actual pollen contents. Unfortunately, at present hardly anyone in North America examines the pollen in honey samples and thus what is on the label of many honey products sold in urban stores or at farmer's markets often has no relationship to what is actually in the jar. Until beekeepers and consumers insist on changes, we will continue to pay high prices for "so-called" premium honey types, which in reality might be nothing more than inexpensive clover, canola, or even blends of honey from different regions. The first step in correcting this would be to demand truth in labeling for honey sold in the United States. Repeated testing of honey sold in almost every U.S. state reveals that this is desperately needed in order to correct the misinformation now found on the jars of most commercial honey. Requirements for truth in labeling of honey would then create a need for developing new sets of accurate PC (pollen coefficient values). After that, with the potential of research funding to expand the needed PC research of honey types, and the potential for future jobs related to honey research, students and researchers would be willing to pursue those tasks and soon consumers throughout the U.S. could believe with certainty what was written on the labels of honey products. BC

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APPLE POLLINATION BASICS

Gary **Pullano**

What Growers, And Beekeepers Need To Know – From A Grower's Perspective

Operating a flourishing family farm near Shelburne, Mass., keeps owner Tim Smith on a busy schedule. Among the important tasks is overseeing Apex Orchards' apple pollination and honey bee management.

Smith spoke about the topic on Dec. 18 at the New England Vegetable and Fruit Conference in Manchester, NH.

Housed on more than 200 acres, Apex Orchards grows a wide variety of tree fruits, apples, peaches, nectarines, apricots, quince, pears, Asian pears, blueberries, table grapes and kiwi. It sells produce at stores throughout the area, at farmers' markets and at the farm itself.

"This is without a doubt one of the top fruit-growing areas in the world," Smith said. "The soils, the microclimates, the varieties all combine to give our customers the best-tasting fruit possible."

In order to help make that happen, Smith pursues a healthy apple-flowering effort because he recognizes the number of seeds set per fruit increases the size of the apple.

"It allows the apples to mature more evenly," he said. "We always try to set king bloom. For that you need flower sets of five to 10 percent for a commercial crop."

He said bees tend to work close to the hive for the first day or two after being moved. Bees will work up to two miles from the hive foraging, and they are likely to work the most attractive crops available.

"Bees will continue to work the same crop they started working," he said. "They tend to work up and down the rows in a high-density planting. Much of the pollen transfer for cross-pollination takes place within the hive."

Changes in beekeeping patterns have brought challenges, such as a proliferation of *Varroa* mites that infest honey bee colonies.

Varroa mites are external honey bee parasites that attack both the adults and the brood, with a distinct preference for drone brood. They suck the blood from adults and the developing brood, weakening and shortening the life span of those on which they feed.

Emerging brood may be deformed, with missing legs or wings. Untreated infestations of *Varroa* mites that are allowed to increase will kill honey bee colonies. Losses due to these parasitic mites are often confused with causes such as winter mortality and queenlessness if the colonies are not examined for mites.

Smith said beekeepers use pesticides within the hives to control mites, but negative impacts can occur from using pesticides, as well as not controlling mites.

He pointed to ongoing concern for *Nosema ceranae*, a fungal disease that is difficult to control and may be interacting with other viruses.

Nosema ceranae is a microsporidian, a small parasite that mainly affects *Apis cerana*, the Asiatic honey bee. It may cause nosemosis, also called nosema (*Nosema apis*, the most widespread of the adult honey bee diseases). The dormant stage of nosema is a long-lived spore that is resistant to temperature extremes and dehydration.

He said the evolution of beekeeping practices includes a focus on nutrition, including the intensity of required feeding schedules for honey bees.

Hive replacement is seen as an essential way to manage honey bee pollination efforts, Smith said.

"Replacing hives is a constant operation for all commercial beekeepers," he said. "Most beekeepers are replacing 100 percent or more of their hives every year."

He urged caution when interacting pesticides with miticides the beekeeper is using for mite control. Use of the chemical fluvalinate, which slowly permeates the hive over a 40-to 50-day period, or SI fungicides "may increase toxicity to bees by 2,000 times."

Smith said it's important for growers to spray during pre- and post-bloom only, acknowledging that extended bloom makes this approach difficult.

"Time sprays to allow for king bloom pollination," he said.

Smith believes almost all pesticides have some repellency to bees.

"Never spray when bees are foraging, even fungicides," he said. "Spray early morning or evenings if necessary during bloom. Try to eliminate SI and strobilurin fungicides during bloom."

Focusing on hive replacement, Smith said the number of hives used per acre is a "risk management decision. How warm will it be; how rainy will it be during bloom? What are the chances of frost during bloom?

"Plan on one hive per acre or per 1,000 bushels of expected production as a minimum," he said.

When placing hives in the orchard, they should be in a place with exposure to morning sun. They should be located near a windbreak in groups to increase competition and cross-pollination.

It is important to inspect hives that growers rent, Smith said. Growers should be looking at hive strength, the frames of the brood and bees and the overall quality of the hives.

"It's always more cost effective to rent stronger hives of bees for pollination," he said.

A four-frame hive will produce 4,000 flying bees. An eight-frame unit will house 15,000 flying bees.

"Two weak hives will never equal the field force of one strong hive," he said.

Inspecting at least a percentage of the rented hives is crucial.

"Consider using a quality-based contract," Smith said. "Work with your beekeeper to get the strongest hives for apple pollination."

Alternative pollinators to honeybees include Osmia (mason) bees and bumblebees.

"Both are good pollinators, but both are prohibitively expensive," he said.

"Always rent strong hives of bees. Don't be afraid to check the hives you are renting. Always decide how many hives per acre based on how much risk you're willing to accept." BC

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Gary Pullano is Assistant Editor at Fruit Grower News.

DOWNTOWN

Be(e) Careful What You Ask For

Do You Want To Be(e) On Speed Dial?

Beekeepers in the city should be regarded as indispensible, of course, but there are a number of lessons, adventures, and a philosophical education in store once the public has us on speed dial. Just like beekeeping, what you put in has a major effect on what you get out, and this changes in a semi-predictable way through the season. Here are some of the lessons we have learned.

Be(e) Careful What You Ask For

I talk too much. As a result of this behavior, several dumb promises have paid off unexpectedly, and maybe educationally (and a little expensively in cell phone minutes). If there is a "long story short" here, it's that we tried to make an organizational friend and ended up getting listed on the Mayor's Help Line for stinging insect incidents. We've therefore spent a fair amount of time sharing a lot of entomology (and enthusiasm) with a wide range of people we both intended and did not expect to talk to. Just because we were greedy for bees.

By April, most of us city beekeepers have been talking to each other about our losses and our saves, our splits and our stragglers. Last year, we were also scratching our heads about where to get bees before June: on the East Coast, packages weren't arriving before the nectar flow, and we had larger than normal losses. Many of our newbees were not able to source bees at all, and we almost did not want them to take a package after May 1st anyway.

And so we chased swarms: we chased them everywhere and every way we could, including trying to connect with the right government folks, the right neighborhood networks, and the right greeniac buddies. Then we chased structural extractions, and then we went for bee trees. We tried to tell everyone about our willingness to do this. All of this publicity seemed like a great idea in April, but like most habitats, things work differently in August.

Beekeeping has caused me to think of just about everything as a natural equilibrium, or a kind of ecology. For nine years we have been trying like the devil to understand how our local government habitat works, and to place beekeeping firmly in a sustainable niche there. We wanted beekeepers protected, and more of those strong feral bees saved. Our beekeepers have networked with many twigs on the organizational branches, and tried to send messages up and down the trunk, usually reaching only small areas. It was therefore a surprise to find out what really worked the system!

On June 12, we got a swarm call from the city animal shelter, and after running around on the roof a bit (the bees had skipped already, unfortunately) we climbed on down and told then to call us anytime, and to feel free to share our number.

Bingo.

We did not know that, in the great urban scheme of things, the animal shelter was getting all the city calls for stinging insect incidents. Needless to say, they already had their hands full with dog and cat adoptions. We knew that there was a unit in the Pest Control division that was charged with gassing hornet nests, but those folks had successfully ducked the publicity bullet. Within about 72 hours, our phone number was on the city help line.

Which, in April, was great! We must have grabbed a dozen hives' worth of free bees, two months before most of the packages came, enough to cover winter losses and several short course students. But things change over the season.

You Can't Step Into the Same River Twice

We like to say all beekeeping is local, but really, all bugs are local, so I am not sure what your season looks like. But I can tell you one thing: swarms are followed really closely by the emergence of ground nesting *Osmia* in the MidAtlantic, and folks are just as anxious to get us to come pick those up, too.

When you take beginning beekeeping, mostly there is not a unit about stinging insects that are not *Apis mellifera*, but city neighbors will still look to a beekeeper for help.

City operators are not much more informed than the general public about differences between flying insects. If it has a stinger, it's a "bee." If it flies and lives in colonies, it's a "bee." All those solitary bugs who were barely there in the early Spring have way more interaction with the public as the temperature rises. The *Osmia* started burrowing, making many yards look plowed, and freaking many homeowners out. So the number and the kinds of calls we received began to change, and we learned a lot about local solitary, bumble-, and non-bee "bees."

Here, *Osmia* are followed by Carpenter bees *(Xylocopa)* and then the first noticeable wasp and hornet colonies. We faced a choice: try to educate the city switchboard operators on insect taxonomy (unlikely), shut off the phone calls, or let it ride.

Even though we were no longer getting real swarm calls, we *were* learning a lot about the dynamics of pollination and the environment in which our honey bees were living. We learned about the lifestyles of *Osmia* and *Xylocopa* and some others, and researched alternatives for living with and maybe even liking these more native species (we were kind of in the comforting business). During some of those phone calls, we could hear people getting more curious about and connected with the green space they lived in. Mostly, they did not want the insects to die, they wanted them to somehow be saved. I got to liking a lot of my fellow citizens.

So we opted not to bail out of the city switchboard, at least for now. But, especially once the hornets started up, we developed some diagnostic criteria for the person on the other end of the phone to use: "Inside, Outside, or Hanging Around?"

Inside is where honey bees want to live: if the insect in question is flying in and out of a hole, especially if that hole is located above ground level, you might have a feral bee colony. If it's in a tree, we will try to get the caller to leave it alone, or even become an ally. If the tree's coming down, we'll see if we can work with the arborist. If it's in your house, we'll connect you with a beek who does extractions.

Outside is when the nest is hanging from a branch or a wall or generally in a pendulous state. In this case, we know we have hornets (at least around here).

Hanging around is what we love to hear: is it just a great gob of bugs all in a blob, sort of hanging around and doing nothing much? Are they kinda brown and gold? What's your address, anyway?

The likelihood of getting one or another of these responses flows up and down from April to October, and every phone call seems to spawn another pair of watching eyes that don't see the world the same way afterward. The Spring brings me free bees, and late August brings me new allies, and an unforeseen mission to let nature take its course in a completely different way.

The Enemy of my Enemy is My Friend (Within Reason)

And what if that caller is talking about hornets? What I want them to know is that, as ornery as they can be, hornets (and maybe spiders, and certainly Praying Mantises) are my favorite pesticide. Unlike the stupid mosquito sprayers, they eat what they kill, and kill only what they need.

Gardeners are easy prey for would-be wasp and hornet advocates.

Nature gave this creature a one-shot pop gun.

Nature gave this creature an automatic weapon.

Those hornets will hang around their gardens and pick off flies and beetles (and, unfortunately, the occasional honey bee) and leave no chemical tracks.

There are habitat issues: if someone is getting stung, a colony in the wrong place has to go. We ask whether the nest is in a public tree, and if it is, we give the caller the number of our publicity-shy city bug gassers. If it is a private site, we let them know that the expense is theirs, but the threat only lasts until the first hard frost (you might have no idea how many colonies this saves!)

Other things to know: people are reassured to learn that the ginormous nest they can see when the leaves begin to fall *will not* be reinhabited, and by the time they can see it, the population is already in free fall. They might be pleased to learn that, while they were living their lives, those hornets were busy and peacefully living theirs, and chowing down on other species that would have made everyone less comfortable along the way.

Sometimes, when they put the receiver down, folks get the picture that there are differences! And that even the less amicable species have a role to play!

You can sometimes explain things this way:

Different Strokes for Different Folks

There is no way that everyone would enjoy taking random pollinator-oriented phone calls, especially on an indefinite basis. So far, in this place, the pay off in free bees, new allies, and the impetus to learn more about the local ecosystem has made this more than worthwhile. I'd encourage any beekeeper to develop some kind of familiarity with the local stinging insect population, and some greener alternatives to extermination. Sometimes you can get folks to live and let live (just like we want them to do with our colonies), sometimes you can get them to make a greener choice than a spray can of insecticide. And that is good for you, your friends old and new, and your bees. BC

Toni Burnham keeps bees on rooftops in the Washington, DC area where she lives.

Collecting & Storing Seeds

What better way to make sure your bees have enough good food?

Bethany **Caskey**

Collecting and Storing Seeds

You can increase the number of bee-friendly plants in your neighborhood by collecting and saving the seeds of pollinator species that you are not likely to find in a retail store. By making conscience choices you can propagate plants that provide essential habitat for bees, butterflies, moths, beetles, hummingbirds, and other pollinators. Collecting and propagating pollinator seed requires just a minor commitment of time, some basic knowledge and good organizational skills.

There is a long list of generic plants that will thrive in almost all areas of the country, but I would urge you to take a visit to **www.pollinator.org** to download a free plant guide that is tailored to your eco-region. They also offer a free app for use on a smart phone if you prefer that method. Some pollinator plant seeds are available commercially, but today and in the second part of this article, we will focus on finding, collecting and storing your own seed reserves. Gathering your seeds locally is cost effective and will also assure that the species you gather has adapted to your region.

Generic List of Pollinators

Lavandula spp. (Lavender)
Rosemarinus officinalis (Rosemary)
Salvia spp. (Sage)
Echinacea spp. (Coneflower)
Helianthus spp. (Sunflower)
Cercis spp. (Redbud)
Nepeta spp. (Catnip)
Penstemon spp. (Penstemon)
Stachys spp. (Lamb's ears)
Verbena spp. (Verbena)
Phacelia spp. (Bells or Phacelia)
Aster spp. (Aster)
Rudbeckia spp. (Black-eyed Susan)
Origanum spp. (Oregano)
Achilliea millefolium (Yarrow)
Gymnocladus dioicus (Kentucky Coffeetree)

(spp = Latin abbreviation for multiple species)

Seed gathering begins simply by observing and keeping a record of the location of the pollinator plants you want to collect while they are in flower. Depending on your enthusiasm and energy, seed collecting can cover several counties, several blocks, or your fencerow. It is important to keep track of where you have located a desired plant species since as the flower and seed matures, it may become very difficult to relocate. It is a good idea to mark individual plants with surveyor's tape, a surveyor's flag or to write down specific landmarks to help you relocate the plants when the seeds are ready (For example: two miles north of intersection H33 and highway 137 and by the 120 mile marker sign on the south side). A handheld GPS can give you the latitude and longitude to save along with the type of plant. Most GPS units will allow you to mark waypoints with a description that you can upload to your computer later. The former president of the Iowa Prairie Network, Eugene Kromray, recommended recording plant locations on a large county map. You can keep a simple notebook, and if you have the skills, creating a computer database can streamline later location and recovery of seeds. Kromray also likes to carry a camera and keep a photo record of all the plants he collects. Never collect on public land without written permission and *always* get permission from private landowners.

Columbine Capsule & Seeds

If you are just beginning to collect your own seeds, start with plants that are prolific seed producers and are easy to collect. Some flowering plants like cosmos, marigolds, columbine, zinnias and bachelor's button are good beginner plants. Only collect seeds from the healthiest and pest free plants. Don't deadhead or remove the dying flowers before collecting, instead keep a watch for the seedpod development. If you are gathering seeds from plants that may be a hybrid, your results and success with replanting can be mixed.

The next step is to observe the plants through their life cycle. Your harvest timing is important. If seeds are gathered too early, the seeds will not be mature and will have low viability. Attempting to collect the seeds too late can result in the seeds being expelled and lost before they are gathered.

There are basically two types of seed harvesting and cleaning: wet and dry. Wet seeds are those enclosed within

Redbud Pod & Seeds

a fleshy fruit or berry (cucumbers, peppers, melons, squash, apples, etc.). When separating seeds from wet pulp, like a pumpkin, the seeds can be washed from the pulp and then laid out to dry on newspaper or a screen. The harder pulp fruits and vegetables can be opened up and the seeds removed manually and layed out to dry.

Most of your pollinator seeds will be dry seeds. Dry seeds are harvested when the seed is mature and, at least partially, dried on the plant. A ripe seed has a coat that is typically some shade of tan, brown, or black and feels firm and dry. Unripe seed is usually white or green in color. You can also cut seed open to test ripeness. A ripe seed should be filled with a white material that consists of embryo and the endosperm that surrounds it. In an unripe seed, this same material is milky or watery and the seed coat surrounding it will be soft and easily compressed. As the seed matures, the inside will become firmer, and the seed coat will harden and is not easily crushed between your fingers. The seed is ready for harvest at this stage even if the seed coat has not fully darkened.

Collect seeds about midday or afternoon and when the weather is dry. Moisture from rain or dew can ruin seeds quickly. In dry climates, most seeds can normally be left to mature and dry in the field, but in areas with high humidity or frequent thunderstorms, it is better to harvest early and allow the seeds to continue to dry under controlled conditions.

Be sure to label each bag or envelope with the plant species, location and date. This will help you remember what seed it is and where you collected it. Keeping good notes will also help in the future so you will know which plants did well and the ones to not bother collecting again.

Plants with seeds that ripen in pods should be gathered just as the pods begin to open. It is advisable to collect the entire pod and allow the seed to continue to ripen in the pod as it dries. Positioning a paper sack over the seed heads and using a twist tie to close the open end can contain plants that break open and scatter their seeds. You can also snip off the entire head or the seedpods and place them gently upside down in your paper bag. You can then shake the seed heads inside the bag to loosen the seeds.

Seeds such as Wild Columbine (*Aquilegia canadensis*) or Bishop's Cap (*Mitela diphylla*) are very easy to collect. The urn-shaped pods open when ripe and expose the seeds in their little cups. By bending the stalks a bit and tapping the pods, the seeds will fall into your bag. Some seeds like those from marigolds or black-eyed Susans can be easily pulled from the seed head and put into your bag.

Do not use plastic bags for seed gathering. Plastic prevents the necessary drying process and creates mold and rots the seeds. Plastic can also create a static cling that is a problem for tiny seeds. Small brown paper bags can still be purchased at most grocery stores or you can maybe find a stash of unused popcorn or similar bags.

If the seed heads are not completely ripe and dry when gathered, either hang the stems and seed cases or lay them flat on newspaper or paper towels away from direct light. It is easier to dry the entire seed head than loose seeds. If you package and store seeds before they are fully dry, they will mold. An easy drying method lets the seeds dry in open paper bags to allow for air circulation, for one or two weeks.

If you are planning to store your seeds long term in containers that restrict moisture release like thick plastic, glass or metal you will need to make sure your seed is very dry. The more a container restricts the release of moisture, the drier your seeds will need to be. Most ambient drying will not make a seed dry enough for this kind of storage, but there are options:

- Silica gel can be added to airtight containers in a weight equal to the weight of the seeds in the container. Usually the gel with a packet of seeds should remain in the container for two days to a week. Do daily dryness tests to make sure the seed does not get too dry and become damaged or dormant. When your seed is the proper dryness, remove the packet of seed from the container and place it in another airtight container.
- If you have access to a food dehydrator that allows the temperature to go down to 85°F, set the dehydrator to that temperature with your seeds spread out inside. Check the seed often to prevent over-drying. You will need to experiment with the amount of time it will take for different seeds.
- Spreading your seed in a sun-exposed room can accelerate drying. Any gentle heat can speed up drying as long as the temperature never rises above 100°F.

Collected seed is dry enough if it passes one or more of these tests.

- Bend small or thin oblong seeds. If they are dry

rairie Cone Flower

enough, they will snap instead of bending.

• Put bigger seeds on a hard surface and hit them with a hammer. Very dry seeds will shatter. Seeds that are not dry enough will mash.

• You can also put an envelope or other paper in your bag of seed overnight. In the morning, compare that paper with one of the same type that was not left with the seed. If the paper that was placed in the seed seems as dry or drier than the paper not with the seeds, then your seed is probably dry enough to store in an airtight container.

Coffee Tree Pods & Seeds

Not all seeds will need to be cleaned before storage. If you are sowing your seeds right away, cleaning is not as critical. Seeds stored in their pods or seed heads usually harbor insects that over time will destroy most of your crop. Pulpy type seeds must be cleaned to prevent mold. Thrashing (removing the seeds from the other collected material) can help reduce the volume of seed, and insect eggs, pathogens and mold spores are removed with the chaff. Rubbing the collected seeds against a course screen or sieve above a piece of paper with a gloved hand is an easy way to thrash seeds. The seeds should sift through the mesh to the paper below. You will have to experiment with mesh sizes for different seeds. After the seeds have fallen to the paper, roll the paper into a tube. Hold one end over a small jar and slide the seeds into the jar.

Inside every seed is a plant embryo that lives on the food stored in the seed, the endosperm, and it will need to be kept cool and dry. If the embryo exhausts all the stored food, it will die and cannot germinate. Keeping the seed cool and dry will delay the rate of food absorption. Dry seed is less apt to suffer attacks from bacteria and fungus. If you are saving your seeds and not sowing them right away and if insects or rodents are a concern, you will need to protect your seeds by storing in thick plastic, metal or glass. BC

Next: Storing and Dispersing Your Pollinator Seeds.

HOGG HALFCOMB
Cassette Comb Honey

Herman **Danenhower**

After the passing of John Hogg in 2012, the continuation of production and marketing of the Hogg Cassettes was in question. Herman Danenhower of Kutztown, Pennsylvania, a Halfcomb enthusiast and long time beekeeper, contacted the family and they agreed that this unique comb honey system should not go away. He was given permission to use the cassette mold, and purchased the beeswax sprayer which is used to coat the cassettes with beeswax.

The sprayer took some engineering to build and it does work well. It sprays the bottom of the cassette with unbleached beeswax from Herman's cappings. This may improve acceptance by the bees, as it has the real nice aroma which is lacking in the previously used bleached beeswax.

Another improvement is the diagonal label. Two colors will be available. There are blue-colored labels for 12 ounce combs and red ones for 10 ounce combs. Sometimes if the honey flow is cut short, the bees cap over the combs a little thin. If combs do not weigh 12 ounces we now have this label so one can sell 10 ounce comb for less.

Also new will be complete supers, and refill superpacks for eight-frame beekeepers. These supers hold 32 cassettes, while the 10 frame supers hold 40 cassettes.

The Hogg Halfcomb has many advantages. There is no need to buy foundation and there are far fewer parts of the cassettes to scrape before marketing. Because it is a half comb with no central foundation, the consumer finds a very delicate product with 50% less beeswax. It spreads on bread or a muffin with ease and does not tear up the bread.

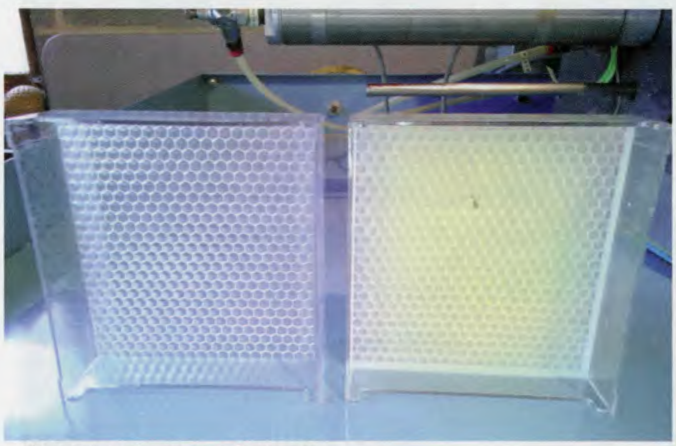
The Hogg Halfcomb is a unique and attractive package which displays the beauty of a honeycomb. It can help bring back the lost awareness of comb honey. In the late 19th century, comb honey was the primary product marketed by American beekeepers. Today, many people are not even familiar with comb honey. It fits well into today's eat local trend and people really like it. Comb honey offers several advantages to the beekeeper. High quality sections sell for premium prices. An extractor as well as settling and bottling tanks are not needed. Hogg Halfcombs are another rewarding beekeeping opportunity.

Complete assembled supers and superpack refills will be available through Betterbee. Bulk ordering, and a brief video, can be found at hermanshoneycomb.com. There is also a video by John Hogg about the Hogg Halfcomb system. It originally was included with each Halfcomb super. The video is now on the web at www.youtube.com/watch?v=yMfdqgzZ5b8.

Production of comb honey is not difficult but requires very strong colonies and an intense honey flow. The challenge is to make colonies very strong without inducing swarming. Many different techniques have been described to provide strong colonies at the time of the major honey flow. John Hogg, Galesburg, Michigan, who invented and marketed the Hogg Halfcomb, developed and promoted the Juniper Hill Plan for producing Halfcombs. His prescription for successful comb honey production called for hives boiling over with bees at the start of a good honey flow. John made several modifications to his plan over the years. The plan, as modified and used by Herman Danenhower of Kutztown Pennsylvania, is presented here. It is important to note that all beekeeping is local. The timing of manipulations is based on local honey flows. The goal of the manipulations is to provide a peak force of field bees in a colony that has gotten past the urge to swarm at the start of the major honey flow.

First Operation

Herman starts during the dandelion bloom which is mid-April to early May in southern Pennsylvania. This is one or two weeks prior to the swarming season. He selects strong overwintered colonies in two deep brood chambers. The brood boxes have not been reversed and the bees are just starting to use the lower hive body. They must not have started queen cells in preparation for swarming. The hive is arranged so that the queen and two frames of brood are placed in the bottom brood box below an excluder. Most of the brood remains in the second brood box above the excluder. A shallow or medium super is added to the hive. This super is the "buffer," It provides room for nectar storage and helps prevent pollen storage in the comb honey cassettes when they are added.Optionally the queen is clipped and marked at this time. The excluder

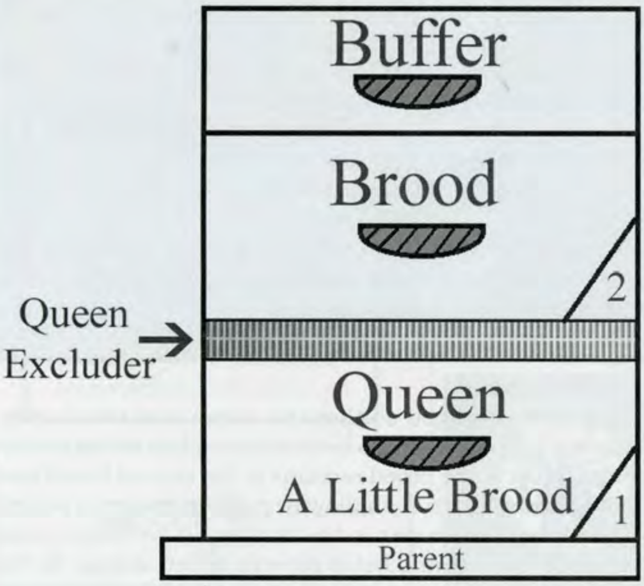


Waxed and unwaxed cassettes.

Complete superpak.

Ten and 12 ounce cassettes with color coded labels.

should have a notch on the upper rim edge. This notch provides an exit for drones confined above the excluder. The hive is left this way for about 17 days. During this time period the bees will often produce queen cells in the bottom box. If there are queen cells in the bottom box at the time of the second operation 17 days later they may be left and used as the replacement queen for the new (set aside) hive.



1st Operation

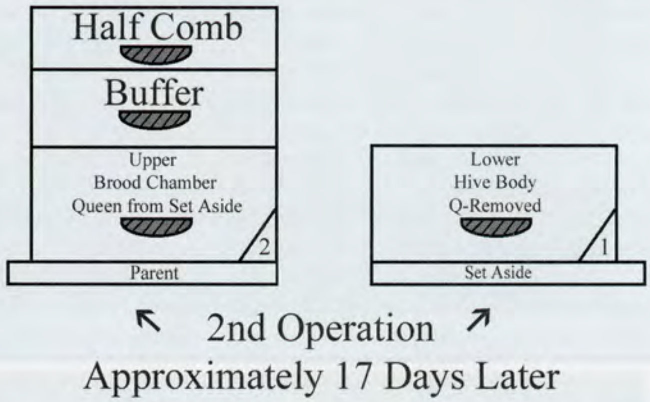
Second Operation

About 17 days after setup the colony it is rearranged. The lower hive body is moved behind the original hive and placed on a second bottom board with its entrance facing the opposite direction. The upper brood box and buffer super remain in the original location. The queen is moved from the lower hive body and placed in the upper hive body on the original stand. A Halfcomb super is added at this time.

Several things have been accomplished by these manipulations. The brood has hatched from the upper brood chamber. There will be plenty of field bees and little tendency to swarm because there is no brood. In effect the colony has already swarmed and now needs to re-establish itself. They have a good queen, a large field force and room to expand. This hive will move honey up and out of the brood nest to make room for the queen to lay. If there is a good honey flow they will fill supers rapidly. The set aside, the lower hive body on the new stand has plenty of brood but no queen and a limited field force because most fielders have gone back to the original stand. If there is a queen cell it can be left for the new colony. If no queen cell, the "set-aside" can be allowed to raise a queen or can be given a laying queen. The hive will build up fairly quickly because there is plenty of brood to help the colony maintain population before the new queen starts producing brood.

Adding Supers

A second Halfcomb super is added when the first is about 60% full. Filled supers should be removed as soon as they are fully capped. Prompt removal provides pristine white cappings which really show off the beauty of the comb. Triangle escape boards work well for removing bees from filled supers. Avoid fume boards so there is no possibility of off flavors or odors. One error often made is adding more supers as the season is winding down. The goal is sections which are rapidly drawn, filled and capped. To avoid partial combs err on the side of too few comb honey supers. The length of the comb honey season varies with



the area. For Herman in southeast Pennsylvania the flow is usually about May 1 to June 10. He usually gets one nicely filled super from each hive. Areas with overlapping major honey flows will have a longer comb honey season. John Hogg, in Michigan had a very long honey flow and often got several supers from each hive. BC

SMOKER MAINTENANCE

Follow These Basics For A Long Lived Tool

Ross **Conrad**

A smoker is one of the primary tools used by your average beekeeper. By blowing smoke into the hive the beekeeper is able to simultaneously distract the worker bees and cover up the smell of their warning pheromones thereby interfering with one of the primary communications channels the bees utilize to organize and defend themselves. The smoker helps make beekeeping a much more enjoyable activity. While a great deal has been written about how and why to use a smoker when working with bees, not a lot has been written about the unexciting but important topic of smoker maintenance despite the fact that questions on this subject come up every once in awhile.

The lack of focus and attention on smoker maintenance may be due to the simple nature of the smoker. Today's modern smoker is basically a metal can (fire chamber) with a hinged lid that, with the aid of bellows, allows air to flow in from the bottom of the fire chamber and out through the top. The narrow opening in the lid allows the smoke to be easily aimed in any direction necessary. Despite its apparent simplicity, without some timely maintenance there are a number of parts on a smoker that can and will eventually break, or stop working. Among the factors that are responsible for how much cleaning and maintenance a smoker needs are: number of years in use, number of hives and number of hive visits per year, and the type of smoker fuel used.

Being the most vulnerable and delicate part of a smoker, the bellows is one of the most common parts of a smoker that requires repairs. Typically a hole forms in the leather or plastic part of the bellows, or a seam holding the bellows together comes apart. This can occur as a result of prolonged heavy use, something that punctures the bellows, or from leaving the smoker out in the weather where sun and rain slowly but surely degrade the material that makes up the bellows. Small holes are easily patched up temporarily with duct tape, preferably the heavy-duty type of duct tape (such as 200 mph tape, extreme duty tape, or gorilla tape) that can better withstand exposure to water, heat and the heavy use that the smoker commonly must endure.

When duct tape no longer is able to do a satisfactory job of sealing up holes in the bellows, a new bellows is called for. This is the reason why I prefer smokers with bellows that are bolted on and easy to remove and replace if necessary. When the bellows on a smoker is permanently attached, there is no other choice than to throw out the old smoker and purchase a new one once the bellows is no longer functional or repairable with duct tape.

A drawback to the removable smoker bellows is that the nuts holding the smoker on may work themselves loose over time and get lost. Taking the time to occasionally tighten up these nuts will help prevent losses. Alternatively, a drop of thread locker, such as Loctite, on the threads of each of the four bolts that hold the bellows on can help in eliminating this potential problem. Alternatively, the nuts can become rusted in place on old smokers and penetrating oil may be required to remove them without breaking the bolts or stripping the threads.

One issue beekeepers often run into, especially with a new smoker, is with the metal grate that keeps the smoker fuel elevated and prevents the fuel from clogging the air hole in the bottom of the fire chamber. Sometimes the grate does not fit correctly when the smoker arrives new from the manufacturer. This results in the grate falling out when the smoker is turned upside down when spent fuel and ashes are being cleaned out of the smoker. These grates are held off the bottom of the smoker with metal legs. By removing the grate and bending the legs outward a bit they will catch the side of the fire box with enough friction to hold the grate in place when the smoker is turned upside down.

Occasionally the welds or rivets on a smoker with give out. Rivets are typically easier for the average beekeeper to fix by drilling out the remains of the broken rivet if necessary and riveting a new rivet into place with a riveting tool or pop rivet gun. While aluminum rivets will work, stainless steel rivets will hold up better in the long run. Due to the added skill and equipment necessary to repair a broken weld, your average beekeepers will typically need to find a welder to repair smokers with welds that have given out.

With regular use, a smoker will eventually become covered with tar and creosote from the burning smoker fuel. While unsightly and smelly, these deposits normally do not interfere with the proper functioning of the smoker unless they are allowed to build up to an extreme degree.

Many beekeepers don't bother worrying about this build up as long as the smoker continues to perform faithfully. Some beekeepers even seem to take pride in the amount of wear and tear their old smoker can handle and still function. For those who want to clean up the resinous debris from incomplete combustion, scrape off as much debris as possible with a wire brush, screwdriver, or hive tool. Then burn the remaining creosote build up with something like a propane blowtorch, and then re-scrape to remove the dried brittle remains. An electric drill with a wire brush in the chuck does a great job. This should only be done in a well-ventilated area and after the bellows has been removed however.

Another approach some have used successfully to cleaning up a dirty smoker is to soak the dirty metal parts of the smoker in a very strong solution of sodium carbonate (soda crystals or washing soda) overnight and simply rinse clean in the morning. If your bellows are made of leather and/or wood it is important to not allow them to get wet when soaking the smoker or these materials may become more likely to crack and split. It is especially important to clean the rim of the smoker where the lid fits over the top, otherwise it can make opening and closing the lid difficult and the seam in the lid may split due to the use of excessive force. A clue that the build-up on the rim of the smoker could use cleaning is if you have to use your hive tool to pound or pry the lid open or closed.

Over time a smoker may become difficult to keep lit. Despite pumping madly on the bellows, the amount of smoke that the smoker will produce may be greatly reduced and potentially ineffective in producing the desired result on the bees. This is often because the air hole in the bottom of the bellows that feeds air to the fire chamber becomes filled with tar and creosote over time. By removing the bellows and reaming out the air hole in the bottom of the bellows with a pocketknife, the smoker will stay lit longer and will emit smoke like a brand new smoker. It is a good idea to also clean out the air hole in the bottom of the metal fire chamber as well, though this air hole is a lot less likely to become clogged compared to the hole in the wood or plastic backing of the bellows.

When cleaning the creosote buildup from your smoker, don't forget to clean the grate sitting in the bottom of the smoker as well. While it is unusual for all the holes in this grate to become totally clogged with tar and creosote, it is a possibility and should be prevented. Just be sure to place a leg of the grate on either side of the air inlet in the bottom of the smoker when reinstalling it after cleaning.

A smoker, no matter how old, should produce copious amounts of cool white smoke when the smoker is filled with fuel that is dry and burning well. By taking the time to perform a little smoker maintenance here and there, this important tool will supply you with decades of use instead of just years. BC

Ross Conrad is author of Natural Beekeeping, 2nd Edition and will be teaching beginning and advanced beekeeping courses in Lincoln, VT during the month of May. Visit dancingbeegardens.com for more information, or call 802-349-4279 to register.

The Food Safety Modernization Act

Ann **Harman**

We are all familiar with the news stories of people sickened from foods contaminated with *Salmonella* or *E. coli* or other organisms. It is impossible for anyone shopping for groceries to determine whether a bag of vegetables or a prepared dish is contaminated – until it is eaten. Although we can take precautions in buying food and preparing our meals, we really cannot be certain of our foods today.

Although we may hear of problems in our immediate locale or a major national outbreak problem, it is estimated that about one in six Americans get sick each year from foodborne diseases. This number represents a significant problem.

In general, contaminated food, discovered after illnesses occurred, brought response from government inspectors and regulators. In an effort to switch from response to prevention of these illness outbreaks the Food Safety Modernization Act (FSMA) became law on January 4, 2011.

This Act is designed to hold everyone in the food chain, whether local, national or global, responsible and accountable for controlling food safety. The U.S. federal Food and Drug Administration (FDA) has been provided with a new framework for approaching food safety. Basically the new Act can be divided into five areas:

Prevention-based controls of the entire food supply
Inspection and compliance
Imported food safety
Response – mandatory food recalls
Enhanced partnerships

Let's see what each of these covers.

The FDA now can require prevention-based controls in all aspects of the food supply chain. This would include growing, processing of foods, shipping of food – basically a food from its start to the consumer. Tracking food globally is becoming the norm. Labeling with tracking information has begun and will continue being developed.

Since inspection holds the food industry accountable for safe food, the Act specifies how often the FDA should do inspections. Frequency would, of course, depend on the particular crop or food. In addition the FDA can use new and improved inspection approaches. Many new methods are being developed to speed inspection and assure safety of food.

The FDA must ensure that imported foods meet U.S. standards and are therefore safe for us to eat. Under the new law importers must be certain that their suppliers are using preventive controls. The FDA can accredit foreign inspectors who will be certain that the foreign foods meet U.S. standards.

New with the FSMA is the ability of FDA to do a mandatory recall of any and all food products found to be unsafe. Previously voluntary recalls were requested, not required. However the requests were generally followed.

The term 'enhanced partnerships' is one that perhaps beekeepers should pay attention to. It means the FDA working together with all food safety agencies – federal, state, local, territorial, tribal and foreign – for improving feed safety. The FDA is assigned to improve training of all those food safety officials. So not only is the federal agency involved in food safety but also those in your state or locality.

How long will it take to make certain our foods are safe? Although the U.S. Congress has established certain dates, the only promise made is that it is 'a long-term process.' Mandatory recall of unsafe food is immediate, but other aspects of the Act will take time. The budget allowed for the FDA will impact the time it takes for all parts of the Act to be completed.

Beekeepers these days could be classed as urban, suburban or rural – on a farm. FSMA is making and has made some definitions concerning a farm. However, sorting out just how beekeeping and producing honey fit into the farm definitions is not clear just yet.

It seems that in the original Act the definitions for farms and their operations were not suitable. The FDA admitted that the input from farmers demonstrated that there is great diversity in size and operations of what could be considered farms and farming operations. Therefore the original Act definitions and requirements will be changed. The new revised rules will be published by early Summer 2014, no definite date other than that.

When the new rules are published comments on the revisions will be accepted. However because FDA must complete these rules in a given time (not stated) the comment period would appear to be a shortened one. Since rural beekeepers might want to comment, it would be essential to keep track of the Food Safety Modernization Act (FSMA). So as Summer approaches you can Google: Food Safety Modernization Act, and open up 'I Have a Farm' to find definitions and revisions needing comment. The comment period will be available 'early Summer.' Be prepared to sit down and carefully read (and re-read) the information.

Beekeepers must remember that they can be regulated by their state, county or other local regulations, either for keeping bees or for harvesting, packaging and selling honey. Those regulations can also be changed from time to time.

Honey is a misunderstood food. Not to beekeepers! But to the general public, including those who are in charge of food inspections or are composing regulations dealing with food safety. It is interesting to note that in a survey of consumers taken by the National Honey Board several years ago honey was actually thought to be a mixture, not a pure, single substance. The general public knows only that bees have something to do with honey (and bears like it).

As it stands now, the Act does recognize that *honey is a low-risk food*, along with a number of other foods. So the information contained in the FSMA may actually help beekeepers assure their customers that honey is a good food. The list of low-risk food is actually quite long, and interesting. The list does include maple sap for maple syrup – understandable because the sap is merely boiled to evaporate water. Sugar is on the list and so are fudge, taffy and toffee. You can see the whole list on the 'I Have a Farm' part of the FSMA website.

Although the problems with imported honey and its intentional adulteration have appeared in the news, the problems importers have had should diminish with the Act. In addition the Eurofin testing agency is conducting tests on both olive oil and honey, both known to be easily adulterated. New technology, incorporating climate and geology, is being used to determine purity and geographical origin. Such information would help identify trans-shipped honey.

Those beekeepers living on farms will have to determine the size of their business according to the Act. However the definition of 'very small business' is awaiting comment during the 'early Summer' comment period.

What about suburban and urban beekeepers? Let us return to the paragraph explaining 'enhanced partnerships.' There you will see that the FDA will be working with state and local regulators and inspectors. Since the size of a beekeeping operation in urban and suburban areas is quite small, the state and local food safety officials, trained by FDA, would be the ones in charge of any rules about honey processing and packing, as they are now.

It is up to us, the beekeepers, to make those writing regulations aware of just what honey is. They need to know how bees collect nectar and make honey. They need to know how beekeepers remove honey from the bees and then from the honeycombs and package it for sale. They need to know that honey does not support growth of organisms. They need to know that honey has always been considered a pure product. Willful adulteration with some type of sugar syrup does not make it a hazardous food; it deceives the customer. Education of non-beekeepers into the production of honey is essential.

Keep an eye on your state legislature and any bills that involve honey or include it with other foods. Safety regulations that apply to pickles may be totally inappropriate for honey. Get to know your state and local people involved with food safety. Keep in mind that elected legislators are not necessarily permanent. Neither are inspectors or others involved with food safety. Although all may seem to be well right now, beekeepers cannot be complacent. It is important to have honey understood as a low-risk natural food, not as one 'manufactured' by humans. Whether urban, suburban or on a farm, keep your eyes and ears up to date on FSMA. BC

Ann Harman shops, read labels and keeps bees in Flint Hill, Virginia.

BIGGER PICTURE

Jessica **Louque**

Feeding children is a challenge.

A typical night for me doesn't really get started until after 9:30pm, when the kids are all in bed. The washing machine can be on without disrupting anybody's bath time, last calls have been made for waters or one more book to be read, and there's quiet in the house. A large majority of my night is in the kitchen, cleaning up, fixing backpacks, and preparing lunches for the next day. Making halfway decent lunches for four kids is a time consuming, mentally challenging, and sometimes daunting task.

I understand the challenge for other parents. George is proud of himself if he tries a new shape of tater tot but always wants odd fruit like kiwi, while Charles will eat nearly anything but carrots and kiwi because "they make my tongue feel funny" but he will drink the juice. Maggie can't decide what she will or won't eat, but Henry will eat nearly anything, except it has to be "just so" with his provolone, mozzarella and honey ham sandwich with lettuce and the Italian dressing-spicy mustard-honey sauce on sub bread. It takes a lot of time and effort to choose the foods, remember to buy the food, keep stock of what's in the pantry, and make sure it's what the kids will actually eat. On top of all this, the nutritional value of the meal should be a high priority, but you have to keep it in check with the cost of food.

Fresh food is usually a good starting point for healthy food. I'm not here to debate raw vs. uncooked or frozen vs. fresh vs. canned. Overall, fruits and vegetables are better for you than french fries and pizza. Everybody gets at least a half-cup of fruit every day. The plan is to give a decent variety while staying in the boundaries of What-Will-Be-Eaten Land. On the average day, it's quartered strawberries, blackberries, and blueberries. If they look good at the grocery store, raspberries will be thrown in. George is the only one who will eat kiwi, so I will cut up one of those and throw in his to make up for the blueberries that Maggie won't eat. If black cherries are on sale, they get pitted and halved and added into the fray. Some days are "dark fruit day" and black cherries, blackberries, and blueberries will be the fruit *du jour*. They all love the tiny crates of clementine oranges, and when they come in season all they get is an orange for at least two days a week if not more upon request. Cantaloupe is a big hit, but that's normally only one day a week. Grapes are also a good throw-in because of the ease of processing.

If you might be thinking about implementing any of this, here is some background information for you. To buy fruit for four kids for five days, it's around $90 a week. It's just an average, but it takes into account the cantaloupe you bought for $3 for one day as opposed to the $25 of fruit you bought on Sunday and the next morning all the raspberries were rotted and the blackberries all had mold on the bottom that you didn't see. For any of you gardeners with kids, you may now see why we are planning to install a few rows of blueberries and blackberries on the farm. Originally we were planning to do a u-pick or a farm stand, but now the initial phase is just to stop paying almost $4.00 a pint at the grocery store for berries that crap out after a day or less!

Another thing to consider is what is "packable" in the mayhem that is the backpack. Apples do not hold up well in slices, although they do okay whole. Since we have worms to feed and compost to fill, I try to cut up as much of the excess as possible so they aren't throwing it away at school. I rarely send anyone with a whole apple because I can't stand the thought of losing the core, but I don't send slices at all. You can use lemon juice to keep them from turning brown (it's oxidation), but depending on the kid, if they see that brown it won't get eaten. Cantaloupe is not a good packer, but if you can get it to where it doesn't jiggle around too much in the container it will be okay.

The third point on fruit is pesticide residue. I'm sure most of you have seen the lists of safe and unsafe fruits from the grocery store, but the basic rule of thumb is that if you eat the inside and leave the outside (like a banana, citrus, melons) they are fairly safe, but if you eat the entire fruit, you should be careful of residues. There are plenty of fruit and vegetable washes available to the concerned consumer, but it's always a better option to go with "homemade hand grenades," which is my way of saying to make your own cleaners. For fruit, I soak them in a bowl for about 10 minutes in a 50/50 solution of white vinegar and water. This will not only remove residues, but it will help remove anything that would have caused spoilage and seems to increase the storage life. It needs

Chicken Sandwich.

to be rinsed really well, as I have had it pointed out to me before that "the blueberries smell dirty I don't want to eat these" because you could still smell the vinegar on them. It did not alter the taste (you know, sometimes you just have to do a snack check) but I didn't make that mistake again.

If you really want to rock out in the fruit sections, you can always add in some greek yogurt or make a plain yogurt mixed with honey as a dip for the day's selection. The next time you're in a grocery store, check out the difference in the protein of greek yogurt and all the other yogurt. I'm not a big fan of greek yogurt, but that was a real eye opener for me. I've recently started trying to make my own yogurt, but I haven't hit the mark with making something the kids like more than store bought.

The next step in the lunch box is a vegetable. Strangely enough, all the kids like broccoli, but only sometimes will they eat it at lunch. Carrots work well for those who will eat carrots, and celery is taken fairly well if ranch or peanut butter is provided as a dip. FYI, I have tried to make a honey dip for celery and those two flavors just didn't go together. I usually put vegetables through the same process as fruits in the vinegar wash, but if I'm not being lazy I will buy the "whole" vegetable, like whole carrots or whole broccoli and cut them up myself. It helps on the carrots because you can peel them and then cut them up, but everything still needs to be washed. Remember, even if they're not covered in residues, you weren't with those veggies for the rest of their life outside of the 15 minutes you have owned them. Maybe Mr. Grocery Shopper thought he needed carrots to make his flu-riddled wife a soup and then thought that canned soup would be easier, and now you have a flu carrot. Wash that carrot!

The kids love to get potato chips, and I occasionally indulge them. I absolutely hate not having some alternative to this starchy/carb bonus, but I don't want them to be hungry either. I at least try to mix it up with pretzels or popcorn. If they get pretzels, I make a honey mustard dip that seems to go over well (2 tbsp spicy mustard, 1 tsp honey, ¼ tsp bourbon smoked paprika, 1/8 tsp bourbon smoked sugar), but it's all so salty I don't like to give them a lot.

The "main course" is usually a sandwich for everyone. Sometimes a salad gets tossed in (a non-bee pun for once!) and I make sure it has some tomatoes, avocado, broccoli, spinach, and carrots, but this is more of an occasional addition instead of a normal course. Wraps come and go in the likeability factor, but sandwiches reign king. Currently, three of the four are on a peanut butter and Hershey's chocolate almond spread sandwich. I turn George's into a "chicken" sandwich with a cookie cutter because he won't even eat his crust.

Sliders.

Drink choices are another point of contention for me because most drinks other than water are mostly empty calories, but only Maggie will drink water. Most of the time the boys want Gatorade, but even the small bottle is too much for Charles and George for one lunch period. I try to give them juice just to get them out of the Gatorade sometimes.

Sometimes it's easier when the supper leftovers are wanted in the lunchbox the next day, but that only gets you off the hook for three lunches at the most out of four. One of the kids' favorite leftovers are the sliders. Hopefully you can try these on your own, modify the sauce, and have a hit with your family too!

Slider Ingredients:

Any brand of bread rolls (Ideally 12-15, it takes two on average for a good meal depending on your other sides)

Your choice of deli meat – I use honey ham and turkey, usually nine slices of each

Your choice of cheese – I use mozzarella and provolone, usually six slices of each

Mustard sauce – spicy mustard, bourbon barbecue sauce, garlic sauce, honey to taste

Cut the rolls in half to split them sandwich-style. Lay the meat out evenly across the bread, then stack the cheese on top. Place the top half of the rolls back on, and then slather the top in your mustard sauce. For an extra kick, add mustard seeds to your sauce, or smoked paprika. Cook in the oven at 350°F for about eight - 10 minutes, or just enough to melt the cheese well. You can also put the mustard sauce on the bottom roll just underneath the meat. BC

The Voice Of The South

Finding Queens And Belly Laughs

Experienced beekeepers often take for granted their basic skills that tend to perplex beginners. Finding queens seems daunting to some, while apparently effortless to others. Many newbies exclaim, "How'd you find her so quickly!" after I find a laying queen within minutes of opening a hive. Some folks cannot find a queen even when presented a comb known to have one walking on it. They often get exasperated, and when pressured to indicate the queen, they point to a drone and declare, "There she is!"

The chuckles and laughs rippling through the crowd may temporarily embarrass the pointer, but I usually quickly defend the person by stating that it is not at all easy to find queens without a lot of experience in looking for them. I remember my own path to queen finding, and it took me my first full season of queen rearing with a commercial beekeeper to become competent. I fondly remember that Spring-Summer as one of the best times in my life. I learned as much as possible about commercial queen and package production, befriended my mentor, Old Joe, and had several hearty belly laughs while sprawled on the ground in the mating yard.

Old Joe lived a happy life filled with beekeeping, hunting and fishing, and a tight circle of friends that met regularly for breakfast to discuss the events of everyone's week. Standing well over six feet, he had a strong muscular build, especially for a man of his late sixties. He could heft deep honey supers and load them on the truck all day long without falter. He defined masculinity and the ultimate outdoorsman. Sometimes he seemed gruff as he moaned about politics or situations that challenged his own political or religious positions, but he barked loudly with little bite. He laughed daily and clearly enjoyed a good joke.

When it came to beekeeping, Joe knew more than anyone around, and I easily hero-worshipped him. I constantly and quietly compared my skills to his. I tried not letting him know my feelings of inadequacy, but he must have known that I "competed" with him in the beeyard. This competition was most evident in the mating yard where I raced him down lines of mating nucs while catching out laying queens and inserting a new round of queen cells.

Of course, I could not keep up with Joe, and he usually lapped me and completed more than two rows of mating nucs to my one. He would often rib me by saying, "It's a good thing that I pay you per hour and not for number of queens caught." I simply groaned at his remarks.

On about our fourth time out to catch queens that were sold to clients in Midwestern states, I realized that I was getting better at the task. I understood that Joe's skills began with a special ability to evaluate the condition of a mating nuc as soon as it was opened. Joe used either double baby nucs, or four-way baby nucs depending on the mating yard. Of course, we did not have Small Hive Beetles that would attack such small nucs today. He usually ran two combs with a feeder in the early part of the season, but we often shifted to three combs without a feeder by mid-May.

Examining nucs is a lot like driving a car. The driver processes an incredible amount of sensory information related to safe navigation through traffic, and most experienced drivers do not feel overwhelmed with the task. New drivers of course feel very different. I came to understand that Joe was fast because he honed all of his senses to the task at hand.

His hearing could tell him a queenless buzz from workers within seconds of opening a nuc. His eyes would look for returning pollen foragers, which is a sure sign of brood rearing. Of course, he gauged the age of young brood to see if it fit the expected pattern of egg-laying from a newly mated queen. He also looked for quiet bees walking on the combs, and he easily found the center comb as the most likely place for a laying queen. He had a knack for finding the queen on the first comb removed from the nuc. His comb scans were quick – perhaps five-10 seconds per side, and he usually scored the queen with that first scan. If he needed to examine all combs, he could do it in minutes before scanning the walls of the nuc. He was fast and confident.

My early approach was clunky. I sort of jumped into the nuc without any evaluation of sound or a possible queeless state, and I carefully scrutinized each comb for minutes. It seemed that I looked at every bee on each comb's surface before finding the queen. Often I found my first queen when Joe was beginning his fourth or fifth nuc. It took me awhile to figure out how he could move so fast. The trick is not in trying to pick out a single bee; instead, one needs to recognize the group behavior of the queen's court, or understand how a queen moves on a comb when she is disturbed. Queens tend to plunge through a crowd of workers when they are disturbed and trying to hide. Workers tend to stop moving forward when bumping into other bees; whereas, queens move unhindered by worker bees. A person can learned to recognize that subtle movement quite easily.

But queen finding was more than finding the queen. We also had to cage them and evaluate the condition of the nuc before inserting a new queen cell for the next round of queen matings. My clumsiness at caging the queen and putting worker attendants into Benton mailing cages with her REALLY slowed me down. I was way too tentative, but face it, getting stung on the finger tips hurts. It seemed that after just a few nucs, my index finger and thumb were so swollen that I could no longer bend them at the joints. I became even more inept at grabbing workers after the first few stings. Joe was like a robot that quickly plucked eight-10 workers from the combs and inserted them into cages within seconds. I eventually developed a quick grab of attendants that avoided the sting.

Inserting the new queen cells required re-building the weaker nucs with either bees or brood from stronger nucs. Joe excelled here too. He had a good memory about the condition of the nucs that he had previously visited. When he encountered a particularly weak nuc or one that needed food, he would quickly return to a nuc and swap either a heavy honey comb or a solid capped brood frame for an emptier comb from the smaller unit. I almost always forgot where the strong nucs where and needed to open three or four of them before getting the needed resources.

However, by the time we had our sixth outing to the mating yards I grew confident and predicted that I could at least keep up with Old Joe. We started as usual, with him getting a fast lead on me. However, I caught a rhythm and pulled within a couple of nucs of being even with Joe's position along the rows of nucs. I remember his wry smile as he realized my proximity, and then he kicked into a higher gear, which left me in the dust. How could he go faster?

I did not give up, and I was determined to close the gap before our task was done. My rhythm ebbed and flowed, but I slowly crept closer and closer to Joe's position. I realized that a good part of my problem was always looking to see where he was, so I purposely opted to only look at his location every five or six nucs. I reached to within a couple of nucs, when something unexpected happened and gave me one of those belly laughs that hurt.

Joe had come to the end of a row that was in the corner of the mating yard closest to a pasture. He sat on his tool box hunched over a nuc, and his grumbling told me that he could not find the queen in the unit. This rarely happened to him, but when it did, he often softly cussed or spoke to the queen, asking her to reveal herself. I was sure that this was my chance to not only catch him, but I even thought that I could get the lead. Such hubris!

So, I finished one nuc and proceeded to the next one that was directly across from him. He continued to look for the queen, and I froze in my tracks when I looked at him. He was so concentrated on finding the queen, that he was oblivious to his immediate surroundings. He felt something brushing against his veil, and he half-heartedly swatted at a tree branch or something that was pressing on it. I was stunned because a 2,000 lb. Brahman bull extended his head over the barbed wire fence from the pasture side and licked Joe's veil. I do not know if it was salty sweat or perhaps some honey on the veil, but the bull wanted a taste.

I stood without words and waited for a few seconds before Joe finally turned his head to peer eye-to-mouth with the bull. Within milliseconds Old Joe screamed like a girl and exploded from his seat to run wildly away from the bull. The scream actually had a Doppler effect to my ears as quickly as Joe passed me running to the truck. Perhaps I should not have laughed, but the soprano tenor of the scream, and the speed of his escape, contrasted so much with his usual macho composure that I could not help myself. I actually fell to the ground with laughter. My ribs hurt, and I must have laughed for 10 minutes. In hindsight, I could have used that time to catch queens and extend my lead on the old man. But the laugh did me some good.

Joe regained his composure, and we ended in a tie that day. I remember that the bull hardly budged when Joe ran away. He seemed almost friendly during the remainder of the afternoon. Joe eventually smiled about the event, and he steadfastly accused me of setting him up and not warning him. He said, "You'd do anything to beat me down these nuc rows." I pled that it all happened so fast that I could not warn him. I never convinced him, and that story always remained one of his favorite tales for our breakfast circle of friends. BC

Jeff Harris is the Extension/Research Apiculturist in the Department of Entomology at MS State University.

GLEANINGS

APRIL, 2014 • ALL THE NEWS THAT FITS

SHARING THE PROBLEMS

British researchers report diseases are being driven into wild bumblebee populations from managed honey bees and policies to manage these diseases need to take into account threats to wild pollinators.

The researchers from Royal Holloway University of London, Queen's University Belfast, Rothamsted Research and the University of Exeter say their findings provide vital information for beekeepers around the world to ensure honey bee management supports wild bee populations.

They found diseases that are common in the managed colonies now are widespread among UK's wild bumblebees.

Dr. Matthias Fürst from the School of Biological Sciences at Royal Holloway says wild and managed bees are in decline at national and global scales.

"Given their central role in pollinating wildflowers and crops, it is essential that we understand what lies behind these declines," he says. "Our results suggest that emerging diseases, spread from managed bees, may be an important cause of wild bee decline."

The research published in the journal *Nature*, assessed common honey bee diseases to determine if they could pass from honeybees to bumblebees.

It showed that deformed wing virus (DWV) and the fungal parasite *Nosema ceranae* – both of which have major negative impacts on honey bee health - can infect worker bumblebees and, in the case of DWV, reduce their lifespan.

Honey bees and bumblebees were then collected from 26 sites across the UK and screened for the presence of the parasites. Both parasites were widespread in bumblebees and honey bees across the UK.

"One of the novel aspects of our study is that we show that deformed wing virus, which is one of the main causes of honey bee deaths worldwide, is not only broadly present in bumblebees, but is actually replicating inside them," Fürst says. "This means that it is acting as a real disease – they are not just carriers."

The research team also looked at how the diseases spread and studied genetic similarities between DWV in different pollinator populations.

It found three factors suggest that honey bees are spreading the parasites into wild bumblebees – honeybees have higher background levels of the virus and the fungus than bumblebees; bumblebee infection is predicted by patterns of honeybee infection; and honey bees and bumblebees at the same sites share genetic strains of DWV.

Prof. Mark Brown from Royal Holloway University says it has been known for a long time that parasites are behind declines in honey bees.

"What our data show is that these same pathogens are circulating widely across our wild and managed pollinators," he says. "Infected honey bees can leave traces of disease, like a fungal spore or virus particle, on the flowers that they visit and these may then infect wild bees."

Alan Harman

2ND INTERNATIONAL WORKSHOP ON HIVE AND BEE MONITORING

The 2nd International Workshop on Hive and Bee Monitoring is accepting submissions for Papers, Exhibits, and Demonstrations of Hive And Bee Monitoring Methods, Equipment, and Research, including Scale Hives, Hive Sensors, Hive Communications (wireless, phone, and satellite), Infrared Imaging of Hives and Bees, Bee and Colony Acoustics, Radiofrequency Identification Tags for Bees and Hives, Bee Tracking and Mapping Using Sound, Video, Harmonic Radar, Radar, or Lidar.

The multi-day workshop will be held in association with the Annual meeting of the Western Apicultural Society (September 18-19) and the Missoula Honey Festival (September 20). The Workshops start Wednesday, Sept 17. The Trade Show runs September 18 and 19th. Colonies of bees and hives will be made available on Saturday, September 20, for field demonstrations of equipment and technologies.

Please forward potential presentation titles, suggestions for topics, and whether you wish to also be an exhibitor as part of the Western Apicultural Society Trade Show before February 28th. Registration and information on the Western Apicultural Society's (**http://ucanr.edu/sites/was2/Conference_Information/**) and Frank Linton's Colony Monitoring websites (**http://colony-monitoring.com**).

WRONG TAX!

Legislation is under consideration to exempt the honey bee industry from Washington State's draconian business and occupation tax.

The bill sponsored by Republican Sen. Jim Honeyford expands the definition of agricultural product for purposes of the state B&O tax to include honey bee products and bee pollination services.

This will exempt them from the tax under the general agricultural product exemption. The exemption is permanent and not subject to the 10-year expiration date or a tax preference performance statement.

Supporters say exempting beekeepers from the tax will help them be competitive with those from out of state.

No category of state B&O tax applies to any farmer selling agricultural products at wholesale or to any farmer who grows agricultural products owned by others, such as custom feed operations. A farmer is defined as a person producing agricultural products for sale.

"Just as the state considers milk that comes from cows to be an agricultural product, so should it consider products derived from honeybees," says Honeyford, who serves as ranking Republican on the committee.

Alan Harman

GREEN GENE

Researchers have found a protein in plants they say they will be able to manipulate to improve on everything from crop growth to fruit production, flowering time and disease resistance.

Purdue University research shows the protein the scientists are calling MED18 controls important plant processes, including when a plant blossoms, how it resists key fungal diseases and how a plant responds to abscisic acid, a hormone that regulates the way plants cope with environment stresses such as drought.

Lead researcher Tesfaye Mengiste, Purdue professor of botany and plant pathology, says understanding and manipulating MED18 could lead to improved resistance to necrotrophic fungal diseases in plants.

"Now that we know what it does, we can use MED18 to improve crop growth, fruit production, flowering time and disease resistance," Mengiste says.

Using MED18 to toughen up plants' defense against fungal diseases would not necessarily require generating transgenic plants, he says. Natural variants with desirable characteristics could also be used to cultivate more disease-resistant specimens in plant populations.

Alan Harman

ORGANIC NOT PERFECT

Organic farming does not necessarily have lower overall environmental impacts than conventional farming but is generally good for wildlife.

That's the conclusion in a new analysis led by Oxford University scientists of data from 71 studies published in peer-reviewed journals that compared organic and conventional farms in Europe.

The Oxford researchers found that while organic farming almost always supports more biodiversity and generally has a positive wider environmental impact per unit of land, it does not necessarily have a positive impact per unit of production.

Organic milk, cereals, and pork all generated higher greenhouse gas emissions per unit of product than their conventionally farmed counterparts – although organic beef and olives had lower emissions in most cases.

In general organic products required less energy input, but more land than the same quantity of conventional products.

In terms of biodiversity, generally organic farms had 30% higher species richness than conventional farms but 16% of studies suggested organic farming could have a negative impact on species richness.

"Many people think that organic farming has intrinsically lower environmental impacts than conventional farming but the published literature tells us this is not the case," says Hanna Tuomisto, who led the research at the university's Wildlife Conservation Research Unit.

The researchers suggest reducing the environmental impacts of farming is a priority, as is biodiversity conservation on farmland. They also conclude that introducing new techniques could help to reduce the environmental impact of all types of farms – anaerobic digesters could be used to convert animal waste into biogas for heating and electricity, livestock could be selectively bred to reduce nitrogen and methane emissions, and new crops could be developed to reduce the need for pesticides or harness nutrients more efficiently.

Alan Harman

BUMBLES ON THE MOVE

European bumblebees introduced into central Chile in 1998 as captive pollinators have become an invasive pest threatening South America's ecology after escaping from their greenhouses.

Bombus terrestris, with their thick fur, somewhat clumsy flight and less aggression than honeybees or wasps, soon established colonies in the wild.

But researchers say this was not the end of it. The buff-tailed bumblebees turned out to be an extremely invasive insect that embarked on an unparalleled victory tour that took it as far as Patagonia.

European Bombus terrestris *pollinating a Fuchsia flower native to South America.* (photo by Paul Schmid-Hempel)

By comparison, the first European bumblebee species, *Bombus ruderatus*, was introduced back in 1982 but was relatively harmless.

Retired Federal Institute of Technology Zurich professor of experimental ecology Paul Schmid-Hempel, who has been monitoring the spread of the buff-tailed bumblebees over the last 10 years, is shocked.

"This is one of the most spectacular examples of the invasion of an entire continent by a foreign species introduced by man," he says.

In a research report published in the *Journal of Animal Ecology*, Schmid-Hempel says his findings show the bumblebees spread southwards from central Chile along the Andes at a rate of around 200 kilometers a year.

After just a few years they had crossed the mountain chain and reached the Atlantic coast of Argentina in late 2011. By 2012 the insect had already penetrated deep into south Patagonia reaching the gateways to some of the major national parks.

"Given that colonies and not individual insects have to become established, this migration speed is astonishingly fast," Schmid-Hempel says. – *Alan Harman*

HONEY BEE HAPPY FEET

Honey bees taste with their front feet when deciding whether to feed.

French researchers say the bees make the decision based on information they get from both front tarsi – the end part of the legs.

The work by University of Toulouse researcher Gabriela de Brito Sanchez and Martin Giurfa, director of the university's Research Center on Animal Cognition, on the ability of honey bees to taste with claws on their forelegs reveals details on how this information is processed.

Insects taste through sensilla, hair-like structures on the body that contain receptor nerve cells, each of which is sensitive to a particular substance. In many insects, including the honey bee, sensilla are found on the mouthparts, antenna and the tarsi.

The French results, published in the journal Frontiers in Behavioral Neuroscience, are based on hundreds of honey bees included in the study.

Sugary, bitter and salty solutions were applied to the tarsi of the forelegs to test if this stimulated the bees to extend or retract their tongue – reflex actions that indicate whether or not they like the taste and are preparing to drink.

The results revealed that honeybee tarsi are highly sensitive to sugar: even dilute sucrose solutions prompted the bees to extend their tongue. Measurements of nerve cell activity showed the part of the honeybee tarsus most sensitive to sugary tastes is the double claw at its end. Also, the segments of the tarsus before the claws, known as the tarsomeres, were found to be highly sensitive to saline solutions.

The research team also looked at what happens if honeybees receive contradictory information – for example, about tasty sucrose from the right foreleg, but about water or distasteful caffeine from the left.

It was found the bees' central nervous system weighs this information from both sides, but unequally – input from the side that is first to taste something tasty or distasteful counts for more.

If a bee first tasted sucrose on one side, it would typically extend its tongue and subsequently ignore less attractive tastes on the other. But if the order was reversed, it was about 50% less likely than usual to extend its tongue for sucrose.

Alan Harman

AUSSIE BEES - 1 AUSSIE ENVIRONMENTALISTS - 0

After spending years being chased out of government forests by over-enthusiastic environmentalists, Australian beekeepers may finally be getting a break.

The Victoria state government says it aims to revitalize the honey bee industry by opening up more beekeeping sites on public land, cutting licensing red tape and providing greater security of access for the state's beekeepers.

Agriculture Minister Peter Walsh told the Central Victorian Apiarists Association conference the state government had worked with beekeepers and public land managers to develop a new, more bee-friendly apiculture on public land policy.

Walsh said the previous Labor government shut down hundreds of beekeeping sites on public land, crippling the industry.

"This government is committed to ensuring there are enough public land beekeeping sites to support a viable and productive honeybee industry, and as part of our new policy we want beekeepers to identify new suitable sites and inform us about them."

"Under our policy, beekeepers will be given licenses that last 10 years instead of the current three, six or 12-month terms," he said.

Walsh said there are more than 3,600 bee sites across 7.6 million hectares of Victorian forests, parks and conservation reserves, but that drought, fires and floods in recent years had impacted significantly on the industry's productivity.

"What this new policy will do is help create a more robust and productive industry with expanded access to public land, greater security and reduced administrative burden," Walsh said.

OBITUARIES

Raymond Eston Crocker, Sr., 78, died January 14, 2014 at Regional Hospice Home. Born July 23, 1935, he was a son of the late Louie Eston Crocker and Ruth Willis Crocker and his late stepmother, Virginia Hardin Crocker, who helped rear him from a young age. He was married to the late, Marguerite Ervin Briggs Crocker.

Mr. Crocker attended Spartanburg Methodist College and Clemson University and retired as a supervisor from Hoechst Fibers. He was a Petty Officer 1st Class veteran in the U.S. Navy and a charter member of St. Christopher's Episcopal Church. He was an avid gardener and he was a beekeeper for 61 years earning the Spartanburg Beekeeping Association recognition as Bee Whisperer of the Year, 2012.

James Harold Gibbs was born in Twobuttes, Colorado, on August 12, 1925 and went to be with the Lord January 5, 2014.

When he was a teenager, his family moved from Twobuttes to San Diego, where he explored the unadulterated San Diego coastline and had Balboa Park as his playground.

He served in the Navy in World War II. A scientist at heart, he graduated with a degree in engineering and a masters in physics. He then attended Abilene Christian College to pursue his heart's desire to the study the Bible. He and his beautiful bride of 62 years, JoAnn, met at Abilene and were married in 1949.

After working at Scripps Research Institute, teaching at UCLA, and engaging in other jobs, he turned his energies to growing a thriving bee business, developing lasting friendships with local land owners who hosted his bees.

ENOUGH GOOD FOOD

Climate change could force a change in food production in the 12 states in the U.S. northeastern region, Tufts University researchers say.

Researchers at Friedman School of Nutrition Science and Policy at Tufts Univ have evaluated the degree to which the northeast can satisfy food needs of its residents, known as regional self-reliance.

Their results published in *Renewable Agriculture and Food Systems*, are based on calculations of regional agricultural land use and production between 2001-2010 when more than 100 crop varieties were harvested and livestock production involved all six major species.

The research by the Medford, MA-based university identifying potential vulnerabilities of the 12-state region of CT, DE, NY, PA, MD, ME, MA, NH, NJ, RI, VT and WV.

Project leader Tim Griffin, associate professor and director of the Agriculture, Food and Environment program at the Friedman School, says food production in the U.S. is concentrated in certain areas, but it is important to explore the ability of all regions to produce food.

"This is certainly the case in the northeast, which has a high population density and a declining agricultural land base," Griffin says.

He says there is substantial diversity in the northeast food system, for crops in particular.

"A different picture emerges when you look at the farmland acreage," Griffin says. "A small number of crops occupy a large portion of the acreage and almost 40% is corn, mostly used for animal feed.

"A small proportion of acreage produces foods people eat, such as apples and potatoes, though much of it contributes indirectly by supporting livestock production systems."

Griffin's team found regional self-reliance to be highest for animal-based products, particularly milk and eggs. The region produces about as much milk as it consumes and about 70% of eggs consumed. For seafood, the region produces 45% of the shellfish it consumes and 23% of fish. Just under 30% of chicken consumed in the region is produced there.

For vegetables, the region produces 26% of the amount it consumes and for fruit, 18%.

Vegetable crops grown in the largest amount are starchy such as potatoes and corn. In the fruit category, the region is most self-reliant for blueberries and cranberries.

Regional self-reliance in the northeast will be impacted by two other factors – population growth and dietary choice. The U.S. Dept of Commerce predicts there will be an additional two million people living in the Northeast by 2030, an increase of about 3%.

BEEHAVE VIRTUAL HIVE

British scientists have created a virtual hive that gives them just about everything except a bee sting.

In their search to unravel the complex causes of colony decline, the new computer model will help scientists, beekeepers and regulators to understand multiple environmental effects on honeybee colonies.

The model simulates a honey bee colony over the course of several years.

It is freely available at **http://www.beehave-model.net**

The scientists, led by Prof. Juliet Osborne of the Environment and Sustainability Institute at the University of Exeter, created what they call the Beehave model to simulate the life of a colony including the queen's egg laying, brood care by nurse bees and foragers collecting nectar and pollen in a realistic landscape.

"It is a real challenge to understand which factors are most important in affecting bee colony growth and survival," Osborne says. "This is the first opportunity to simulate the effects of several factors together, such as food availability, mite infestation and disease, over realistic time scales."

The model, published in the Journal of Applied Ecology, allows researchers, beekeepers and anyone interested in bees, to predict colony development and honey production under different environmental conditions and beekeeping practices.

To build the simulation, the scientists brought together existing honeybee research and data to develop a new model that integrated processes occurring inside and outside the hive.

The first results of the model show that colonies infested with the common parasitic mite *Varroa* can be much more vulnerable to food shortages. Effects within the first year can be subtle and might be missed by beekeepers during routine management.

But the model shows these effects build up over subsequent years leading to eventual failure of the colony, if it was not given an effective *Varroa* treatment.

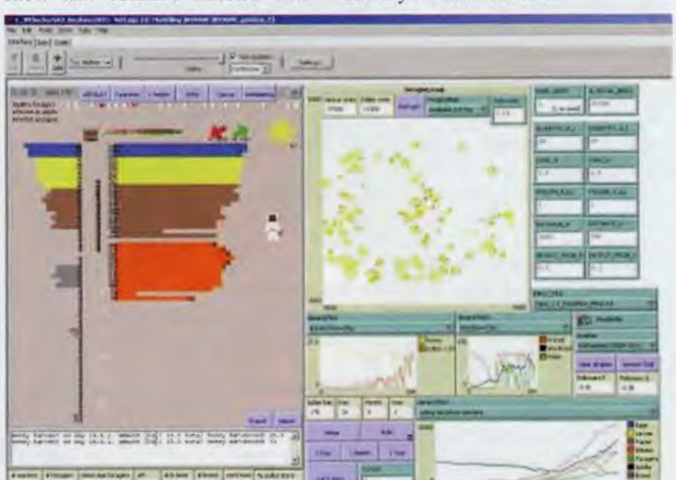
Beehave can also be used to investigate potential consequences of pesticide applications. It can simulate the impact of increased loss of foragers. These results show colonies may be more resilient to this forager loss than previously thought in the short-term, but effects may accumulate over years, especially when colonies are also limited by food supply.

Beehive simulations show that good food sources close to the hive will make a real difference to the colony and that lack of forage over extended periods leaves them vulnerable to other environmental factors.

Addressing forage availability is critical to maintaining healthy hives and colonies over the long term.

"The use of this model by a variety of stakeholders could stimulate the development of new approaches to bee management, pesticide risk assessment and landscape management," Osborne says. "The advantage is that each of these factors can be tested in a virtual environment in different combinations, before testing in the field."

While Beehive is mathematically very complex, it has a user-friendly interface and a fully accessible manual so it can be explored and used by a large variety of interested people, she says. – *Alan Harman*



A screen shot of the beehive model showing the virtual beehive in action. (photo by University of Exeter)

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Jackie Park-Burris is a second generation queen producer from one of the largest queen rearing families in the bee industry. They have been raising Park Italian Queens in Palo Cedro, CA for over 75 yrs. All five branches of the Park Italian queen family are involved with the Bee Informed Teams! (BIP photo)

The reason I call her "my gal Marilyn" is because Terry Bradshaw does. She taught him to ski. A few weeks later, on David Letterman, the iconic Hall of Fame quarterback gushed about his vacation in Aspen and about "that gal Marilyn." At one point, Letterman interrupted to say, "Wait a minute! You're married man. Who's this gal Marilyn?!"

Bradshaw's "aw shucks" persona is no put-on, according to my gal. On cell phone calls, Bradshaw never forgets to ask, "How's your mom and them?"

Marilyn cracked the whip on me last October after we got back from the Apimondia bee conference in Ukraine. I landed in the hospital prior to the trip and couldn't do any Fall bee work before we left. Now it was mid-October Indian Summer here in Colorado, and I hadn't poked my head inside a beehive for six weeks. Paul pulled my honey for me in September, but I hadn't treated for mites or fed any light hives. I was pretty confident my mite load was low, but I still needed to get 40 hives ready to go to California for the almonds on one of Paul's semi loads. I wanted to get going, because you never know when Old Man Winter's going to show up around here.

Experience taught me long ago that the bees always have to come first. I once drove to Santa Fe for the weekend, and when I got back, half of the queens I'd left on the kitchen table were dead. You never forget something like that.

And it was in Santa Fe that I was scheduled to speak at the Western Apicultural Society (WAS) meeting this Fall, hard on the heels of our return from Ukraine. I felt overwhelmed. The talk entailed a day of preparation, plus three days on the road. Right when I had perfect weather to catch up with the bees! I told Marilyn I was backing out. The bees had to come first. But she wouldn't hear it. I'd given my word. I could take care of my little darlings when we got back. Everything would be fine.

We left at the last minute. We always do. Marilyn drove, while I rehearsed my talk out loud. We rolled into Santa Fe after dark.

I said I was scheduled to speak at WAS, but I was really invited to speak on the bus tour on the last day. The bus tour featured a visit to the tiny, historically Hispanic settlements in the rugged mountains on the "high road" between Taos and Santa Fe, highlighted by a visit to Melanie Kirby and Mark Spitzig's Zia Queenbee Farm. This was on the way home for us, so we followed by car. The lunch stop was at the Santuario de Chimayo, an early 19th century church. Pilgrims believe that holy dirt from a hole in the church floor heals the sick. Some believers eat the dirt.

"You should rub some on your bald head." Marilyn said with a wry smile.

At the community theater in Penasco I gave my talk about our adventures in Ukraine. But first I had a little surprise for the audience. I pulled out a frame of new comb riddled with textbook American Foulbrood (AFB). There were puddles of AFB brood goo in the bottoms of cells, so you could do the "ropey test." You dip a matchstick in the goo, and when you pull it out, the goo sticks to it and stretches like mucus. There was dried up scale in the bottoms of cells. The capped brood cells were sunken and shotgun-shot with holes. And it was all easy to see, because it was in new white comb.

The theater lighting was a bit dim, so I handed the frame to someone in the front row and told her she could take it on the bus to pass around. Because you can talk about AFB all you want, but you really have to see it. Then you don't have to send off samples to labs, or wonder. Once you've seen AFB, and smelled it, you don't forget. So I thought my sample might be a rare educational gift for some.

I dived right into my talk, which had nothing to do with AFB. I wasn't very far into it, when a gentleman raised his hand. He suggested that my AFB sample was an inappropriate gift, because by virtue of handling it, folks might transmit the bacterium to beehives.

This struck me as farfetched, like catching AIDS by shaking Magic Johnson's hand. We weren't even looking at bees that day. I brushed off his remarks and kept to my topic, but did I detect a pulse of alarm ripple through the crowd?

Outside in the sunshine after my talk, I saw beekeepers talking animatedly as they examined my AFB frame, but some stood back, as if the frame were radioactive, or maybe harbored Ebola virus.

I thought somebody might want to keep my specimen for reference, but before the bus took off, a woman handed it back to me, wrapped in its original plastic bag. "We didn't know what to do with it," she said. I didn't know what to do with it, either, so I brought it home. It's still wrapped in that plastic bag, in my closet.

Back in Colorado, Indian Summer droned on for weeks. Then one stunning blue-sky late November day, I did a final round of sugar syrup feeding. That night it snowed 17 inches. A couple of nights later, the mercury dropped to single digits. Old Man Winter was here.

Ed **Colby**

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