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Features . . . Bee Culture . . . The Rest

Winners and Losers

Just finished James E. Tew's article, Winners and Losers in Today's Environment. This is very well written, thoughtful, and insightful piece. The question raised concerning the honey bee being the canary gives place for thought. While we know what makes the canary sick in the mine, the cause of the honey bee's plight is not so well defined. And, while the honey bee's response to environmental changes results in either death or adaptation, we must understand that our responses will only garner the same result for us. Short term profits are nice, but the bottom line may very well be the bottom line.

Greg Carey

Honey Bee Day??

The recent article in *Bee Culture* Magazine about planting trees and such for the honey bees habitat. While reading the articles I was reminded of the many days dedicated to the many causes in our country. In particular, Arbor Day came to my mind and how they have a day set aside on which they plant trees. Then I was struck dumb wondering if there was such a day for the honey bee. I couldn't remember hearing of any special day dedicated to the honey industry or the honey bee, herself. So I was prompted to write this letter to offer a suggestion to the honey community: Maybe it's time that we can push Congress pass a proclamation to honor our winged friends and set aside a week (not just a day) to recognize the value that our girls provide everyone each day. I believe this would help keep the issues faced by the honey bee and the honey community out in front of the public-eye instead of waiting for the next catastrophe to befall the honey industry. This is a win-win situation for the beekeeper and the public. And it would educate the public about the bee and its habitat. Just some food for thought.

Besides, Congress is not doing much in Washington right now and it might be a good time to approach them on the subject. It might give them something that they can agree on and it won't cost little more than some ink and paper. Heaven knows we don't have any extra money to spend these days . . .

Herbert Hudler III
Abilene, TX

Can't Get Russians

I enjoy reading *Bee Culture* and have learned a lot.

I have seen the ad about The Russians Are Coming, I won't be able to come Ohio in October. I think the Russian Bee may be good, but I have tried to obtain some Queens for more than five years. I have made calls to alot of the Russian breeders and still don't have any Russian bees.

If you could pass it on to the Russian breeders that there are people who would like to have Russians but there are none to be had.

Two places have a hybrid Russian which I have tried.

If you know of any that a hobbyist beekeeper could purchase please let me know.

Ray Cashion
Asheboro, NC

We Love Bee Culture

The mailbox in recent issues of *Bee Culture* has become a clubby we love *Bee Culture* column. As an entomologist (Cornell PhD, 1945), author (Man Against Tsetse, Struggle for Africa), subscriber to *Gleanings in Bee Culture* since high school days (1930s), beekeeper then and still a beekeeper at age 96, maybe I should join the club.

When my issue comes, I go first to the Bottom Board, because I like Ed Colby's easy writing style with just enough personal information about his gal Marilyn, his colleagues, and friends, to add spice to his stories and to engage his readers.

Then I go to James Tew, whose articles contain wisdom born of successes and failures that he has experienced over decades, living with his bees. He reminds me of the outstanding professor of plant pathology at Cornell decades ago, H.H. Whetzel, who let his students know that text book information is not set in stone, and that problems exist, that others have missed – problems that await their efforts to solve. Tew's don't know the answers are stimulating.

Downtown beekeeping is a great addition to the list of regular columnists due to the explosion of back lot beekeeping concurrent with the massive population growth of people over the world as a whole. And don't ever print an issue of *Bee Culture* without Toni's ear on the top of one her hives listening to the hum of her bees. A first prize winner whatever the photo-contest.

One of the best of *Bee Culture* innovations is Ask Phil. I have already drawn upon him for answers to my questions and will continue to do so.

Finally, the scientific content of the articles from other *Bee Culture* writers has changed *Bee Culture* from being simply a trade journal to that of an important scientific one as well.

John McKelvey, Jr.
Richfield Springs, NY

Editor's Note: *Thank you, Mr. McKelvey.*

Blue Sky Bonus

I have been reading a few older *Bee Culture* magazines, from a local beekeeper. I thought you might be interested in a kindness story.

On a side note, if you know anyone wasting their money on Carbonite, the computer back-up service, tell them to save their money, it's a scam. They "Purged" all of my pictures, dating back, probably 10 to 15 years. All Gone! So today, when this happened it brightened things up, quite a bit.

O.K. So, if you read my last post, I got stung, real bad, by Carbonite.

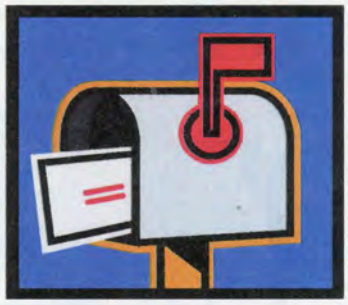
While, still fuming from them

DELETING all my information. I received a call from Blue Sky Bee Supply, in regards to an attempted purchase through eBay.

About three weeks ago, I found a nice looking stainless steel smoker, free shipping and all. I put the smoker in my cart and tried to check out. I usually have a heck of a time trying to find the alternative payment area, so I don't have to use PayPal. I owe them too much already, and we are trying to get our account paid down. I looked, and looked, and couldn't find any way around PayPal. So, I contacted the seller. It turns out, it was Blue Sky, out of Navarre, Ohio. They wrote back, and told me that I could call them for an alternate payment. I got busy and didn't read the email for a few days, during which they sold out of the smokers. Big Surprise! I kept checking back to see if they were going to have any more of the smokers, only to find, they didn't have anything listed. Uh Oh.

I wrote to them and received a call, which I missed, but immediately called back. The lady I spoke to was very pleasant. I explained that I had missed a buy from them earlier. She told me to hold on. She came back on, and told me that the owner had said he could make the same deal on a larger smoker. Then told me that they could also do the free shipping on the order. I responded, and told her to tell the owner, that he didn't have to go to this length to satisfy me. I understood he had to be losing money on this deal. She said that it was okayed by the owner, and that was that.

As a New Bee, ain't got no bees yet, bee – well, I don't have any



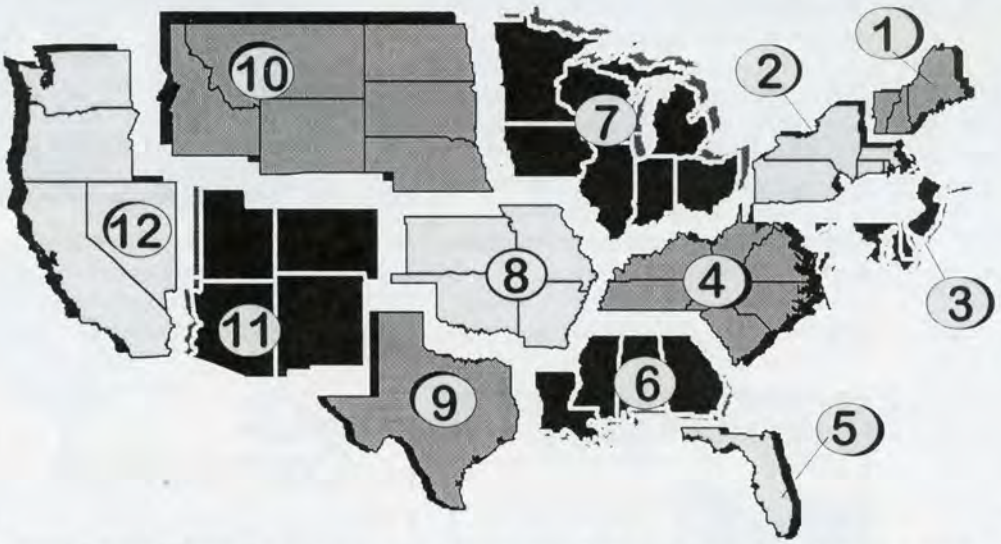
to keep yet, this was a breath of fresh air today. Many many thanks for the extreme customer service, shown to me, by Blue Sky Bee Supply.

Rhonda Henning

Correction

In our March 2014 issue, page 81 – *Construct A Bait Hive and Jib* – there is a correction. It was indicated that the hardware was 5/16" diameter. All hardware should have been noted as 3/8" diameter. This size is a better match for unistrut and the larger diameters provide a greater bearing surface on the wood.

MAY – REGIONAL HONEY PRICE REPORT



Demand, Prices and Expansion.

With honey prices continuing to climb, and colony numbers steady to maybe increasing, we wondered what our reporters are planning this year regarding their expectations for demand during the season ahead, what they intended to do relative to the price they are going to charge, and are they going to ramp up production to accommodate the demand they expect, and to take advantage of increasing prices.

Overall, 70% expect demand to increase this season. That's not surprising since demand for local honey has been on the rise, and has even increased more since the bee scare started several years ago. But demand for honey in general has increased, with imports exploding, albeit in response to reduced domestic production, but also coupled with more processed foods containing honey. So, increased demand.

Our reporters are responding to increased demand a couple of ways. Raising prices a bit for one. 52% will raise prices this season pay for wintering costs, and for moderate expansion plans. Yet, 48% are keeping prices dead on from last year, probably anticipating some resistance as honey, though popular, is at an all time high on the grocery store shelf, and at farm markets and even home sales. It has risen to the point that an even modest crop can compensate for loss of income due to not pollinating one or more crops this season, thus avoiding the increased losses that activity ultimately brings.

Expansion plans, as mentioned, are only modest in the time of watching losses increase or remain high each winter. To make up those losses, and stay even in numbers, however, many are making increases above what they expect to need, so that when higher than expected losses occur, the needed number of colonies will still be alive. Make more than you need, lose more than you expect, and about break even. That in a nut shell in not a sustainable business model, but it is what it is.

The Northeast in general seems to be the most conservative in terms of expected demand, price increases and expansion plans. Expansion plans especially are essentially zero, and price increase plans are flat. Interestingly, where keeping bees seems to be the most challenging recently, the west coast, beekeepers there are the most aggressive in terms of price increase and expansion plans.

	REPORTING REGIONS												SUMMARY			History	
	1	2	3	4	5	6	7	8	9	10	11	12	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS																	
55 Gal. Drum, Light	2.25	2.45	2.25	2.00	2.25	2.25	2.38	2.25	2.00	2.25	2.15	2.60	1.80-2.70	2.26	2.26	2.17	1.98
55 Gal. Drum, Ambr	2.12	2.25	2.12	1.97	2.05	1.99	2.23	2.12	1.80	2.12	2.03	2.50	1.75-2.58	2.07	2.07	2.04	1.88
60# Light (retail)	204.50	202.50	175.00	190.00	180.00	173.33	209.25	200.00	204.58	171.00	179.00	235.00	140.00-285.00	196.67	3.28	182.70	169.00
60# Amber (retail)	216.33	210.00	175.00	184.25	180.00	166.67	207.00	200.00	202.39	150.00	166.50	211.25	140.00 -285.00	192.28	3.20	178.24	164.77
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																	
1/2# 24/case	95.57	71.95	66.80	69.00	85.57	85.57	57.51	85.57	85.57	51.84	86.40	97.00	45.60-140.00	78.34	6.53	78.50	71.48
1# 24/case	128.94	121.45	110.00	101.10	96.00	116.69	94.25	132.00	119.82	106.20	102.60	121.80	79.20-172.80	113.63	4.74	106.53	103.07
2# 12/case	120.63	100.73	102.60	86.50	90.00	94.14	88.22	120.00	80.00	67.68	90.00	99.67	67.68-144.00	97.79	4.07	93.80	92.63
12.oz. Plas. 24/cs	118.96	93.95	71.40	81.25	74.40	88.00	71.77	120.00	93.68	74.40	105.60	92.80	62.40-134.40	88.97	5.56	83.20	82.75
5# 6/case	151.26	112.48	100.50	89.50	114.00	120.00	102.50	210.00	132.20	102.30	97.20	116.00	83.10-210.00	117.85	3.93	110.41	102.95
Quarts 12/case	161.50	154.44	168.00	123.00	120.00	116.01	135.04	244.00	154.54	125.64	144.00	148.80	96.00-244.00	139.09	3.86	127.72	114.42
Pints 12/case	88.03	86.95	102.00	86.00	104.00	68.80	95.64	86.37	66.00	86.37	96.80	90.50	54.00-121.20	85.14	4.73	83.03	76.79
RETAIL SHELF PRICES																	
1/2#	4.80	5.45	3.66	4.06	4.50	4.00	3.26	4.50	4.50	3.80	4.50	6.00	2.50-7.25	4.12	8.24	4.11	3.88
12 oz. Plastic	6.75	5.98	4.00	4.32	5.00	5.00	4.19	5.75	5.45	4.73	6.69	7.33	2.45-8.99	5.17	6.89	4.80	4.68
1# Glass/Plastic	7.17	6.32	6.46	5.91	6.50	6.70	5.42	8.00	6.45	5.81	5.91	7.87	3.00-10.00	6.40	6.40	6.09	6.01
2# Glass/Plastic	13.56	10.15	11.03	10.24	11.00	10.00	10.05	15.00	11.54	9.70	10.95	12.67	6.00-18.00	11.09	5.55	9.93	10.00
Pint	9.00	9.95	9.55	7.83	7.00	7.66	11.13	8.65	7.00	7.33	8.48	11.30	4.00-13.50	8.55	5.70	8.56	7.88
Quart	17.00	13.98	16.38	13.11	13.00	13.43	14.22	22.00	6.00	12.93	12.00	17.55	6.00-22.99	14.09	4.70	14.58	13.10
5# Glass/Plastic	29.25	22.48	25.90	23.19	26.08	29.50	22.22	40.00	26.08	19.45	22.16	30.00	15.00-40.00	24.66	4.93	22.63	21.62
1# Cream	10.75	7.10	8.28	7.50	8.24	8.00	6.61	8.24	8.24	7.22	8.75	10.00	4.90-12.00	8.04	8.04	7.45	7.20
1# Cut Comb	10.75	8.49	9.63	8.25	8.49	6.92	8.50	8.49	8.49	10.00	9.25	8.00	4.50-12.00	8.74	8.74	8.15	8.63
Ross Round	12.00	9.95	8.25	6.13	9.00	7.00	7.00	11.00	9.00	9.00	10.50	12.00	6.00-12.00	9.00	12.00	7.75	7.99
Wholesale Wax (Lt)	6.65	7.50	6.00	5.07	3.20	4.87	6.00	7.00	5.98	6.00	4.15	4.88	2.85-10.00	5.53	-	5.08	4.97
Wholesale Wax (Dk)	5.81	6.15	6.00	4.73	3.15	4.75	5.50	7.00	5.05	5.05	2.80	4.50	2.00-8.00	5.09	-	4.64	4.65
Pollination Fee/Col.	98.00	50.00	97.50	61.00	60.00	57.75	56.60	85.00	93.26	80.00	87.00	112.50	35.00-185.00	76.52	-	79.05	77.58

INNER COVER

Some Defense Department guy once said about the capability of his enemies – we know what we know, and we know what we don't know, but it's what we don't know that we don't know that's dangerous.

Here's what we know about honey in this country. We know how much we produced, how much we exported and how much we stashed away in loans or in warehouses for a rainy day. We know how much of our honey got eaten by us last year.

And we know what was imported, and from where the importer says it came from. Actually, we don't know all of that for sure. We know we don't know where some honey comes from, but we do measure that it came in. We know what we don't know.

What we don't know that we don't know is how much honey came in under the radar, labeled as sugar syrup then relabeled and sold as honey, or labeled as a honey blend then relabeled and sold as honey, or just not labeled, reported, recorded but sold – yes, as honey. We don't know what we don't know.

And what else we don't know is how much economic effect that has on – other imports, exports, price of bulk, wholesale and retail honey. We don't know any of this, and we know we don't know, and we don't even know how much else we don't know.

When the major bust on illegal imports occurred a bit ago it turns out the major players weren't hiding that they were importing honey, just where they were importing it from. So they say. Honey labeled as being from Where ever, but actually originating in China, contaminated or not, but cheap as dirt did harm the U. S. honey market. And though low on everybody's priority list of criminals to chase, eventually when you flaunt your evil deeds long enough someone, somewhere is going to notice and the gig is up. Caught.

Or maybe not. Maybe all the bad guys have been caught and the fear of jail time convinced others from trying the same trick again. Maybe. What do you think?

Here's some numbers.

In 2012 we imported 312 million pounds, and in 2013 338 million pounds – a 26 million pound difference. So overall in 2012 we produced, imported or used from stores 500 million pounds, in 2013 519 million pounds. Remove exports and stored and in 2012 we consumed 451 million pounds of honey total, and in 2013 466 million, meaning we consumed 15 million more pounds of honey last year than in 2012. If you take a look at the 2013 Honey Report on page 16, you'll find the per capita consumption figures...they come out about right, even when compared to last year. So maybe they got them. Maybe all the crooks are off the street. Maybe the eagle eyes in commerce, and the COOL laws, and True Source Honey folks, when added up, put the fear of God, or jail in them and they've given up and there are no more new kids on the block. Or maybe we don't know what we don't know and they're still out there, bringing in really cheap honey, and selling it for really high prices. Most folks reading this don't have a clue and wouldn't know where to look if they wanted to find out. But some do, and then don't. They don't want to give up this illegal gold mine and they don't want to be caught. Yes, some of you out there know, don't you.

Things Not To Forget

The 2015 calendar photo contest. The theme this year is bees and water – bees drinking water, bees swimming in water, bees looking at their reflections in water, bees sharing water, bees storing water – bees and water. Put your bathing caps on and find a good place to get some good shots and get your photo in *Bee Culture's* 2015 Beekeeping Calendar. The original beekeeping calendar.

And don't forget Tall, Slow and Cool. You know, your recipe for a drink with honey and a kick like a mule. We've got a few, but not nearly as many as I thought. So, what do you drink on a hot afternoon, maybe at a tailgate party, or on the deck after a long day in the beeyard, that's got honey, maybe a few other ingredients, and enough hootch to pickle an egg. We want your recipes, and we'll share them with the world, just as soon as, or if it ever, warms up.

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Being A Mentor

Have you ever been a mentor? Lots of people haven't. Me for one. It can be a tad intimidating. Suddenly you have to explain everything you are doing, from why did you choose that kind of beesuit to why do you use that kind of smoker fuel, to how come your colonies aren't white like everybody else's, to why do you use so little smoke, to – and the questions go on and on and on. Everything you do is new to a, what do you call these people, mentees? Yes, Merriam-Webster says it's Mentee. A protégé. One who is being mentored, by you, the mentor.

And then there's the time thing. Most of us have lives that say you work bees when you can, not so much when you want to. And too often that time is on short notice. Very short notice. It was supposed to be raining today, but when you got home it hadn't rained, the sun was shining and instead it's going

What We Don't Know. Mentors.

to rain tomorrow. Better get some feed on, supers on, treatments on, splits made, cover replaced, queen released, new frames added, drone comb removed, sticky board put in, robbing screen put on, mouse guards taken off, pollen trap set, beeyard mowed, bear fence fixed, hive stands replaced, those splits checked just because, No. 7 checked to see if that new queen took, all the beetle traps checked and emptied, and – well, the list goes on and on. Beekeeping is never done and you do it when you can, not always when you want.

So you call the mentee, who also has a day job, and won't be home for an hour, and by then you'll be done and have to eat fast and be off to Lion's Club. Busy lives make this tough. That's why I haven't done it. Maybe you, too.

And this begs the question – were you a mentee? If you were, how much help was it? Have you avoided a lot of mistakes because that old guy always just smiled and said maybe try it this way and see if it isn't easier, or gave you a really short course on smoker lighting the first time and because of that yours never, ever goes out, or showed you how to stack supers in the garage in the fall so the wax moth wouldn't eat everything in sight, or showed you that trick when looking for a queen by holding the frame so you were looking not down, but across the surface, or what's the best trick to see if there's a bunch of *Varroa* in a colony, or a way better way to put wax on a plastic frame, or – well, all the tricks that you use now that if you think about it, came from that old guy those four or five times you went out with him all those years ago.

Unfortunately, most of us haven't had that luxury. We take a class, maybe go to a couple of field days, listen to the speakers at the meetings talk way, way over your head, watch some YouTube shows, read a few books, maybe call up one of the other new kids on the block who took the class with you and you get together because misery loves company and just maybe he knows more than I do and what can it hurt?

If you're lucky your club has a Q & A every once in a while aimed at beginners and you can ask those really need-to-know questions, like when can I quit feeding, or why are there butterflies in my hives, or do those little black beetles mean anything, or when do I put another box on, or my bees simply left, where can I get some more?

A mentor very often is the difference between success and, choose one: 1) failure, 2) frustration and then failure, 3) an extremely painful afternoon and then failure, 4) not failure, but never success, 5) taking five years to accomplish what could have been done in two, 6) never finding the joy in opening a box of bees, 7) buying bees every year, but that's not failure, 8) never learning to extract because there's never been any honey, 9) abject poverty from buying bees and equipment you didn't need, and 10) failure.

Ok, maybe I went a little overboard. Lots of people do learn to keep bees successfully without a mentor, but we both know they would have been a success at most anything they tried just because that's who they are.

So if it's a time thing for you not being a mentor, how do you resolve that? We have a guy in our club who has sort of the same situation. He's retired, so he works mostly when it's convenient for him, and for the bees – mid-day on nice days, when most folks are still at work. So here's what he does. He schedules his own field day, different than those the club sponsors, which have their own problems on timing, and he invites anybody and everybody to his house on a day that's convenient for most of the people who need and want to have someone point out all the things needing pointed.

He keeps anywhere from 10 – 15 colonies in his home yard overwinter. His home is easy to find and he has ample parking. And with that many colonies there's bound to be a colony in every kind of condition you can imagine. He'll have a just-installed package so they can see what they should be doing, some weak overwintered colonies he's nursing along and some busters getting ready to be split, and maybe he'll even split one that day, just so folks can see how it's done.

He'll spend a couple hours, or more in the afternoon doing all this, answering all the questions, showing again and again what needs to be seen, and answering the same questions again. It's how we learn, and how he teaches, and it's the best way there is to become a beekeeper. And you know, once these folks have been through one of those sessions, it's amazing how they will turn their timing around so they can come back, on his schedule instead of theirs, so they can do it again. Being grunt labor for an experienced beekeeper is an incredibly good way to learn what's going on inside a hive. But here's one thing about that. Too often those students do it a few times and then wander off on their own, thinking they have a handle on it. Mostly, that's not the case, and the things you learn in May aren't the things you learn in July or October, so a season-long approach to looking over that experienced shoulder is a good idea. It'll pay dividends the rest of your life if you're a student, and if you choose to be that mentor, you'll have good, and getting better free help all season long.

If you haven't yet, this year raise your hand and give someone else a hand. Be a Mentor.

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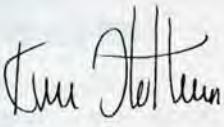
I know we've been over this before, but in this issue we have some dynamite information on getting a pollinator meadow established, and even collecting seeds to plant there. You may feel there's enough good food all season long for every bee in your bunch, but even though I don't gamble, I'll bet there isn't. There may be plants blooming and you may see bees visiting, but I'll bet there isn't enough good food so your bees thrive, rather than survive. If you ever have to feed because your bees didn't gather enough food, why do you think that is? Either it's because you got greedy and took too much, or there wasn't enough out there to begin with. This year, plant some pollinator friendly forage. Even if it's only a pot full of flowers on the deck. Absolutely every little bit helps. Just ask your bees.

May. Swarms. Honey flows. Enough said.



It's Summers Time —

Family, Chickens, Cats, A Goat and A Pony . . . oh my!

A strange thing happened to me at the end of March – I turned 60 years old. I'm not sure how this happened. I don't feel 60 – well maybe some days I do. I don't think I really look 60, but then what exactly does 60 look like? This seemed to happen very quickly. I blinked and here I was – 60 years old.

I spent my birthday in northern California with several members of my family, including my son, Matt. I'm the youngest of four siblings and it seemed to be a little traumatic for all when the baby of the family turned 60. It was a good visit with Matt, my sister, my oldest brother and his wife and a niece. They took me out for a nice birthday dinner with a cake and that embarrassing moment when the staff comes out and sings to you.

I was able to spend some time with my best friend from junior high and high school. Her name is Shelly. She was one of my first friends when we moved to California in 1966. And although we lose each other every once in awhile for a time, we've been close friends ever since. A lot has happened in the almost 50 years we've known each other – parents have passed away, children are all grown up, she has grandchildren and I did leave California about 35 years ago. It's amazing how the closeness stays. She always remembers that I don't like nuts or raw onions and we talk about dumb things we did as kids.

The weather was terrific in California. At 60° most days I was totally comfortable. The family all still had their jackets on and my sister cranked up the furnace every night. I enjoyed the sunshine and being able to go out without a big coat on.

Kim graciously stayed behind to finish up the Winter in northeast Ohio – taking care of the chickens, our cats and as luck would have it the neighbor's pony, goat and cat – Fawn, Nanny and Rosie. It was not much fun for him on the days we had more cold and yes, more snow – four inches one day and four inches again another. No snow since I got back so I'm trusting that we're done with it for this year.

Spring seems to have finally arrived here in Medina County, at least we hope so. Today was glorious. We all got to be outside – us, the cats, the chickens and even the pony and goat, who are now back in the care of our neighbors. We started taking things out of the garage. The first sign of Spring – the car stays out of the garage. The tractor/mower started right up. And although it was still a little cool, the bees were flying a bit.

The chickens had a marvelous day. One kept getting out of the pen and we couldn't figure out how, but every time we turned around she was just standing outside the pen. I checked the fence and couldn't see anything and it didn't seem like she was flying out of the pen. There is usually a lot of commotion when that happens. Finally Kim took a real close look and found the spot where she was walking out. He put down some stakes and she was secure again. They had a great day scratching in the mostly mud.

We thought about getting more chicks this Spring, but haven't made that jump yet mostly because of a lot of travel time. And asking your neighbors to come over and feed and water the chickens is pretty easy. But asking them to baby-sit a bunch of new chicks – not so much. So it may wait until next Spring.

The current girls are doing well at just past two years old. We're getting an average of seven or eight eggs a day (Kim says four or five). All I've read says that the egg laying really starts to slack off at this age. A lot like the queen in a beehive.

We have not had any problems to speak of. Just like bees there are lots of things that go wrong in a chicken coop – diseases, injury, parasites, problems. But we have either been really lucky or we're doing things right.

The Winter was a little hard on them, but everyone survived and although we thought we saw signs of a little frostbite on a couple of combs, all seem fine now.

We've already been notified that packages will be a couple of weeks late. Every year we order seedlings from our soil and water conservation district and those are going to be a couple of weeks late also. It seems like we're going to get a slow start on everything this year.

Kim, Peggy and I are headed to North Carolina this Friday for the Mother Earth News Fair in Asheville. Have you heard of the Mother Earth News Fair or the magazine of the same name? This is the first year in Asheville and we are really looking forward to it. Kim is speaking a couple of times and we'll be selling books and just enjoying everything that goes on. There are four Fairs this year. Check out the ad on page six. If there is one that is at all close to you I encourage you to try and make it. This will be our third year to participate or attend the one that is held in Seven Springs, PA in the Fall. There is one in Washington State and one in Kansas City.

It's pretty amazing. There is everything organic, gardening, chickens, bees and beekeeping, alpacas, pigs, composting, water – and it just goes on and on. It's almost overwhelming.

Well when you receive this it will be almost May and I really hope for all of us that it will be a nice, warm Spring. Good luck with your bees, your chickens and your garden.

Kathy Summers

Honey Production – 2013

United States Honey Production Up 5 Percent

Honey production in 2013 from producers with five or more colonies totaled 149 million pounds, up 5 percent from 2012, according to USDA NASS data. There were 2.64 million colonies producing honey in 2013, up 4 percent from 2012. Yield per colony averaged 56.6 pounds, up 1 percent from the 56.0 pounds in 2012. Colonies which produced honey in more than one State were counted in each State where the honey was produced. Therefore, at the United States level yield per colony may be understated, but total production would not be impacted. Colonies were not included if honey was not harvested. Producer honey stocks were 38.2 million pounds on December 15, 2013, up 20 percent from a year earlier. Stocks held by producers exclude those held under the commodity loan program.

Record High Honey Prices

Honey prices increased to a record high during 2013 to 212.1 cents per pound, up 6 percent from 199.2 cents per pound in 2012. United States and State level prices reflect the portions of honey sold through cooperatives, private, and retail channels. Prices for each color class are derived by weighting the quantities sold for each marketing channel. Prices for the 2012 crop reflect honey sold in 2012 and 2013. Some 2012 crop honey was sold in 2013, which caused some revisions to the 2012 crop prices.

So, What Else?

That's the new official word on the 2013 Annual Honey Report. Now, let's look at the rest of the story, and some we missed along the way between 2012 and 2013.

Colony counts, according to the 2012 survey, were 2.624 million, but they were revised down to 2.539 million for this year's report, an 85 thousand colony difference (only 3%, but it's 3%). Honey production per colony fell from 56.1 pounds/colony to 56.0 pounds. Not a lot, but for 2.5 million colonies it adds up to almost 5 million pounds difference.

The bee counters offer this on making changes and reliability:

Revision Policy: The previous year's estimates are subject to revision when current year's estimates are made. Revisions are the result of late reports or corrected data. Price revisions can be the result of additional sales reported the following year. Estimates will also be reviewed after data from the 5-year Census of Agriculture are available. No revisions will be made after that date.

Reliability: Since all honey producing operations are not included in the sample, survey estimates are subject to sampling variability. Survey results are also subject to non-sampling errors such as omissions, duplication,

Honey: Number of Colonies, Yield, Production, Stocks, Price, and Value by State and United States, 2013

State	Honey Producing Colonies[1]	Yield per Colony	Production	Stocks, Pounds Dec 15[2]	Average Price per Pound[3]	Value of Production[4]
	x1,000	Pounds	x1,000	x1,000	Cents	1,000 Dollars
AL	7	52	364	55	281	1,023
AZ	29	36	1,044	251	189	1,973
AR	22	60	1,320	66	201	2,653
CA	330	33	10,890	2,505	210	22,869
CO	26	43	1,118	324	210	2,348
FL	220	61	13,420	1,074	204	27,377
GA	67	50	3,350	637	224	7,504
HI	13	83	1,079	65	198	2,136
ID	83	32	2,656	1,036	201	5,339
IL	7	48	336	101	415	1,394
IN	6	47	282	82	267	753
IA	39	48	1,872	1,217	254	4,755
KS	6	46	276	39	255	704
KY	3	41	123	17	302	371
LA	50	98	4,900	490	183	8,967
ME	7	43	301	27	303	912
MI	85	55	4,675	982	213	9,958
MN	130	58	7,540	1,282	197	14,854
MS	17	116	1,972	39	185	3,648
MO	10	47	470	85	253	1,189
MT	159	94	14,946	5,231	208	31,088
NE	46	60	2,760	1,628	206	5,686
NJ	11	44	484	34	389	1,883
NY	55	48	2,640	1,030	199	5,254
NC	10	38	380	84	363	1,379
ND	480	69	33,120	6,955	204	67,565
OH	17	45	765	390	321	2,456
OR	62	35	2,170	456	229	4,969
PA	13	45	585	257	298	1,743
SD	265	56	14,840	6,381	206	30,570
TN	7	45	315	63	358	1,128
TX	106	59	6,254	1,689	212	13,258
UT	30	34	1,020	92	207	2,111
VT	3	51	153	46	331	506
VA	5	35	175	42	423	740
WA	69	39	2,691	1,023	221	5,947
WV	6	46	276	83	356	983
WI	59	60	3,540	1,558	231	8,177
WY	47	66	3,102	558	211	6,545
Other States[5,6]	33	39	1,295	186	417	5,400
U.S.[6,7]	2,640	56.6	149,499	38,160	212.1	317,087

[1]Honey producing colonies are the maximum number of colonies from which honey was taken during the year. It is possible to take honey from colonies which did not survive the entire year.
[2]Stocks held by producers.
[3]Average price per pound based on expanded sales.
[4]Value of production is equal to production multiplied by average price per pound.
[5]Alaska, Connecticut, Delaware, Maryland, Massachusetts, Nevada, New Hampshire, New Mexico, Oklahoma, Rhode Island, and South Carolina not published separately to avoid disclosing data for individual operations.
[6]Due to rounding, total colonies multiplied by total yield may not exactly equal production.
[7]United States value of production will not equal summation of States.

Honey Prices 1995-2012

Cents/lb.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All Honey	68.5	87.8	75.7	65.5	60.1	59.7	70.4	132.7	138.7	108.5	90.4	104.2	103.2	141	144.5	160.3	172.9	195.1	212.6
Retail Shelf	100.0	117.3	125.7	114.7	126.6	130.4	142.2	152.5	188.5	188.7	183.3	191.0	196.1	197.6	278.4	305.4	328.4	340.5	373.5
%Difference	31%	25%	40%	34%	53%	54%	51%	13%	26%	42%	51%	46%	29%	28%	48%	48%	48%	43%	43%

and mistakes in reporting, recording, and processing the data. While these errors cannot be measured directly, they are minimized through strict quality controls in the data collection process and a careful review of all reported data for consistency and reasonableness.

To assist in evaluating the reliability of the estimates in this report, the "Root Mean Square Error" is shown for selected items in the following table. The "Root Mean Square Error" is a statistical measure based on past performance and is computed using the differences between first and final estimates. The "Root Mean Square Error" for honey producing colonies over the past 10 years is 1.2 percent. This means that chances are 2 out of 3 that the final estimate will not be above or below the current estimate of 2.64 million colonies by more than 1.2 percent. Chances are 9 out of 10 that the difference will not exceed 2.2 percent.

And I, maybe more than most, appreciate the difficulty in obtaining sound data on an industry of migratory beekeepers who have good ideas on how many colonies they manage, most days, but wait a week and that number will change as colony numbers bounce all over during the season. My frustration in getting good data, however, pales in comparison with keeping colonies alive.

But here's a particular issue that troubles me. North Dakota. The original 2012 colony count there was 495,000, with colony production averaging 69 pounds. Those numbers were revised this year to 480,000, with a colony production average still at 69 pounds. And if you look back a bit, you see these numbers:
2010 – 510,000 colonies, 91 lb avg
2011 – 460,000 colonies, 71 lb avg
2012 – 480,000 colonies, 69 lb avg
2013 – 480,000 colonies, 69 lb avg

But here's the issue...the 2013 numbers are identical to 2012, yet beekeepers in North Dakota tell me registered locations were over 600,000 hives – and that's just the legal locations – the .10/hive honey promotion check off proves the claim. And, they say, add another 100,000 hives that always show up. Moreover, three of the larger, maybe the largest operations in the state had a 40 pound average. One phone call would have cleared this up.

So you can predict that the 2013 average will be 'revised' next year. Meanwhile, the honey world believes there's more honey out there than they thought. Or maybe less. 600,000 colonies producing only 40 pounds each makes 24 million pounds, while 480,000 colonies making 69 pounds each makes 33.1 million pounds. But, what if it's really 480,000 colonies making only 40 pounds...that's a whopping 19.2 million pounds. So, North Dakota is somewhere between 19 and 33 million pounds of honey this year. And that's only 1 state. The biggest, granted, but only one. Root square mean or not, the reliability factor here is a question.

But then, how did we do when making the same estimates, which we do every year in our November issue? Hmmmm, not so good either. We surveyed our monthly honey reporters, just over 100 good folks in the field, and asked for their average production per honey producing colony...like NASS we don't include colonies that don't produce honey in the final analysis (but we did get a colony count). We calculated a 48.8 pound average, a bit lower than the official 56.6 pound average (maybe we need more reporters in North Dakota?). But for us, colony count is tricky. We don't have access to all the beekeepers NASS does, nor the staff they do. So we started with an estimate from our reporters and others that during the honey season beekeepers had right about 2.7 million colonies prior to harvest last year...say May. But every report we got after that was that colony counts were dropping – rapidly. After talking to several operations with colonies in the thousands, in the south east, south, Midwest and out west, we dropped our estimate from 2.7

Snap Shot Of Colony & Honey Production

YEAR	COLONIES (x000)	PRODUCTION (000 lbs)
1993	2875	230.6
1994	2783	218.2
1995	2655	211.1
1996	2581	199.5
1997	2631	196.5
1998	2637	220.5
1999	2652	203.1
2000	2622	220.3
2001	2550	186.1
2002	2574	171.7
2003	2599	181.7
2004	2554	183.5
2005	2409	174.6
2006	2394	154.9
2007	2443	148.3
2008	2342	163.7
2009	2498	146.4
2010	2692	176.4
2011	2491	148.4
2012	2624	147.1
2013	2640	149.5

Top Ten Producing States Each Year

2007			2008			2009			2010			2011			2012			2013		
State	x1000 Col	x1000 Prod lbs	State	x1000 Col	x1000 Prod lbs	State	x1000 Col	x1000 Prod lbs	State	x1000 Col	x1000 Prod lbs	State	X1000 Col	X1000 Prod lbs	State	X1000 Col	X1000 Prod lbs	State	X1000 Col	X1000 Prod lbs.
ND	420	31.1	ND	390	35.1	ND	450	34.7	ND	510	46.4	ND	460	32.6	ND	495	34.2	ND	480	33.2
CA	340	13.6	SD	225	21.4	SD	270	17.8	CA	410	27.5	CA	370	17.7	SD	270	17.0	MT	159	14.9
SD	255	13.3	CA	360	18.4	CA	355	11.7	SD	265	15.6	SD	250	16.5	FL	199	12.7	SD	265	14.8
FL	160	11.4	FL	150	11.9	MT	146	10.2	FL	200	13.8	MT	145	13.3	CA	340	11.9	FL	220	13.4
MT	135	9.2	MN	122	9.5	FL	150	10.2	MT	157	11.6	FL	180	10.9	MN	130	8.7	CA	330	10.8
MN	130	8.8	MT	134	9.4	MN	122	7.9	MN	126	8.3	MN	120	6.3	MT	149	7.7	MN	130	7.5
TX	105	8.6	MI	71	5.2	ID	103	4.7	TX	100	7.2	MI	74	4.7	TX	95	4.9	TX	106	6.2
ID	92	3.8	TX	77	4.9	TX	74	4.7	WI	68	4.4	TX	78	4.5	MI	76	4.3	LA	50	4.9
MI	72	4.6	WI	58	4.6	MI	66	4.0	MI	70	4.0	WI	57	3.6	WI	63	4.3	WI	59	3.5
WI	60	5.0	GA	55	3.9	LA	37	3.8	NY	47	3.0	GA	65	2.8	LA	41	3.5	GA	67	3.3
Total	1769	109.7		1642	120.3		1773	109.7		1953	141.9		1799	112.9		1858	109.1		1866	112.5
All Sts.	2442	148.5		2301	160.9		2462	144.1		2684	175.9		2491	148.4		2624	144.4		2640	149.5
% of Tot.	72.4%	73.8%		71%	75%		72%	76.1%		73%	80.6%		72.2%	76.1%		71%	76%		71%	75%

million down to 2.4 million colonies. A modest 10% or so seasonal loss. Eventually, estimating from the fewest colonies producing the least amount of honey to the most that could be out there producing the best crop possible, our estimate came out to a range of 96 to 132 million pound crop, somewhat below the 149.5 million pound crop estimate by NASS. But I still wonder about their count from North Dakota. We can only wait and see if this year's estimate is revised next year...I'm holding my breath here.

Well, their report is what we have, so using that information, with a bit of caution I admit, we calculate the annual per capita honey consumption each year. Here's how that works.

We calculate the total amount of honey we start with. So that's imports + US production + stocks carried over from 2012 + the amount of honey from 2012 on loan carried over (which is 0).

338,247,226 + 149,500,000 + 31,829,000 + 0 = 519,576,226 pounds of honey IN in 2013 (please, check my math).

From this we remove honey not consumed here, or yet. So, that's exports + stocks from 2013 still held by beekeepers in their warehouses + honey put on loan not yet bought back.

11,922,422 + 38,160,000 + 2,173,000 = 52,255,422 pounds. Subtract this from honey in and you have total honey consumed in the US in 2013 of 467,320,804 pounds. Divide this by the population in the US in 2013 of 316,128,839 people, and you end up with 1.48 pounds of honey consumed per person last year. That's up a just a tiny bit from last year's 1.44 pounds per person. But that .04 pound increase amounts to 12.6 million pounds more honey consumed this year than last, and it amounts to 8% of the total US production last year.

The most interesting number here though is imports. We imported 338.3 million pounds of honey last year, more than double the 149.5 pounds we produced, and up 26 million over last year. The caveat here, however, is what came in from China that nobody recorded. Supposedly, only 212,000 pounds – about 350 barrels came to the US, and most of that was flavored. Believe that?

The big players were Argentina at 97.2 M, Vietnam at 74 M, India at 56 M and Brazil (mostly organic) at 20 K. Total then of just these four is 247 M pounds, or 73% of all the honey we imported. The prices on all of these, of course, is much lower than the $2.12/lb beekeepers are getting for domestic honey. Low ball import prices are in the $1.30 range up to $1.70 or so.

The top ten gang still rules, though Michigan dropped off the list this year and was replaced by Georgia. Not surprisingly, the top 10 still have 71% of US colonies (same as last year), producing 75% of US honey (down 1% from last year). When you look at production per colony in those states, it's easy to see why. The 1,866,000 colonies in those states producing 112,500,000 pounds of honey, averaged 60.3 pounds of honey each, compared to the average of 56.6 pounds the rest of us made. Not only are there more colonies in those states, they do a better job than the rest of us.

On an absolutely positive note, the prices received at all levels for honey this past year have been fantastic. USDA overall average price on all honey has moved up from $1.99/lb to $2.12/lb. They adjusted the 2012 price from $1.95 to $1.99 for this year's report, but still, the increase is welcome. Bee Culture's retail price has moved from $5.97 in 2012, to $6.28 in 2013, another healthy jump.

NASS quotes an average price of $2.11 wholesale, very close to Bee Culture's $2.09, and a retail price of $3.13, much lower than our $6.28 price. Still, they have nearly a 30% mark-up between beekeeper and store price...while the distance for ours is more than double at over 60% increase. I think I like our prices better. But because we survey different groups it's hard to tell which is better, or even most correct.

There's no doubt that some groups will use this NASS data as an indication that life in the bee world is improving and what are we complaining about, anyway. More colonies, more yield per colony (what bad weather?), more honey produced, able to carry over more honey, prices and income up. What could possibly be the matter? Be ready for this, unless, of course, you agree with the results shown here...life is getting better, right? BC

The Pollinator Stewardship Council

WORKING TO PROTECT POLLINATORS

Pollinators must be protected in every setting in order to be abundant and healthy for essential pollination moments.

Pollinator Stewardship Council Board members are active at the state and national level on bee industry issues. In the first quarter of 2014 Board members have been involved in the development of the North Dakota Pollinator Plan, the Mississippi Farm Bureau Federation Pollinator Dialogue Work Group, the Federal Pollinator Protection Dialogue Committee, the Varroa Summit, and a Congressional Briefing. Beekeeper, Jim Doan spoke to Senate Congressional members in a hearing accompanied by Christian Krupke, Ph.D., and Dave Goulson, Ph.D. The Pollinator Stewardship Council supported this collaborative educational activity that also featured presentations to U.S. Fish and Wildlife and USDA.

Board members are leaders in their State Associations, such as Beth Conrey, President of the Colorado State Beekeepers Association, who along with the Front Range Beekeeping regional associations, featured retired entomologist, Diana Sammataro, of the USDA-ARS Bee Research lab in Tucson for presentations to beekeepers in the Denver area. Dr. Sammataro spoke in Longmont to the Boulder County Beekeepers Association (BCBA), in Berthoud to the Northern CO Beekeepers Association (NCBA) meeting and in Denver for the metro area beekeeping groups. The CSBA was appreciative of Dr. Sammataro for "spending her first days of "retirement" with the Colorado beekeeping community!"

Pollinator Stewardship Council, American Beekeeping Federation, and American Honey Producers Association Board members attended the *Varroa* Summit in Washington, D.C. in February. The *Varroa* Summit featured many presentations summarizing concerns with bee health. The impact of pesticides was discussed, although there continue to be diverse views on the impact of pesticides by researchers and the chemical industry. Ongoing research is welcome to address the solutions to *Varroa*. "Sustainable methods for maintaining animal pollination services – which already support 35% of global food production – must be developed. . . This will require increased cooperation between the academic world, governmental bodies, apiarists, and companies directly dependent on pollination . . . although the use of pesticides cannot always be avoided, application should take place in cooperation with beekeepers." (The Plight of the Honey Bee, a report by Rabobank, 2011) Many university researchers are working diligently to understand the real-world, field-level interactions of pollinators in the environment. The beekeeper's voice, however must be heard. The observations and experience of beekeepers is a valuable aspect in bee health research.

Key to bee research is SETAC-Pellston. Pollinator Stewardship Council members participated in the development of a Pesticide Risk Assessment for Pollinators which focused on four major goals:

1) design or identify testing protocols to estimate potential exposure of bees to pesticide residues in pollen, nectar, and other exposure routes;

2) design or identify testing protocols to measure effects of pesticides on developing brood and adult honey bees at both the individual and the colony levels;

3) propose a tiered approach for characterizing the potential risk of pesticides to pollinators; and

4) explore the applicability of testing protocols used for honey (*Apis)* bees to measure effects of pesticides and pesticide risk on native (non-*Apis*) bee species."

This workshop also proposed additional research which "may lead to improvements in the pesticide risk assessment process for pollinators." The SETAC participants summarized their recommendations for further research or collaboration per the following:

- Exposure nomogram for pesticide concentrations in pollen and nectar
- Exposure data from trunk injection

- Likelihood and magnitude of pesticide exposure through guttation
- Pesticide fate within the colony
- Modification and validation of larval test
- Standardized protocol for chronic feeding study
- Testing method to assess effects on foraging behavior
- Artificial diet for larval testing
- Toxicity testing for non-*Apis* species
- Improvements to monitoring efforts
- Research on effects of pesticides on community or landscape populations
- Modeling development and refinement

This SETAC-Pellston initial committee report was compiled in 2011. This report was to produce testing protocols defined by the four goals. As of March 10, 2014 the testing protocols have not been defined; the report has not been finalized and published. It is out of a sense of duty and respect to the people who put in the time and effort on the SETAC report that it should be released. Standardized testing protocols would facilitate "***increased cooperation*** *between the academic world, governmental bodies, apiarists, and companies directly dependent on pollination.*"

Native and managed pollinators are a national resource needing protection. The testing protocols would provide a standard for industry research when a pesticide is submitted for review to EPA, for industry/non-industry research when a State Lead Agency may re-review a pesticide, and for non-industry/academic research in studying a pesticide.

Pollinators must be protected in every setting in order to be abundant and healthy for essential pollination moments. Pollinator Stewardship Council members and staff are working to protect managed and native pollinators. We are working beekeepers who are invested in the bee industry, in the protection of honey bees and other pollinators vital to a sustainable and affordable food supply from the adverse impact of pesticides. Help us protect your bees! *Your financial support of this nonprofit is the key to our success.* For more information about the Pollinator Stewardship Council visit our website at **www.pollinatorstewardship.org**.

A Closer Look

EUROPEAN FOULBROOD

Clarence **Collison**

Outbreak of the disease appears to be linked to colony stress conditions, such as lack of food or water.

European foulbrood (EFB) is a severe bacterial brood disease caused by the Gram-positive bacterium *Melissoccus plutonius*. The disease has worldwide distribution and is an increasing problem in some areas (Forsgren 2010). There are several other bacteria species associated with EFB including *Achromobacter eurydice*, *Brevibacillus laterosporus*, *Enterococcus faecalis* and *Paenibacillus alvei*, although their roles in disease development are unclear (Alippi 1991). EFB affects mainly unsealed brood, killing honey bee larvae usually when they are four to five days old. The youngest larvae that die from the infection cover the bottom of the cell and are almost transparent, with visible trachea. Older infected larvae move in the brood cell, and instead of the normal coiled position, the larva dies displaced in its cell, twisted around the walls or stretched out lengthways (Forsgren et al. 2013). The color of the larvae changes from pearly white to yellow, then brown and finally, when they decompose, grayish black (Bailey 1961). Some larvae may also die after the cell is sealed, resulting in sunken cappings resembling the symptoms of American foulbrood. If a high proportion of the larvae die, the brood pattern appears patchy and sometimes gives off a foul or sour smell due to secondary invaders such as *Enterococcus faecalis* and *Paenibacillus alvei* (Forsgren 2010; Arai et al. 2012).

The first step in EFB infection is the asymptomatic colonization of the gut. Bacterial cells of *M. plutonius* are digested with contaminated food and multiply vigorously within the midgut of the honey bee larva. Larvae are susceptible at any stage, but the older they are the less they are affected by the infection (Bailey and Ball 1991). One hundred or fewer bacterial cells are enough to cause infection in the larva (Bailey 1960). McKee et al. (2004) transmitted EFB to healthy larvae at a minimum concentration of 200 bacterial cells per milliliter and reported a strong correlation between dose of *M. plutonius* and larval mortality. The infection in individual larvae is not always lethal. The larvae may die before capping and be ejected from the colony, die after capping and void their infective, intestinal contents within the brood-comb cell or succeed to pupate and form normal or undersized adults (Bailey 1959b).

"The larvae may die before capping and be ejected from the colony, die after capping and void their infective, intestinal contents within the brood-comb cell or succeed to pupate and form normal or undersized adults."

Even some larvae experimentally fed high doses of *M. plutonius* in bioassays survived the infection to reach pupation, although pupation was delayed (McKee et al. 2004).

In nature, *M. plutonius* multiply only within the larval gut of the honey bee. In the bee colony, pathogen transmission and persistence seem to depend on the survival of infected individuals, which deposit the bacteria along with their feces into the cell when they pupate (Forsgren 2010). *M. plutonius* remain viable in these deposits, surviving long periods of desiccation (Bailey 1959a), and although many of the bacterial cells are cleaned away, some manage to infect other larvae. If the infected larva dies before it pupates, most of the bacteria in them are eliminated from the colony when they are cleaned out by adult bees. Not all individuals within the colony are colonized by the bacterium. *M. plutonius* can be detected in larvae and pupae without any clinical symptoms although is mainly found in diseased larvae within limited areas of the brood nest (Pinnock and Featherstone 1984; McKee et al. 2003; Forsgren et al. 2005; Budge et al. 2010). Adult worker bees collected from the brood nests in diseased colonies have higher bacterial loads than bees collected from the flight entrance (Roetschi et al. 2008), probably because nest bees inhabiting the brood area are in close contact with the infected brood containing massive amounts of the bacterium. Worker bees from the brood nest in

apparently healthy colonies can also contain surprisingly high levels of *M. plutonius* (Roetschi et al. 2008). Adult worker bees act as carriers of the bacterium not only within the colony, but also between colonies and apiaries (Belloy et al. 2007; Mckee et al. 2003).

Belloy et al. (2007) evaluated the distribution of *M. plutonius* among adult bees originating from apiaries and colonies with and without EFB symptoms to understand the spatial distribution of the pathogen in the host population. In more than 90% of the colonies without EFB symptoms located in apiaries with EFB symptoms, the bees were carriers of *M. plutonius*. In apiaries without EFB symptoms, but near apiaries with EFB symptoms, bees carrying *M. plutonius* were detected in about 30% of the colonies. In regions without European foulbrood history, all bee samples were negative. The proportion of adult bees carrying *M. plutonius* in colonies without symptoms appeared to increase when the distance to apiaries with clinical EFB symptoms decreased.

Outbreak of the disease appears to be linked to colony stress conditions, such as lack of food or water. Genetic factors, weather and geography may also play a role (Bailey 1961). Most larvae die within a brief period, usually around midsummer (Bailey 1981), and sudden outbreaks of the disease followed by a spontaneous recovery a few weeks later has been observed (Bailey 1961). Severely infected colonies moved from endemically infected areas to areas free of disease can recover spontaneously and become apparently healthy (Bailey and Locher 1968).

Bailey (1983) suggested that the pathogenic effect from *M. plutonius* infection results in the competition for nutrients between the infected larva and the pathogen resulting in starvation of larvae. However, in their in vitro infection experiments, McKee et al. (2004), provided infected larvae with food in excess and yet disease symptoms and death of infected larvae occurred. Thus, they suggested that the death of the larvae may be a result of additional pathogenic mechanisms such as invasion of the peritrophic membrane and penetration of the host tissue.

Bailey (1960) artificially infected 0 to one day-old larvae with *Streptococcus pluton* (now named *Melissoccus plutonius*) and placed them in colonies and they were usually removed by adult bees. Removal was delayed from colonies deprived either of unsealed brood or their queen, or which were reinforced with adult bees. The feces of surviving larvae, whose weight was subnormal, contained many viable cells of the pathogen. Colonies reinforced with unsealed brood removed more infected larvae than usual. It was concluded that infected larvae are ejected when larval food is merely adequate, as it may be when a colony is growing rapidly; and they are kept when larval food is more abundant, as it may be when brood rearing is retarded. Natural outbreaks of disease occurred when brood-rearing, in colonies heavily infected with EFB, was increasing during nectar flows, which was also when secondary infection with *Bacterium eurydice* White increased. At such times, larvae heavily infected with both organisms may die quicker than they are being removed. At the same time, infection of new larvae with *S. pluton* seemed to decrease; transmission of *S. pluton* was presumably checked by the death and ejection of unsealed larvae. Thus outbreaks usually seemed to be self-limiting. Colonies eject introduced larvae even more readily after the main nectar flows, which may account for the difficulty in causing disease artificially at this time.

The transmission of EFB was investigated by feeding larvae raised in vitro with a diet containing *M. plutonius* that had been artificially cultured or extracted from diseased larvae (McKee et al. 2004). EFB did not develop in larvae fed 1.1 x 10^9 artificially cultured *M. plutonius* organisms/ml. However, the use of *M. plutonius* extracted from diseased material effectively transmitted EFB to larvae at a minimum concentration 200 *M. plutonius* organisms/ml. The method used to raise and infect larvae in vitro had an associated larval survival of 81.2-100% (mean 91.9%). A strong correlation (r^2= 0.96) was established between the mortality of larvae that died from EFB and the dose of *M. plutonius* organisms. A clear linear relationship exists between the time duration of feeding *M. plutonius* inoculated basic larval diet

(2 x 10^5 organisms/ml) and larval mortality $r^2 = 0.92$).

Previous reports have assumed that the infection by *Melissococcus pluton* (now known as *Melissococcus plutonius*) occurs orally via food intake. From wounds of honey bee pupae, caused by the mite *Varroa destructor*, coccoid bacteria were isolated and identified as *M. pluton* (Kanbar et al. 2004). Thus, European foulbrood is possibly an infection also transmitted by *Varroa* mites. They also found that *M. pluton* in culture produces a toxin tyramine which is the causative agent of the observed toxic symptoms seen in four to five day-old bee larvae when fed this compound in their larval jelly.

Oxytetracycline hydrochloride (Terramycin®) is a bacteriostatic antibiotic that inhibits the multiplication of *M. plutonius* and is used in many countries (Thompson and Brown 2001). American beekeepers have used the antibiotic for prevention of both European foulbrood and American foulbrood since the 1950's, and Terramycin® resistance of *Panebacillus larvae* (the causative agent of American foulbrood) has been reported (Miyagi et al. 2000). No resistance to Terramycin® has been found in *M. plutonius* and studies in the United Kingdom showed continued susceptibility of the bacterium (Waite et al. 2003). BC

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Clarence Collison is an Emeritus Professor of Entomology and Department Head Emeritus of Entomology and Plant Pathology at Mississippi State University, Mississippi State, MS.

MUCH, MUCH MORE ABOUT PROTEIN IN THE HIVE

Larry **Connor**

Forager bees return to the hive with pollen pellets of different sizes and proceed to the brood nest periphery to deposit the pollen pellets into cells prepared by the house bees for, or already containing, pollen. This pollen is then available to the bees for brood rearing. It is critical that the pollen be close to the brood nest, for a separation of brood just a few inches from pollen will prevent the bees from utilizing the pollen. This is a common mistake made by beekeepers who do not return combs to their original position when they inspect the hive and manipulate combs, so bees are unable to benefit from stored pollen on misplaced frames.

When returning to the hive, pollen foragers go to the brood nest and unload their pollen by "kicking" the pollen pellets off their legs into a cell, which often already has pollen in it, where other workers use their heads to push or "hammer" the pollen into a paste-like consistency. Foragers and house bees both add secretions that initiate a lactic fermentation through bacterial intervention. This fermentation reduces the starch content from 2% to 0%, increases the levels of reducing sugars and fiber while reducing the ash and pH levels. The bacteria that converts the floral pollen into bee bread are *Pseudomonas*, *Lactobacillus*, and *Saccharomyces*.

Bee trapped pollen (pollen collected in pollen traps) declines rapidly in food value when left at room temperature. This is why human-harvested bee pollen should always be stored frozen. The bees apparently preserve the food value of pollen by the lactose fermentation process, although, unlike honey, little bee-collected pollen lasts very long in an active hive as it is rapidly consumed. The most likely period for long term pollen storage is during the wintering period.

Many beekeepers place dry protein mix in sheltered areas for bees to collect and take back to the hive, especially early in the season when little natural pollen is available.

Pollen pellets from a pollen forager weigh between 7.7 to 8.6 mg. Colonies collect more pollen when there is more brood pheromone, more queen pheromone or is genetically selected to collect more pollen. When I worked with Dr. G. H. "Bud" Cale Jr. of Dadant and Sons, he strongly advocated the selection of bee colonies with excellent pollen foraging traits. He worked in the 1970s to develop inbred lines and a hybrid bee that collected high amounts of alfalfa pollen. The hybrid was never accepted by the industry and was abandoned, but the inbred lines were incorporated into the Starline hybrid of the late 1970s as the high alfalfa pollen collection traits translated into high general pollen foraging, greater brood rearing, and higher honey production. More recent selection work by Dr. Robert Page developed both high and low pollen collecting lines. He showed that the high pollen collecting line would collect so much pollen that there were no empty cells in which to rear brood, while the low pollen collecting line would die from pollen deficiency unless fed supplemental protein patties.

Adult worker bees between one to 14 days old feed on stored bee bread and digest it. Adult drone bees one to eight days old obtain dietary protein from food supplied from young worker bees. This is a mixture of glandular secretions, pollen and honey. Larval and adult queen bees are fed royal jelly that is secreted from young worker bees. Royal jelly is also fed to worker larvae for the first three days of their larval life. Royal jelly is secreted by the hypopharyngeal glands of worker bees between the ages of five to 15 days old and is a milky white, creamy, strongly acid substance rich in protein lipids, reducing sugars, B vitamins, vitamin C and minerals. It has a water content of 65 to 67 percent.

Feeding on pollen/bee bread stimulates these bees' mandibular and other gland systems to produce royal and worker jelly that they feed to bees during development. Without pollen in the hive, nurse bees quickly become depleted of body proteins and other nutrients needed to produce these foods, and brood rearing stops. This is the point when worker bees start to eat the drone eggs, then the larvae, and finally start eating and removing any worker brood. This appears to keep the "investment" in the developing brood from being totally lost while keeping the adult bees alive.

Young worker bees consume large amounts of pollen to obtain protein and amino acids to complete their own growth and development. If there is a shortage of pollen, the young worker bees do not form fully developed hy-

Bees feeding at pollen patty in hive.

popharyngeal glands and they will be unable to support normal worker development to feed the queen so she can produce eggs.

Somewhere between the 10th and 14th day, the need for protein drops and the worker bee stops feeding larvae. After this point the adult bee feeds on honey and nectar for carbohydrates.

At the colony level, the dynamics of pollen foraging are stunning. One colony in California's Orange County made 1.7 million foraging trips resulting in pollen loads. Estimates have been made that one "average" pound of pollen will provide food to produce 4,500 bees, and that the average colony produces somewhere around 200,000 bees per year, requiring about 44 pounds of pollen. Operators of pollen traps collect that much or more in a season's time, suggesting that colonies hoard pollen much as they do honey.

Another way to look at this is that it takes about 10 average pollen loads (20 pollen pellets) to provide the pollen needed to feed one developing larvae. I think it difficult to have too much pollen in a colony, although Dr. Page has shown that is genetically possible. Since there is a statistical correlation between the amount of pollen collected with the amount of brood a colony produces, and another correlation between the amount of brood in a hive and the amount of honey a colony stores, selection of high pollen lines also selects for both high honey reproduction. All things being equal, the amount of brood a colony produces is correlated with the amount of honey it will produce, which is only logical, since more bees should produce more honey. Thus, high pollen foraging is desirable, just as long it is not at the expense of nectar foraging.

There are natural cycles in pollen collection, often alternating with those of nectar collection. In turn, the brood rearing cycles of a colony are related to these pollen foraging cycles. In areas where there is a dearth of pollen at certain times of the year there will be a drop in brood rearing that cannot be countered by feeding sugar syrup alone, but requiring supplemental protein feeding to maintain bee populations.

Enter the beekeeper

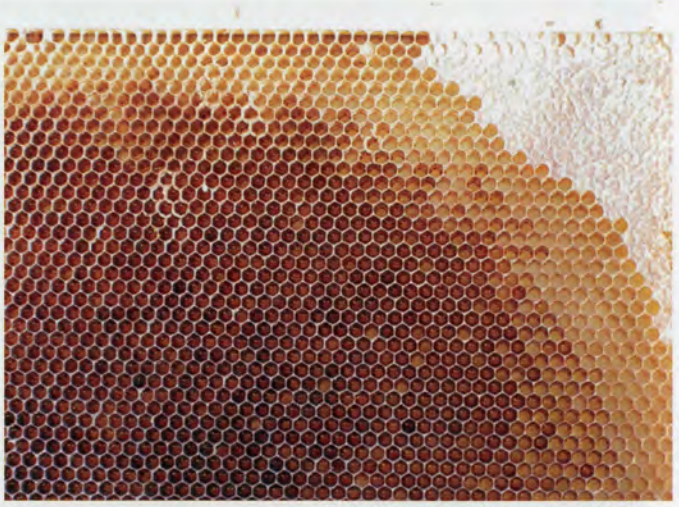
Depending on genetic background, most overwintered colonies of bees start brood rearing by mid Winter, and have brood on one or more frames by late Winter in northern tier states. One estimate of wintering needs in northern states is 600 square inches of pollen stored in the comb. The nutritional needs of this brood is filled from the stored food reserves in the bees themselves (Winter bees that have not reared brood) and the stored pollen the bees reach as the cluster expands. Towards the end of Winter the colony's brood area expands into honey frames with pollen stored in the outside combs and frame corners.

Bees store protein in the cells of their bodies, and well-nourished Winter worker bees are called 'fat bees'. Once they have exhausted their personal supply of protein, and if no more stored pollen exists in the hive, the colony may become depleted of the nutrients needed for brood rearing. This need peaks during the late Winter and early Spring, just before fresh pollen begins to ap-

pear (depending on the area). This pollen is highly critical for proper colony growth. Fortunately, some of our most abundant and diverse plant communities bloom in the Spring and produce abundant pollen to support rapid colony growth. Key plants include various willows, elms, soft maples, and countless Spring wildflowers.

Wise beekeepers make sure their colonies have adequate stored pollen in the combs when they prepare them for Winter. These pollen frames must be in the areas where the colony will expand as Winter progresses, where it can be consumed and converted into brood. If frames containing pollen are placed away from the brood area, say in a hive body below the cluster, that pollen will not benefit the bees. Some beekeepers collect frames of pollen during the season, store them in a freezer to prevent wax moth infestation and loss of protein value, and slip a frame of pollen on the edge of the brood area during Spring inspections. This may be beneficial in some areas, but it would be better to overwinter this pollen on the hive where the bees will reach it during cluster expansion.

Pollen substitutes are formulated and marketed to feed to the colony during late Winter to stimulate brood rearing. This stimulation results in stronger colonies earlier in the season and may produce swarms with a net gain of zero, or less if an important queen is lost. See *Swarm Essentials* by Steve Repasky and myself for a more detailed discussion of this conflict. Pollen substitutes do not contain pollen, while pollen supplements do. If so, the pollen must be treated (usually by radiation) to kill foulbrood and chalkbrood spores, both of which are easily transmitted to a colony if fed in a pollen supplement patty.



Bee bread and honey in a frame.

Like the natural pollen in the comb, pollen supplements must be placed directly in the brood area, where the bees easily reach the food supply. Beekeepers who do not know this may incorrectly place the supplement on the top frames of the honey supers, a foot or more away from the brood area, and the bees will not touch this food, which becomes dry and wasted. Supplements must be placed immediately over the brood area, or between the boxes if the bees occupy two hive bodies.

Beekeepers generally feed sugar syrup to stimulate brood rearing in the late Winter and Spring, and may

score the surfaces of frames of overwintered honey to stimulate feeding by the bees. Once given a Spring "kick start" the colonies will then grow according to their genetic programming. Some races, like Italian bees, will grow rapidly when stimulated by sugar feeding for they will gather pollen early in the season. Other races, especially those from more northern European locations, will resist such a growth stimulus and wait until their genetically controlled seasonal "clocks" tell them that it is time for brood rearing. They will store the sugar feed instead of converting it to bees. A large part of the popularity of Italian bees over the past 150 years has been due to its rapid responsiveness to sugar feeding as a means of stimulating brood rearing. The down side is that these bees will continue brood rearing when natural forage has stopped, quickly exhausting stored pollen and honey reserves. This may be suitable in some areas, but certainly not all.

Some beekeepers panic when they open a colony and find solid frames of pollen, often asking how to remove the pollen to let the queen lay. This is often part of the pollen cycle in the hive, and reflects a period of heavy pollen collection that will result in its conversion into brood and bees. For overwintering colonies, pollen in the brood nest is a very good thing, something to appreciate.

Pollen and pollination

This is a quick comment about the relationship between colony pollen foraging, colony developmental size and pollination. The rapidly growing colony is the most effective pollination unit, not the strong and stable colony. Large, overwintered colonies may have more bees, but may reduce pollen foraging if they enter swarming behavior, commonly correlated with fruit bloom and just after. Once the brood area is full and swarming is not initiated, the bees will concentrate on nectar collection and less on pollen foraging. Very small colonies, such as newly installed packages and newly made splits, often lack the numbers of bees needed to be adequate pollen foraging units. It is the established and rapidly growing colony, with a new queen, six or more frames of brood, and expanding bee population, that collects the most pollen on a per bee basis, and is thus the best pollination colony. BC

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

A BETTER WAY TO TREAT AFB!

A No Chemical Approach Is Always Best

Diane **Yost**

One contributing factor to poor honey bee health is American Foulbrood disease (AFB) caused by the pathogen, *Paenibacillus larvae*, a gram-positive, spore-forming bacterium. These bacterial spores are picked up by adult bees from all manner of places and brought back to the hive where the spores are introduced to the honey bee larvae. Fortunately, adults are resistant to this disease. Spores are resistant to antibiotics and heat and studies have shown that these can persist for at least several decades, which makes eradication of this disease difficult.

As the larvae of a hive succumb to the disease, and fewer bees are able to reach adulthood, the hive collapses as it is unable to maintain its population. Destructive methods to prevent the spread of the disease, such as burning hives and equipment, cause a significant negative economic impact to beekeepers with the loss of their equipment.

Coupled with these destructive measures, the problems associated with antibiotic use for treating AFB, such as causing an increase in bacterial resistance as well as leaving residual amounts of antibiotics in contaminated honey, are reasons to consider research into alternate methods of treatment. Additionally, according to a study by Hawthorne and Dively in 2011, there is evidence of decreased hive immunity to protect the bees from future recurrence of AFB following antibiotic treatment. Therefore, the prevalence and seriousness of AFB, combined with the lack of effective and safe methods of treatment, has created the need for more research. A grant awarded to four researchers in 2011 at the University of NV, Las Vegas (UNLV) funded three research projects considering alternate methods of treatment for AFB, one of which is called "phage therapy," headed by Dr. Penny Amy.

Phage therapy is the therapeutic use of phage, or viruses which infect only bacteria. Dr. Vincent Fischetti suggests that phage therapy is an alternative to antibiotics in human medicine. It seems reasonable, therefore, that this method of treatment could be applied to animal diseases, including AFB. Phage are specific to the hosts they infect, and could target a bacterial species of interest without harming even closely related species, ensuring the survival of beneficial or harmless bacteria in a honey bee hive. A phage cocktail, which specifically infects *P. larvae*, could potentially treat a beehive infected with AFB without harming the native fauna or beneficial microbiota of the hive. Phage are natural entities that already exist in abundance in the environment, are not genetically modified, are self-propagating, would decrease the need for chemicals, and would be harmless to bees and humans. Therefore, researching the potential for use of phage therapy in treating AFB is of interest.

No recent isolates of phage to infect *P. larvae* are readily available; therefore, the first step in the research project conducted at the UNLV to develop a potential AFB phage therapy treatment was screening environmental samples for phage capable of lysing *P. larvae*. An extensive environmental search for *P. larvae* phage has neither been done nor is available; therefore, this search included investigating both materials related and unrelated to beehives to discover where appropriate phage are found in nature and how prevalent they are.

Noting the prevalence and sources for any phage found would be useful for phage ecology, and preserving such phage would be crucial in testing the ability for phage therapy. The researchers at UNLV screened both environmental and commercial materials for *P. larvae* phage, characterized the positive samples, and used these isolates for experimental treatments.

Isolation of phage required acquisition of samples, enrichment with the desired host, *P. larvae* to allow propagation of phage capable of lysing the pathogen, screening of each sample for bacteriophage, isolation to

Graduate student, Diane Yost, by beekeeper Karen Bean's infected hive.

Examples of selection of sample materials that were screened for phage capable of killing the disease-causing organism, Paenibacillus larvae.

The tube on the left contains phage that were isolated from the natural environment in a powdered form. The tube on the right contains powdered phage that has been reconstituted in water, and is ready for application to a diseased hive.

A hive frame sprayed with a solution phage mixed with food, causing the bees to spread the phage around the hive as they cleaned the frame.

obtain pure phage lysates, and amplification of isolated phage. After screening 157 samples for phage capable of lysing *P. larvae*, Dr. Amy and her graduate student, Diane Yost, found 32 phage isolates, indicating approximately 20% of the samples tested contained phage that could kill the disease-causing pathogen. The majority of the isolated phage were obtained from soil under and around beehives. Completion of the environmental screening revealed that *P. larvae* phage are abundant in easily accessible environmental sources and can be successfully isolated, suggesting more phage could be isolated should future researchers decide to pursue phage therapy as an option for AFB treatment.

Characterization of the phage was important to evaluate the potential for treating AFB. The researchers determined the effectiveness of the isolated phage in killing different strains of the pathogen, and they selected 14 phage that targeted a broad range of strains of the bacterium to create a phage cocktail suitable for treatment.

Using this phage cocktail, a preliminary experimental treatment was conducted. Honey bee larvae were infected with the spores of *P. larvae* and then treated with the phage cocktail. An increase in survival of larvae was observed when phage were administered in conjunction with spore infection compared to spore infection alone. Phage administered after AFB infection resulted in a 60% increase in survival, and phage administered prior to infection resulted in a 70% increase in larval survival, indicating the potential use of phage cocktails to increase larval survival in AFB infected hives. Ideally, phage cocktails could be a prophylactic treatment to help prevent infection to begin with, but survival did increase when phage were administered after infection as well.

When the opportunity to treat an infected hive presented itself through a collaborative veteran beekeeper in Bellingham, Washington (Karen Bean), an experiment was designed around field practicality to administer a phage cocktail. Through experimentation, phage were preserved in a powdered form, then taken to an infected hive for five bi-weekly treatments. Although complete eradication of AFB was not witnessed throughout the duration of the field treatment, the hive was reported to be clear of signs of the disease four months after the initial dose of phage was administered, and reoccurrence has not been reported. The beekeeper removed the hive frames with the most severe symptoms, so it is a possibility that the combination of both frame removal and phage administration allowed the AFB-infected hive to improve.

The research being conducted at UNLV indicates the possibility for promising new methods to combat AFB, hopefully resulting in a decreased dependence on chemicals and destructive practices. Phage therapy offers a more natural solution, and presents an economical alternative to hive burning or antibiotic use. BC

Toward Treatment Free Beekeeping

Reducing sameness and promoting differences when practical, is good bee stewardship.

Dewey **Caron**

The Bee Informed Partnership (BIP) has been electronically surveying beekeepers for the past several years. Initially the survey was designed to document the overwintering losses of beekeepers. More recently, BIP has included surveys on management and total seasonal losses. Losses overwinter of (largely) smaller-scale beekeepers has been averaging 30% since the Spring of 2007(see accompanying graph). In only one season, Spring of 2012, were reported loses significantly lower than 30%. A mild Winter and early Spring may have been a major contributing factor to reduction of losses during this season.

This past year, total seasonal losses were just over 45% (45.2± 1.4% of colonies) for the nearly 6500 individual beekeepers (6,114 backyard, 233 sideline, and 135 commercial beekeepers) completing the national survey. This surveyed population managed an estimated 1/4th of the total active bee colonies in the U.S. There are several postulated reasons contributing toward these losses, double what beekeepers consider "acceptable" but *Varroa* mites and their transmission of viruses seems to be a key factor.

If we do not wish to treat, can beekeeping still be profitable and colony stewardship fun?

From the management surveys and my surveys of smaller-scale beekeepers in Oregon, it is apparent that backyard beekeepers are either not treating their bees for *Varroa* mites or they are using a variety of non-chemical or organic treatments. Many express a desire to work toward treatment-free bee stewardship. As with any generalities there are exceptions. In my surveys, anywhere from one-third to 2/5ths(40%) of backyard (small-scale) beekeepers report no overwinter losses. However, among the remainder, the overwintering losses are heavy – nearly 50%.

Electing not to treat bees or seeking to move toward treatment-free is one of several possible options in bee colony stewardship. Managed colonies, along with bee colonies in the wild, experience heavy overwintering losses. It seems that no treatment regime works in all instances and some consider that treatment is not the "solution." Consequently Treatment-Free conferences on both coasts have grown in popularity and at state, regional and national meetings there may be one or several talks covering treatment-free. Four new books on top-bar beekeeping, colonies largely managed treatment-free, have been published in the last couple of years.

Tom Seeley, at the 2013 treatment free conference in Forest Grove, OR described his research on where and how bees live in the wild in contrast to what we "require" of those same bees when we site them in our apiary. He believes keeping bees more similar as occurs in nature is smart beekeeping. He is researching why bees in the wild seem to accommodate more to mites and begin to survive in a more balanced equilibrium with mites.

In his forward to Steve Repasky's recent book on swarming (Wicwas Press), Tom expressed this concept as follows:

"When we beekeepers put a colony of bees in a hive, we gain control over where they live and we make it easy to open their nest and do what we want, but we actually gain little control over the bees."

In the wild, escaped beekeeper swarms must find a suitable cavity, grow in strength and store enough reserves to overwinter. They must also deal with mites and other diseases, as not doing so results in colony death. The strong survive; earlier studies by Dr. Seeley estimated only one in five survive the first season. During better weather in the Spring, the bees thrive and emit swarms to repopulate vacant cavities. Surviving colonies grow in strength with Spring resources and seek to store enough reserves to overwinter.

Beekeepers generally wish to improve the odds of colony survival. How do we assist our managed hives to be survivors? As experienced beekeepers know there is more than one way to assist bee colonies. We provide comfortable domiciles (hives), we supply drawn comb to splits and captured swarms, we feed supplemental sugar, we bolster brood populations and we can seek to minimize the impact of predators and diseases.

We can elect to treat for diseases/mites and provide supplemental feed when colonies lack adequate stores or we wish to bolster/stimulate weaker colonies. Not treating or working toward not treating colonies if you are currently treating and wish to reduce doing so, or want to start new colonies without treating are perfectly good options when striving to reduce our continuing heavy bee

losses. If we do not wish to treat, can beekeeping still be profitable and colony stewardship fun?

Keeping bees without or with minimal treatments, a desire of the majority of small-scale beekeepers in my survey experience, lies, I believe, in considering four components – the beehive, the apiary, the bee stock and finally our approach to colony stewardship.

THE HIVE. Our Langstroth hive is considered both the greatest advance in modern beekeeping and yet it probably helped contribute to great epidemics of disease (think the American Foulbrood epidemic in the early part of the 1900s in the U.S. and in the late 1800s in Ireland or Isle of Wight Disease epidemic (often ascribed as due to tracheal mites) in Europe in the 1920's). The increased adoption of Langstroth movable comb hives of course was not in isolation with other advances in beekeeping that may equally have contributed to disease spread and these epidemics. Could the Langstroth hive (combined with how we have changed our beekeeping) be a contributory factor to the current loss epidemic, ascribed as due to a combination of factors but most surely *Varroa* mites and their transmission of viruses?

Treatment–free advocates often champion a different hive, such as top-bar hives. In the last two years, four books on top-bar-hive beekeeping have been published

Top-bar hives are seldom opened (particularly after they are larger), frames or bees are not moved (within or between hives), and treating for mites or diseases or even feeding is not practical.

alone. Top-bar hives are seldom opened (particularly after they are larger), frames or bees are not moved (within or between hives), and treating for mites or diseases or even feeding is not practical (although some techniques have been described to treat or feed). The hive encourages less intervention. A number of beekeepers now include both types in their backyard apiaries and wait the results to see if a different hive makes a difference.

In reality the type of hive to use might be dictated by the intentions of bee stewardship. Not all beekeepers desire or seek large populous colonies with highly interventive management, nor do all beekeepers seek to maximize the potential honey surplus or use their colonies multiple times in planned pollination. Smaller colony populations, heavier swarming and losing colonies is considered part of normal beekeeping.

Although the Langstroth hive is most practical for colony manipulations and larger-scale beekeeping, it is not necessarily the best one for all beekeepers. The Langstroth hive might be better utilized for beekeepers wishing to work toward treatment-free beekeeping by moving frames less, keeping colonies weaker and planned interruption of the brood cycle. So although not necessarily the hive, how we manage the hive, the way we site it and our interventions might be reevaluated if we seek

Pretty, but best for bees?

to reduce treatments.

THE APIARY: It seems clear that keeping bees in similar boxes, all painted white, six inches to two feet above the ground, in neat even rows, without distinguishing identification features (for the bees not the beekeeper) promotes drifting and with it disease and mite spread. Bees in the wild are ½ mile apart in different trees at

Treatment free means using better stock.

different heights above the ground. Drifting and robbing are not common behaviors of wild colonies but they are in our apiaries.

Manipulations, siting, hiving bee colonies in a small area, all with a common bee stock, seeks to make colonies more similar than dissimilar, consequently making treatment intervention more necessary to reduce heavy losses. Distinctive hives (whether all Langstroth design or a mixture of hive types) and distinctive siting in the apiary are practical, non-expensive things we can do to work toward treatment-free beekeeping.

Apiaries with colonies facing different directions, with different numbers of boxes, each distinctly colored or patterned, spaced apart as the site allows, elevated dif-

Colonies well distinguished.

fering distances off the ground or otherwise made distinct from every other nearby hive all represent smart beekeeping and may assist in working toward treatment-free bee culture. Mites, disease, drifting bees and competition all come from nearby neighboring colonies. Reducing sameness and promoting differences, when practical, is good bee stewardship.

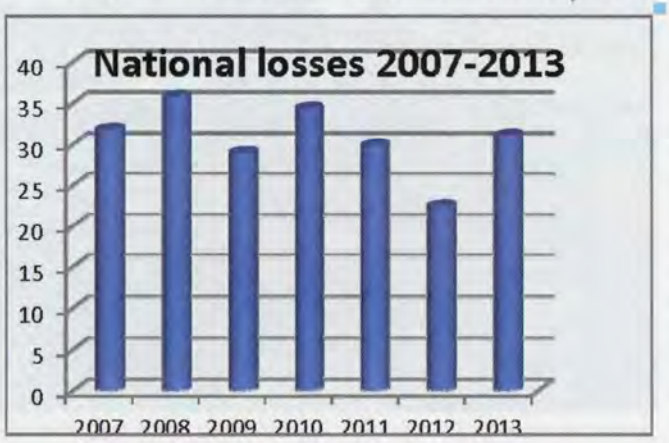
We can read our colonies when we enter the apiary and not open colonies if there is no need to do so. Elevation reduces pest pressure and helps keep entrances more accessible to the bees. A simple yellowjacket trap (where these predators are common) can help reduce this stressor for our colonies. Sunshine reduces *Varroa* and small hive beetle numbers and may help reduce disease pathogens. Think bee comfort and give bees a chance to fight back.

Each unique and distinct.

BEE STOCK. We can train bees to visit certain crops and to detect landmine chemicals, even certain human diseases. We have bred a better alfalfa pollen collector, bees that are more resistant to AFB disease, bees that are more hygienic (and fight mites more effectively), bees that are more productive and we have bees that use less propolis. We have imported bees into the U.S. that are better defenders against *Varroa* mites. Why then, do we persist in purchasing bees from the same source to replace overwinter losses or simply divide survivors and allow them to raise their own queen?

Everyone agrees that our eventual mite "solution" will be bees that can live in better harmony with mites. We have bees that, to a limited degree, resist mites. It is possible for individual beekeepers to breed from survivors that have better mite resistance. Bee *breeders* are working toward the better bee but we still have a ways to go. If we are going to work toward treatment free or do not wish to treat our bees for mites, it seems clear we will continue to suffer heavy losses (30+% annually overwinter, and 45% annually, from our national surveys).

Our role should be to support those programs and purchase those queens/bees that are the better stock. Treatment free means using better stock. As with much of beekeeping there is no one answer, no one stock that meets all our needs, including the ability to resist mites. For some beekeepers the better stock might be Carniolan bees, Russian queens, or hygienic stock, coupled with seeking to raise our own survivor queens. We need to speed the development of bees resistant to mites.



HIVE MANAGEMENT: We can change our apiary and make our hives look different for the occupants, less carbon copy-like, plus we can seek a better, more appropriate stock but it is our management that we can most easily change if we wish to treat less or not at all.

What can we change? Nothing will be easy – change takes us out of a comfort zone. We can seek to raise drones as a mite trap and cull capped drone brood as management. It can help reduce the growing mite population. It is work. We can seek to keep colonies growing by dividing colonies and introducing the improved stock. Growing colonies give the bees the opportunity to "grow out" of their mite problems. This too is work. We can seek to inspect and understand the needs of our individual colonies rather than seek to make them all the same. Less transfer of frames (unless we move honey to help bolster colonies with fewer stores to improve overwintering success) is better stewardship.

Quicker, more directed inspections can be useful as well. Opening the colony is a stressor for the bees. Disruption of the normal brood pattern stresses bees. We do not need to see the queen to know our colony is queenright – we only need to see normal egg laying and the pattern of the brood nest to confirm all is OK in the colony. Simple may be better.

Larger-scale beekeepers feel aggressive *Varroa* treatment necessary to have sufficient colonies to be economically viable. Mite numbers can explode in colonies in the early fall leading to colony crash in early spring. Working toward treatment free may necessarily involve keeping mite populations under control in concert with other measures to reduce losses. There are alternatives for mite control and some treatments may be more "acceptable." They are not as easy to use and may not provide as effective control of *Varroa* but could help make a difference.

Not all beekeepers need or desire large populous colonies. Smaller, growing colony populations and keeping weaker colonies, with fewer inspections, may better serve the beekeeping goals of many smaller-scale beekeepers. No single change will solve all beekeeping problems but we should evaluate how we keep our bees and what we do to them as a first step toward less interventive, more successful beekeeping. BC

TOO MANY DRONES

We've been doing away with drones for ever, it seems.

Jim **Thompson**

Many times I have looked at a hive and thought that this hive has too many drones. Then I remember the items that are available to confine, trap or eliminate drones. So it isn't an unusual observation that a hive may have a lot of drones. What are the causes of a lot of drones? What is a normal amount of drones to have in a hive? Is having a lot of drones a good or bad practice?

As a beekeeper interested in honey production, a lot of drones in a hive presents a detriment because the drones take up space, eat a lot of honey, and do not perform the duties within the hive. A drone's existence depends on mating with a queen and providing some morale.

In the Fall of the year the workers realize that most of the drones are no longer required and force the drones out of the hive. However there still may be a token amount of drones within the hive during the Winter months.

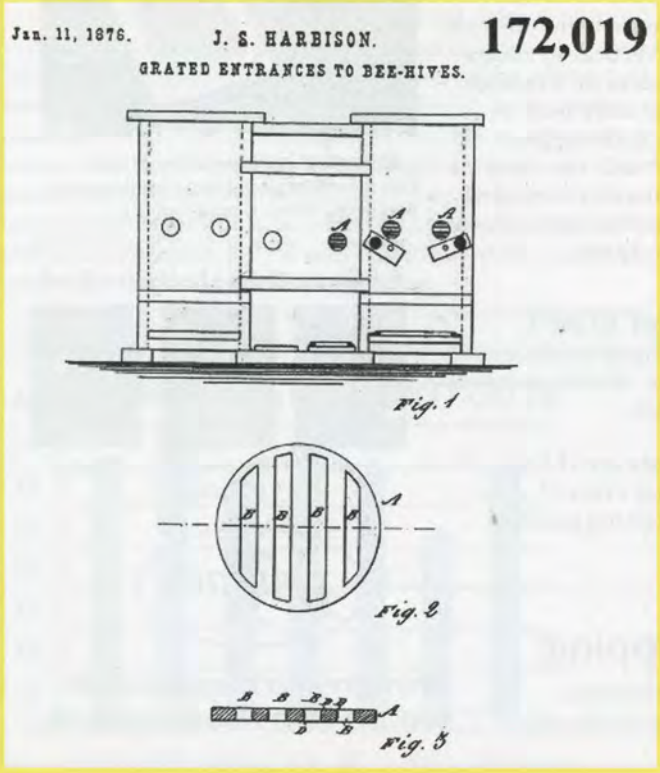
Drones develop from an unfertilized egg. A queen lays an egg that develops into a drone by selecting a larger cell that doesn't compress her abdomen. Many times when comb is damaged by mice and other pests causing an open space, the bees will rebuild the area with drone cells.

When a hive becomes hopelessly queenless, there may be a worker bee who will assume the duties of a queen. All of the eggs that the worker bee lays will become drones and she is called a laying worker. A queen that runs out of semen lays eggs that develop into drones is called a drone layer.

When a queen goes out on her maiden flights, she mates with 12 to 20 drones over a period of two or three days. The volume of semen stored is less than the amount used when artificially inseminating a queen. Many beekeepers advocate changing a queen yearly to assure that she won't run out of semen. I have found that the queen's best production is in her second year. I have also witnessed an observation hive having the same queen for seven years. Yes, she swarmed twice and was recaptured. It was the same queen, as I marked her.

When people believe that there are too many drones in a hive, they use entrance guards, queen and drone traps, cut out drone cells, or eliminate frames that have many drone cells. Anytime you put a restrictive device on a hive you have to remember that not only does the device keep insects in the hive but also prevents other insects entering the hive. You also have to make sure that the hive does not contain other holes, cracks, or rotted areas that could be used for an alternative exit or entrance.

In 1876, J.S. Harbison patented a grated entrance. The entrance was on the front of the hive but located up from the bottom board. Another entrance guard was developed in 1907 that used zinc excluder material. The

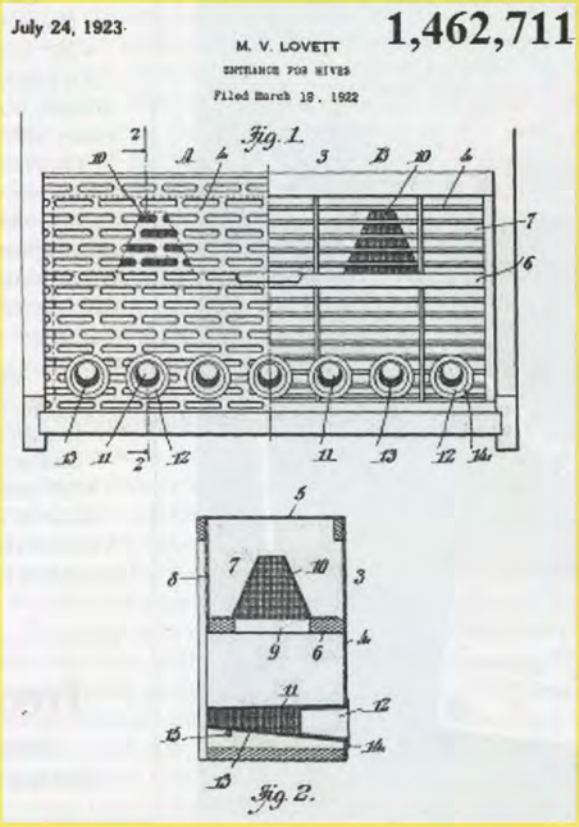

Jan. 11, 1876. J. S. HARBISON. 172,019

GRATED ENTRANCES TO BEE-HIVES.

Fig. 1

Fig. 2

Fig. 3


July 24, 1923. 1,462,711

M. V. LOVETT

ENTRANCE FOR HIVES

Filed March 18, 1922

Fig. 1.

Fig. 2.

entrance guards of the 1950's used the Chrysler steel excluder material.

When a beekeeper uses a pollen trap on a hive the trap prevents the queen and drones from using that entrance. Most pollen traps provide a cone device where the drones may exit a hive and relieve the congestion. A queen could also use this exit, so occasional monitoring is necessary to assure that the hive is queen right.

The queen and drone trap was developed in the 1920s. It has an entrance guard beneath an area that holds queens and drones that enter through upright cones. Once the bees are in the upper area the larger bees cannot reenter the hive nor fly. There is a metal slide on the later models to allow the beekeeper to open and let the bees return to the hive. However the main intent of this trap is to catch drones. The early models of this trap were available for eight and 10 frame hives and had wire cones and zinc excluder material.

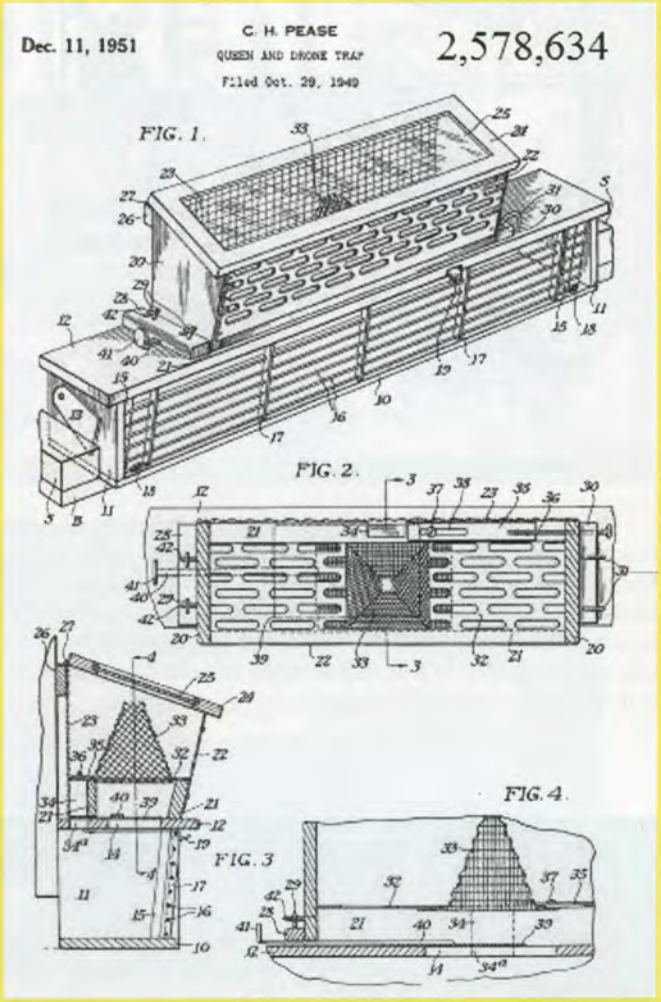
Traps made in the early 1950s, had a combination of zinc excluder material and Chrysler steel. The later models of this type of trap have the zinc movable slide, Chrysler steel excluder material and plastic cones.

An easy method in reducing the number of drones in a hive is to shift those frames that contain drone cells to the position next to the hive wall. Once the developing worker bees that are on these frames have emerged, the frames could be removed. The beekeeper using this method tries to keep frames with worker cells in the center area where the queen is laying eggs.

Varroa mites present another problem. Because it takes 28 days for a drone to develop, female mites prefer to lay their eggs in drone cells. This allows more mites to develop than in worker cells and could be used as a form of mite control. When the bees have sealed the drone cells, the frames are removed and frozen. You are not worried about killing the developing drones as they have a small contribution to the hive. If drone cells were not provided, the mites would occupy regular worker cells. Often the honey bee pupas that get used as food by the developing mites are deformed with K-wings or lopsided. The frames with dead mites and drones are put back in a hive for the bees to clean and the cycle is begun again. This practice does not assure you that the drone population is going to be near zero. It also relies on the queen laying eggs in drone cells rather than in worker cells. Bees will always find room for drone cells and if it is not in the frames, it will be between the frames.

Another approach to eliminate mites is to use the Mite-zapper frames which are electronic plastic frames. When the bees have filled the cells with drone brood, the beekeeper may hook up a 12 volt battery and kill the mites on the drone brood while the frames are in the hive. When the electricity is disconnected, the bees may clean up the frame and you are ready to repeat the process. I am concerned about the frame space that is reserved for drone brood and the electrocution of the queen or worker bees accidently. Whether you use the freezing or electrocution techniques, you might consider a strain of honeybees that have hygienic behavior.

Some beekeepers use drone brood to raise drones to be used in a queen rearing operation. This means that you should have three distinct yards, a drone development yard, a queen mating yard, and a queen development yard.



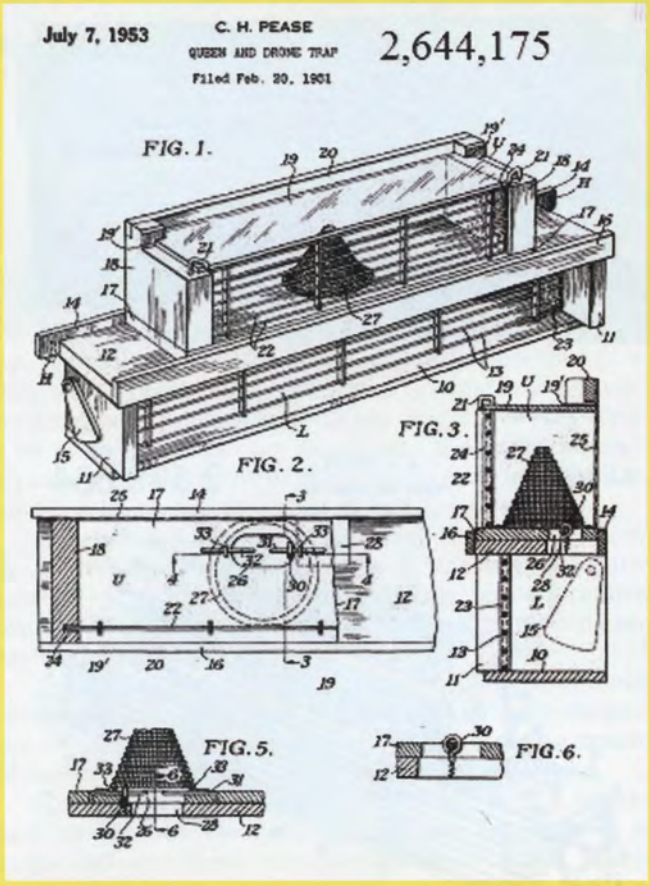

July 7, 1953 C. H. PEASE QUEEN AND DRONE TRAP Filed Feb. 20, 1951 2,644,175

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 5.

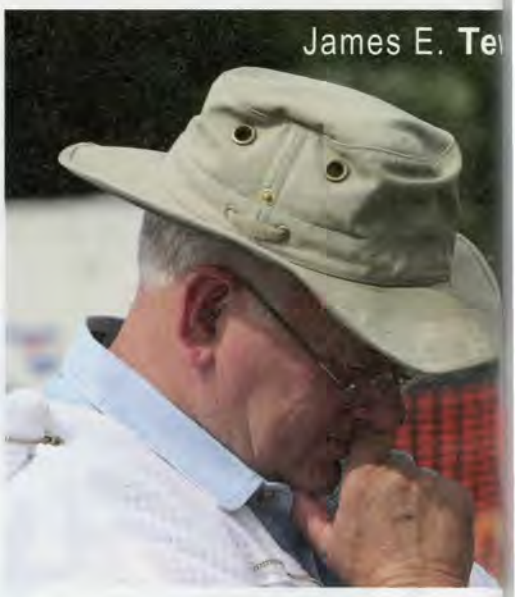
FIG. 6.

If you look at the mathematics or efficiently of wax usage, you suddenly realize that bees can store more honey into a drone cell than in a worker cell. There is less beeswax used per frame so it is beneficial to use drone comb in honey supers. This practice might cause you to use queen excluders or full supers of honey to keep the queen out of the honey supers.

The number of drones or the use of drone foundation depends upon your activity. If you are striving for honey production few drones are needed within a hive. Some methods of mite control require quite a few drones. If you are raising queens, even more drones are needed than in a mite control operation. BC

Speculating About Drones

(Probably) Far more complex than we realize



Articles past

Through the years I have occasionally written various article series that were in some way closely related to each other. A couple of examples of these series are, *"The Solitary Beekeeper"* and *"Bee Culture's Beeyard,"* but for the past few years, I have been writing pieces that were simply on my mind. Increasingly, I have observed that over time I have gravitated to pieces about which I know little but they stimulate discussion. Maybe I should write a series along the lines of *"The Blind-Guess Beekeeper"* or maybe *"The Pot-Shot Beekeeper."*

I increasingly feel that there is more to drones than we realize and, yes, it's a blind guess on my part. I have precious little science and only a few personal incidents to support my feelings. As I have done in recent articles I am writing *above my pay grade* so I need to clearly say that this present piece is a conversation and not a litany of documented recommendations.

Look in any book

Unless you've found a rigorous book discussing bee biology, most bee books and information sources will report that drones are a drain on colony resources and that the astute beekeeper should keep the colony drone population to a minimum. The odd thing is that, in a simple way, such a recommendation is probably correct. Drones are large bees that are fast, long-distance fliers, and they, no doubt, have hearty appetites.

Some speculations from a *Blind-Guess Beekeeper*

Well, exactly how much honey does the entire drone population of the colony eat per season? Though I didn't look very hard, I could not find where anyone has estimated that quantity. This absence is interesting because we have historically used drones' food consumption as the reason for annihilating them.

I used concepts presented in *Fermi's Piano Tuner Problem*[1] to generate a crude estimate to that question. Obviously, I had to estimate everything. Any of you could readily argue with my estimates and form your own. Then I can argue with your estimates. Here are my global guesses.

- A *high* estimate of 1200 drones per entire non-winter season would eat a maximum of five pounds of honey. In many colonies, that estimate can be halved to 2½ pounds and even that will probably be high.
- I project that over a year, a typical colony of 50,000 bees will require a total bee output of 124,000 bees. That number of bees will require an average of 126 pounds of honey. If that is approximately correct, drones are consuming 2% to 4% of the colony's basic honey stores. Pollen requirements are not considered in these estimations.

I based the drone consumption at the general level of 20,000 Ohio wintering bees requiring 75 pounds of stored honey. This consumption rate is estimated from stored honey. It is more difficult to estimate how much collected nectar bees consume before it is ever converted to stored honey. For instance, we never hear about apple or pear honey crops. All that early fruit nectar is consumed by bees and/or fed to developing brood.

The crude basis for my estimations

I divided the year into the following three seasons:

Winter
Spring/Summer
Summer/Autumn

- I estimated that the *Winter season* colony is composed of about 20,000 bees. (15,000 bees, plus approximately 5000 early Spring/late Winter replacements.)
- I estimated that the typical *Spring/early Summer* colony would average about 30,000 bees with an estimated 30% replacement rate for a total of 39,000 bees.
- I estimated that the typical *Summer/Autumn* colony would average about 50,000 bees with an estimated 30% replacement for a total of 65,000 bees.
- I projected that over a year a typical colony of 50,000 bees would require a total bee output of 124,000 bees.

In Ohio, a range of 60-90 pounds of honey would be required for a colony to pass an average Winter. I used 75 pounds as an average amount that an Ohio colony will need to survive the *winter season.* Therefore, over the *winter season,* each of the 20,000 bees will eat ⍰ of a teaspoon of honey. Since drones are ¼ to ⍰ larger than workers, I added ⍰ teaspoon consumption to develop a guess that drones will eat ⍰ of a teaspoon of honey in their life.

Typically, a colony will have up to 600 drones. I used that high number even though most colonies will never have that many drones at any given time. Since drones die and are replaced, I guessed that a healthy colony will produce 1,200 drones per year. If they eat .004 pounds of honey each, that will be five pounds – *maximum* – of honey consumed by

[1]See: www.grc.nasa.gov/WWW/k-12/Numbers/Math/Mathematical_Thinking/fermis_piano_tuner.htm

drones. My estimate does not include the colony expense of incubation energy and pollen required to nurture the developing drones.

What's the point here?

It seems to me that we need better reasons for destroying drones other than food store consumption rates. While these estimated rates are meaningful, they are not anything like full supers of honey or anything near that amount. If a colony, on seasonal average, requires 126 pounds of honey for its own use, drones are consuming 2% - 4% of the colony's honey stores. Maximally, 96% - 98% of the honey crop is unaffected by drone food consumption[2]. You, as the individual beekeeper must decide if that estimated percentage is enough to destroy drones to save that part of the honey crop.

Drone elimination has to be significant

Food consumption by drones must be significant; otherwise, why would worker bees kick them out in the Fall? I can think of one major reason: queens are not produced in the Winter months in temperate climates. It's too cold for them to fly. Drones are simply not needed. So it has nothing to do with stored food. I have no science to support this conjecture, but it seems to make sense. But it also makes sense that bees kick drones out to save Winter stores. Where is the truth?

Winged DNA capsules

(This is where I am far in front of my educational training and I admit it.) What if the issue for the colony is not whether or not queens are available nor whether or not food stores are being used by unemployed drones, but what if the colony is valuing drones because they are winged DNA capsules that propagate the colony's genotype (immediate family lineage) far beyond the boundaries of the parent colony? In essence, drones are an alternative to mated queens and swarms for distributing the colony's genetic material. Ironically, it's not critical that the parent colony survives, but rather it is critical that the genotype (essentially, the colony's family characteristics) survives.

Natural colonies

Colonies in a tree cavity can be a good example of a genetic strain trying to improve its chances of survival. Such feral colonies are not naturally motivated to produce several hundred pounds of honey, but rather they would like to accumulate sufficient food stores and swarm as often as possible. A single natural nest that is in a one-cubic foot cavity can possibly cast three swarms. From a genetic perspective, that colony then has four chances of being genetically viable the next Spring.

If the parent nest or any of the other three-swarm nests cannot survive, they will die out and wax moths will prepare the cavity for the next inhabitants that will just simply try again. Maybe the next season will be better and the flow will be stronger. Maybe the next Winter will be milder. Natural nest cavities are always in short supply. Is that why bees tolerate our artificial hive domiciles as well as they do? Do our artificial hive domiciles simply provide bees with a chance to survive another season?

Winter drones (Not the musical group...go ahead...Google it.)

You will be hard-pressed to find a general beekeeping text that does not tell you that drones are eliminated in the Fall months. They are. I have seen it happen and have photographed the event. From a male perspective, it is a sad and sorry situation. During late August, sluggish drones cluster on the landing board, only to be accosted by hostile worker bees every now and then. On the ground, in front of the colony, drone corpses become nothing more than food for yellowjackets, ants and skunks. Within a few days, it's over. The drones are dead. The autumnal drone massacre is over. Most bee books tell you this bee fact.

But over and over again you have kept telling me that there ***were*** drones in wintering colonies. I listened politely and never doubted you, but thought it must have been a biological fluke. There is no biological or behavioral need for wintering drones.

Then I saw one. On the second week in February 2014, during the coldest Winter that Ohio has experienced in decades, I saw a seemingly healthy, viable drone. It had become wedged in the top entrance. It was a pristine drone with no frayed wings and a full complement of hair. It did not appear to be a drone from last season. It was magical. I have been doing this bee thing for a long time, but I have never seen a drone in Ohio colonies in hard Winter. That would mean that in below sub-zero weather (on several nights, it was 12° below zero) bees had begun producing drones at about the same time they had begun producing workers. I was stultified but not so much that I did not photograph it for your review.

Then, a week later, during a

A dead drone that only recently appeared (Feb. 24, 2014).

[2]I need to be crystal clear. I am estimating a lot of complex variables. Nothing is exact here. I am surprised that my estimations suggest that an estimated population of 1200 drones could actually eat as much as five pounds of honey. That seems like a lot, but it is an estimate for a nine-month season.

I sense that this colony knows what it is doing.

cleansing flight event, I saw a second one on the front of a different colony. Again, it was exhilarating. What are these bees and drones doing? The feeling of seeing Winter drones is a lot like finding arrow points. When you least expect it, one shows up.

So, what is with Winter drones? At this time of the year, there is not an unmated queen in all of Ohio, and yet, the colony has designated resources to producing male bees. Are the bees making costly mistakes or is there a reason for these off-season drones *(well, off-season to me anyway)*? Is the queen off her rocker?

This is not a colony mistake

Thousands of wintering bees apparently had abundant opportunities to stop the production of the two drones that I saw; yet their development was not stopped. Why?

Is genetic survival so important that colonies address it in the coldest part of Winter? The two colonies where I saw drones are not strong colonies and could still die this season. Are these two colonies' genetic chances improved by producing drones that could possibly mate with early virgin queens? Is this a superior route compared to trying to survive as a normal colony? I don't know. This is not science, just conjecture; but there is a logical bee reason. These Winter drones are serving some colony need that I presently do not understand.

Laying worker drones

Colonies that are hopelessly queenless can only produce drones. There is no seminal stock available so the drone-laying queen and ovary-enhanced workers have no choice but to produce undersized, sexually viable drones. Yes, that can be the basic assumption to make, but I feel that a more sophisticated event is occurring. I mean, if the situation is hopeless, why lay eggs at all and why lay multiple eggs in one cell? Even if the very rare diploid egg did happen to be produced, there has never been any evidence that laying workers were able to make a queen from it. Indeed as weak as the laying worker colony has become, there is practically no way for the ailing colony to recover before Winter. Have these queen-deprived bees all gone brain-daft?

I wonder if the production of drones is the only way to get genetic material out of this soon-to-be-dead colony. The drones from laying worker colonies are frequently out-of-season and undersized, but these drones carry the dying colony's genetic material. Maybe – just maybe – these desperate drones will successfully find an unmated queen so this genetic family can survive another cycle. Otherwise, all is lost.

No proof – no science

I have no proof and no science other than the rationality of healthy and productive bee behavior. I offer that drones are not some nearly useless colony artifact in need of constant reduction, destruction and elimination due to their perceived laggardness and wastefulness. The colony values these disposable reproductive vehicles highly. Drones are a colony reproductive resource that has been undervalued by beekeepers. Are our poor quality queens too inbred or are our drones at fault? Colonies – both healthy and unhealthy – are crazy for drones. I sense that we, as beekeepers, need to nurture them rather than cut them down with a hive tool. 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.***

WHAT YOUR MENTOR FORGOT TO TELL YOU!

Ed **Simon**

The conventional wisdom about beekeeping is that there are no pat answers. Whatever works for you is the right way for you to do something. Of course, most beekeepers are never satisfied and are sure there is always a better way of accomplishing a task or solving a problem. Consequently, if you ask five beekeepers the best way to accomplish something you get seven or more answers. None are wrong they just different, they are what works for that beekeeper at that particular time. Here is a collection of hints that may help you in your beekeeping endeavor.

Ants – They will find an easy meal.

Cinnamon sprinkled around the feeder rim and on the inner cover takes care of the ant problem. (Most of the time)

Attaching Wild Comb – Attaching to a frame

After you have collected a wild colony and need to attach the wild comb to a frame, be sure to keep the top at the top. Comb cells have a definite slope to them. The outer edge of the cell is higher than the bottom of the cell. When you attach comb to your frame be sure you keep the top at the top.

Cows/Horses – Hives make good scratching posts.

Cows are curious and like to scratch themselves. A bee hive is just about the right height. Unfortunately they are not very stable when a 1200 pound cow has an itchy butt. Horses also like to scratch. If your hives are in a pasture or where a farmer may release cattle into the area then string an electric fence up to keep them away from the hives. Usually the farmer will let you tap into their electric fence to power your hive fence.

Crystallized Honey – Mix it up

Creamed honey is honey that has been forced to crystallize in a controlled state. When starting a new batch, incorporating it into the liquid honey can be a tiring process. Instead of mixing a couple of pounds of starter culture into 40 or 50 pounds of honey, start by mixing it into a small amount of honey (four to five lbs.) until it's thoroughly mixed with no lumps. Then add the small amount to the larger amount.

Entrance Reducer – Openings up.

When installing a wooden entrance reducer, make sure the opening is up. That way the entrance will be least likely to get clogged with dead bees and debris. This is very important when closing the hives up for the Winter.

Entrance Reducer – They never fit correctly.

When building a wooden entrance reducer, make sure the entrance reducer is smaller than the smallest opening you have on a bottom board. Then use a wad of

tight fit of the reducer.

Extraction Clean Up – Let the bees do the work.

Extraction is a sticky mess and your helpers have a tendency to disappear when it's clean up time. Move your equipment out of the extraction area and let it set for a couple of days. All the junk honey that you would normally wash away will be reused by your bees. Wipe up the thicker/deeper puddles of honey with a wet rag so the bees won't drown and then hang the rags up for the bees to clean the honey off. Cover the equipment so if it rains the bees can still get to it but the rain can't wash all the honey away.

The removal of honey from capping is easily accomplished by spreading the capping wax out on a cookie sheet (I use commercial cookie sheets) and letting the bees reclaim the honey. It's best to take them in at night as the raccoons also like the honey. As a side note, a five gallon bucket of moderately packed capping wax will yield about five pounds of cleaned wax.

⇨

Feeder Jar Holes – If they are too big they'll leak syrup.

When punching holes in a jar lid to make a jar feeders use a brad gun with 18-gauge brad. The 18-gauge brad is a nice convenient size for a feeder hole. The brad gun allows for making quick and non-finger smashing hole. Place the jar lid on a soft surface like a piece of insulating foam, so the brads won't nail the lid to the workbench. Removal of the brads is then quite easy. If the holes are to big then use a nail and hammer and put the lid on something solid so just the tip of the nail penetrates the lid.

Frame Feeder – Bees will drown or get stuck in honey.

When using the one or two gallon frame feeders or division feeders that sit inside a super, add straw before filling the feeder. The straw provides a foot hold for the bees. It will allow them to escape if they get stuck in the syrup. The straw has to come to the top of the syrup.

Hive Air Flow – A stick will do it.

Placing a stick or a piece of wood between the inner cover and the top cover will allow a better flow of hot air from the hive during the Summer months.

Hive Placement – Do not place your hives in straight rows.

If hives are placed in a row, the end hives will eventually have more bees. If you have your hives in a row, your bees will tend to drift to the hives at the ends. Place your hives at irregular distances and at angles to one another. This past year I was standing by the end hive in a row. Within 30 seconds there were bees returning to me – not to the hive.

Hive Placement – Not in a damp valley.

Hives should not be placed in an area where there is a lot of fog or the possibility of a creek overflowing. A friend looked out his kitchen window one morning and saw the bottom brood box of one of his hives under water. Not a good thing to see first thing in the morning. It makes for a bad day.

Honey Storage – Five gallon pails - Do NOT use pails that previously stored dill pickles.

Five gallon pails are very easy to use and a great way to store honey. If you fill them full they weigh about sixty pounds. Before placing the lid on make sure the rubber gasket is in place. Then put a piece of food storage plastic (Saran Wrap) over the top before sealing the pail. This will keep the honey off the top of the pail when you move it. It is also easier to scrape clean than the lid of the pail. Sixty pounds is a lot of weight for the more mature (politically correct) person. Each pound of honey weighs about 12 pounds. Reducing the volume to four gallons can make lifting the pails a lot easier.

As was noted at a bee club meeting, when selecting pails for honey storage do not and I repeat do NOT, NOT, **NOT** use pails that were used to store dill pickles.

Hive Stand – Keep your stands low.

Be careful when placing your hive stands. Think about the following items.

The higher your hives, the higher your supers are when you want to remove them. When full they weigh about 50 pounds each. You do not want to climb a ladder to retrieve a super.

Hive Stand – Make sure your hive stands have a solid base.

Spend the extra time to insure your hive stands are on a solid/level base. You don't want them to tip over as you add hive bodies and supers.

Honey Wax Removal – Wax floats on honey.

After extracting is finished and your new honey has sat for a while, the wax and other debris will float to the top. To remove this scum, use a piece of plastic food wrap. Lay it on the surface of the honey and pat it down gently. When you carefully remove it, much of the wax and other debris will come off with it. I haven't tried this yet but it sure sounds promising.

Inner Covers – The thick and thin of it.

Most inner covers have a thick rim side and a thin rim side. The thick rim side faces the bees during the Winter. This allows the bees to navigate above the frames. The thin rim side faces the bees during the Summer. In theory, the thin side is small enough to the bees won't build comb between the frames and the inner cover.

Inner Covers – Why use them?

Inner covers allow the top cover to remain loose. The construction of the top cover with its dropped down

sides would be very difficult to remove if it was glued down with propolis or comb. By using the inner cover you can remove the top cover with ease and the use a hive tool to un-stick the inner cover.

Installing Bee Packages – They will miss the hive.

Even though you wet down the bees before shaking your new package into the hive, they seem to miss where you want them to go and spill out over the sides of the hive. To eliminate some of this, use an empty hive body and place it on top of the target hive. Then keep the shipping box inside the top hive body while shaking the bees into the bottom box. This will help channel the bees into the lower hive box. You can then use your brush to move the bees clinging to the top box down to the hive.

Marking Queens – They have a tendency to fly away.

Bees have a tendency to move up and to the light. When marking a queen, use this trait. First convince your spouse that queens don't sting. Then hint that the bathroom is an excellent work area. Next ensure her/him that if she escapes you can find her before the next shower.

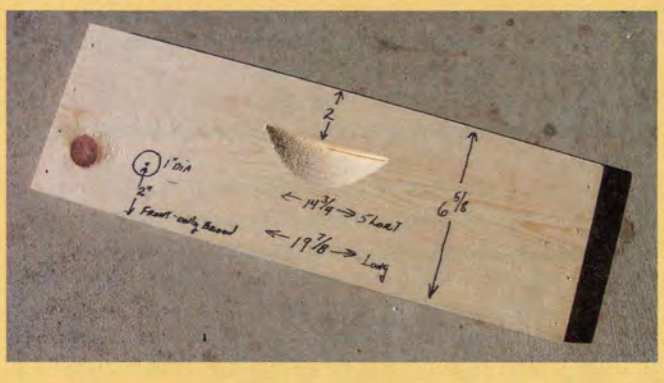
Close the bathroom door, remove the curtains from the window and turn off all the lights. Then use the window sill as a workstation for the queen marking. From then on everything is fine.

Note: Unless you are concerned about the date/year of the queen, then yellow or white are easy colors to find. Red or green on a brown background is very difficult for a person that is red/green color blind to see.

Note: Be sure to allow the marking to dry before releasing the queen backt o the colony.

Measurements – Keep them handy.

Keep a "Story Board" in your work room with all the measurements you need to build your equipment. Here is the one I have for super measurements. It hangs directly above my saw.



Mouse Excluder – Keep them out.

When you winterize your hives and you are unable to find any ¼ inch hardware cloth to use as a mouse excluder. Cut up plastic queen excluder. Unfortunately it will also stop drones from leaving the hive. So when the workers drive the drones out they will be unable to exit the hive.

Mowing Grass – The bees really get upset.

It only takes one time of mowing the grass in front of the hives to convince you to not do that again.

Unfortunately, your spouse (notice the gender non-specific reference) requires the grass to be mowed.

Old shingles to the rescue – Placing an old but serviceable tar paper shingle in front of the hive will at least allow you to not bump the hive when mowing. A normal shingle will normally suffice. If more depth is needed then really go overboard and use a second shingle. You will still have to mow the grass but you won't have to get as close to the hives and possibly bump them with the mower.

A package of unmatched shingles is cheap at the local building supply store.

Nosema Dead Out – Bees can't wait to go.

In the Spring and you found a hive that has a severe case of nosema, clean it out the best you can and it should be safe to use it. Then when you put bees in it, treat the syrup with fumagilin-B. Hopefully that will stop it from recurring while the bees clean up the rest.

Note: If the comb is over three or four years old then it is best to replace it.

Paper Towels – Indispensable

Cheap bulk paper towels that can be tossed away can save you an unbelievable amount of time compared to cleaning out cloth rags.

Painting – Extend the life of your woodenware

When painting a group of woodenware, use a paint roller to apply the paint. Then smooth it out and work it in with a brush. The time saved in not dipping the brush can be significant.

Painting – Cheap rollers

Watch for sales on the cheap rollers. Buy the cheapest you can get and keep them handy for when you need them. It's easier to toss them in the trash than it is to clean them. A little fuzz on the hive does not stop the bees from using it.

Painting – Multiple coats of paint

After using a roller to apply the first coat of paint to the wooden ware, wrap the roller in a plastic bread bag. This will keep the paint on the roller from drying out and allow you to use the roller for the second coat.

Pasture Gates – They are there for a purpose.

If you have your hives on a farmer's property, pay attention to the gate positions when going to the hives. If there are animals in the field, be sure to close the gates. If not, then make sure the gate is in the same position when you leave as it was when you got there. A loose animal will lose you your apiary privileges with that farmer (and all of his friends).

Removing Supers – Less sticky supers

The burr and cross comb you didn't cleanup has come back to haunt you. Even if you did keep things orderly the bees have a way of getting ahead of you. Besides it being a mess you lose honey. To help eliminate this problem, try this procedure.

The day before you remove the supers for extraction swap and reverse the supers on each hive.

Remove each super. Place then in order and all the fronts facing the same direction.

Reinstall the supers starting with the first removed. At the same time make sure the front of the next super is now above the back of the previous super. This placement maximizes the possibility that torn comb and runny honey will not be replaced back in the original position.

The bees will clean up all the loose honey by the next day and the removal should be a lot less sticky.

Swarms – It will happen – be prepared

Be ready. Have an extra brood box or a nuc available to store the swarm. A cardboard box will do in a pinch. If you can, it also helps to have to prepared site to set the swarm. It doesn't hurt to have an extra stand leveled and ready to go.

Skunks – They like bees.

But they can't reach a bottom board that's 18 inches off the ground. Raise your hives and skunks will move on down the road.

Smoker Ash Disposal – Don't start a fire.

Your smoker of ash residue could still be hot. Dump it into a metal bucket. Any still burning fuel can smolder safely without burning your barn down or catching your neighbor's hay on fire. To extinguish the smoker and save some of the fuel, use a cork to smother the fire or lay it on its side to stop any draft.

Smoker Cleaning – Your lid never goes on easily due to soot and creosote buildup.

Remove the bottom grate and clean. Don't forget the holes in the bottom grate

Burn it out – Use a MAP or propane torch to start the residual creosote afire. Then use a scraper or screwdriver to chip the rest away.

Use a wire brush to loosen the soot – After cleaning the big chunks out of the smoker, use a 3" to 4" wire brush on an electric drill to remove the remaining soot and creosote.

You'll probably never get it completely clean but, at least you can put the top on easier.

Smoker Fuel – If it burns then you can probably use it as fuel.

Everyone has their own favorite fuel. I use dried cow manure mixed with landscaping shredded wood and pine needles. The hard part is collecting the manure. You have to be fast with the smoker when the cow decides to void itself. A second method is to invade a pasture with a wagon and a shovel and get the not so fresh manure. After drying it out on the patio and chopping it into small pieces, store it in the ever present five gallon buckets. Other forms of fuel are: Jeans, Pine cones, Pine needles, Rags, Sawdust, Wood chips, Landscaping shredded wood and bark and anything else that burns. Try for something that is cheap and easy.

Smoker – Easy start.

If you have trouble the conventional way, use a propane or map torch.

Warning: Do NOT use artificial propellents.

Temperature Requirements – Thermometers get sticky

One of the most used tool I have in my toolbox as an infrared thermometer with a laser. It will allow you to take the temperature of honey, wax or anything else without having to clean it afterwards. To take a temperature, you just aim it and pull the trigger. Three seconds later the temperature is displayed on a screen. No mess no fuss.

Wax Cleanup 1 – Wax is almost impossible to remove completely. Use a paper towel and place it between the iron and your clothes with wax on it. Press the cloth through the paper towel. The towel will absorb the wax when it has melted. It may take a couple of passes to remove most of the wax.

Wax Cleanup 2 – A 300 – 500 degree Celsius (centigrade) heat gun and cheap paper towels will clean up the sticky wax. First remove as much wax as you can with a scraper. Then warm the wax a little bit with the heat gun. Use the scraper to remove more wax once it is loosened. As a final pass melt all the remaining wax with the heat gun and wipe it with a clean paper towel.

Heat guns are available at all hardware and lumber supply stores. A hair dryer will do in a pinch. But most hair dryers don't get hot enough to heat the underlying metal or wood for an easy wax removal. They are also not built for continuous use. Spouses have a tendency to get upset when you ruin their hair dryer.

Wax Molds – How to form wax cakes.

Cheap and readably available wax molds are:

A. 1 oz. – Mini cupcake mold (look in the Salvation Army Store)
B. 1.5 oz. – ¼ cup – Cupcake baking pans (look in the Salvation Army Store)
C. 8 oz. – 1 cup – Butter containers.
D. 20 oz. – 2 cup – Small baking bread or meat loaf pans (look in the Salvation Army Store)
E. 52 oz. – 6 cup – Larger bread or meat loaf pans (look in the Salvation Army Store)

Be sure to use a releasing agent when forming wax cakes. After they cool you can usually pop them out.

Wax Moths – How to stop them.

Wax moths don't seem to bother supers that are stored where it is freezing. I have kept my "DRY" and some "WET" supers in a barn with no problem. Of course it gets to 20 degrees below zero here in Minnesota.

Weight of Honey – A quick easy way to estimate the weight of honey.

Honey weighs about 1.5 times the volume of the honey.

A gallon of water weighs about eight pounds. A gallon of honey weighs about twelve pounds.

Another conversion that is convenient is that honey weighs about 1.5 times the volume of water. A good example of this is the standard honey bear. It holds eight ounces of honey or water by volume. But it is considered a twelve ounce honey bear (by weight).

Weight of Boxes – A generalized weight for standard bee equipment

55-60 lbs	Fully filled nine frame Medium Super
12 - 18 lbs.	Wet nine frame super (After extraction)
90-100 lbs.	Large 10 frame brood box

What your mentor forgot to tell you about beekeeping. These hints and shortcuts have been collected from experienced and neophyte beekeepers. Additional hints would be appreciated. Please send then to: **Ed@TheBeeShed.com.** BC

Let's Make A Meadow

Randy **Ferguson**

We all know that our honey bees love a wide variety of flowers, weeds, shrubs and trees for forage, and more and more of us are interested in establishing native meadows. These might be small, postage stamp plots for urban and suburban colonies, or larger, more expansive fields that have been restored from crops or fallow fields into vast, waving buffets of bee happiness.

Though our honey bees may not be natives themselves, they love many native flowers and create some of the tastiest honey from them. Couple that with the list of advantages natives hold over introduced species, and it makes the decision easy.

Many plant species that are well suited for honey bee forage provide benefits beyond simply attracting pollinators. They might attract parasitoid and predator insect species that attack orchard pests, helping to control their populations.

Pollinator meadows are typically composed of a variety of wildflowers, native grasses and legumes such as the beloved clovers. Meadows should be carefully planned with plants that will produce blooms throughout the growing season. Upland and meadow sites are generally in full sun for at least half of the day and have good air circulation. But species choices should also take into account a site's unique environmental conditions, such as tolerance for moist soils or shade, if necessary.

It's important to enter into this endeavor with eyes wide open, understanding that *competition from invasive or undesirable vegetation is the most limiting factor in meadow preparation.*

Native meadows don't play well with established grasses and weeds, especially tenacious species such as kudzu and mile-a-minute vines, just to name a couple particularly nefarious examples. It's also important to be totally honest with ourselves when it comes to the methods in which we eliminate these detrimental plants. If you will be establishing a relatively small native meadow (less than ½-acre), you have economies of scale on your side. On these sites, it might be quite possible to establish your meadow without the use of herbicides. But larger sites (in excess of ½-acre) will have significant difficulty eradicating weeds sufficiently to allow for natives to establish without the use of some form of pesticide – natural or synthetic. More on that in the following paragraphs.

Managing expectations is one of the hardest tasks many native seed suppliers face with their customers. "My meadow just hasn't taken off like I thought it would," or "it doesn't look like it did in the catalog" are common refrains. In addition to the uphill battle of killing unwanted weeds and invasive plants, native meadows don't fully

establish in one – or even two – seasons, typically. They develop in stages, with the grasses and some of the not-so-lovely species taking hold first. In the second season, and with sufficient mowing and weed control, things look considerably better. By the third and subsequent seasons, your native meadow will begin looking like the stuff of paintings and will require almost no effort.

Keep in mind, we're trying to restore a native meadow that originally took Mother Nature centuries to perfect. A few growing seasons doesn't sound so unreasonable when you keep things in perspective.

Eradicating Existing Vegetation

Understand that the process of eradication of existing vegetation is not a *once and done* proposition – not by a long shot. It will require repeated activity and patience on your part.

Anyone notice a theme, here.

Take heart; there are a number of methods for eliminating existing vegetation, each with its own advantages and challenges. A small site size offers a practical advantage over larger sites in that you can likely avoid the use of herbicides altogether.

But, larger sites where many alternative methods of eradication just won't be practical from a logistical, economical or environmental standpoint will need to consider the use of some form of herbicide. Otherwise, you may very well find yourself in a never ending battle against aggressive vegetation, all the while watching time and money slip through your fingers.

There are a number of "natural" herbicides touted as safe for the environment and non-target vegetation. Among these are the brand names BurnOutII, Matran™, Nature's Avenger™ and Scythe®. These and traditional herbicides such as glyphosate (Roundup® and Rodeo™ are common examples) should be chosen based on your own philosophical stance, and with due diligence on your part. These products are simply shared to aid in your own research and decision-making.

Perennial weeds are especially difficult to manage. Depending on the species, they might develop rhizomes, bulbs, tubers or extensive root systems designed to help them reproduce after the seedling stage. Pulling these weeds rarely removes their underground networks entirely, and new growth will typically take place from what's left in the ground. It's best to dig these weeds in order to remove as much of the root structure as possible. And, even then, you will likely need to repeat the process on several occasions.

Don't leave pulled or hoed weeds lying on the ground, as they will likely take root again. The compost pile can receive leafy annual or biennial weeds that do not yet have flowers or seeds, as well as the top growth of perennial weeds, provided they haven't gone to seed. But roots of perennials like dandelions and quack grass should be relegated to the garbage bag, as well as any weeds that have set seed.

Smothering is one relatively good, albeit slow, way to kill existing vegetation. Black plastic is typically used for this purpose, but many have had success using a thick layer of newspaper (at least 36 sheets thick) or cardboard sheets as another option. Mulches of an organic or inorganic nature can also be used to serve a similar purpose. Regardless which method you choose, you'll need to first mow the top growth off of the vegetation. Then place the chosen material over the area, making sure to overlap the edges to prevent weeds from growing through the gaps. This method should be left in place for an entire growing season before any hopes of real eradication will come true. It's often advisable to lift the smothering materials once a month and cultivate the vegetation, then allow new germination to occur before replacing the covering and continuing the process. This periodic cultivation, germination and smothering often results in a more thorough cleansing of the seed bank.

Milkweed – it's not just for butterflies anymore.

Another method is *soil solarization.* This term is often mistakenly thought of the same as smothering, but the two are very different and have unique effects. Solarization is the process of using clear (not black) plastic, tightly held to the ground along its perimeter, in order to use the sun's radiant energy to heat the soil to the point of killing many weed seeds, nematodes, insects and plant pathogens. The clear plastic should be left in place for four to eight weeks during a hot period of the year when the soil will receive the most direct sunlight. If done right, the top six inches of the soil will heat up to as high as 140°F, depending on the location.

Cultivating by means of a rototiller or disc can also be effective. These implements cut the weeds and incorporate them back into the soil, where they decay. Some weeds will likely sprout again from the roots or crowns, so be prepared to continue the process as often as necessary.

Was your site previously a manicured lawn with regular (or even irregular) visits from contracted lawn care treatment companies? Was the site formerly a farmer's crop field? Did you decide to have a licensed technician apply an approved herbicide, such as glyphosate to eradicate old vegetation? In other words, were herbicides previously applied to the area for any reason? If so, you'll need to allow an appropriate period of time for those herbicide residues to break down before planting your new meadow.

[A note about soil fertility and use of amendments: Natural fertility on most meadow sites is generally adequate for native species to establish. No fertilizer or lime is needed in most cases. Check your soil pH and select species adapted to that pH.]

Smooth aster is a great late-Summer species to have in your meadow.

What to Plant

After likely spending a full growing season eradicating old vegetation, you can finally experience the joy of purchasing native seeds and putting them into the ground. You now have a few more important decisions to make; namely, what seeds or seed mix to choose.
And that, friends, is the hundred thousand dollar question.

The choice of native grasses and flowers, specific species, seeds and mixes is dependent on a whole host of factors such as your geographic location, topography, soil health and composition, moisture content and aesthetics, just to name a few. The fact that you want to choose a variety of plants offering the greatest benefit to honey bees – and the tastiest honey – further complicates the task. In one popular pollinator mix offered by Ernst Conservation Seeds, the warm season grass side oats grama is paired with the legume partridge pea and a selection of herbaceous species including lanceleaf coreopsis, big leaf lupine, tall white beardtongue, anise (lavender) hyssop, Maximilian's sunflower, common milkweed and wild bergamot as its heavy hitters, followed by no fewer than eight additional species rounding out the roster. It's a veritable Whitman's Sampler of pollinator delights.

Your local extension office can be helpful in choosing ecotypes appropriate for your region. You can also consult the USDA's PLANTS Database or the The Biota of North America Program. Organizations such as The Xerces Society for Invertebrate Conservation and the Pollinator Partnership also have great suggestions for bee-friendly native plants.

When to Plant

Traditionally, seeding is thought of as a Spring activity. But when does Mother Nature do her seeding? In the Fall, of course. There are some noteworthy advantages to Fall seeding. But remember, you have the option of seeding in the Spring or in the Fall. Your decision might be driven more by your success (or lack thereof) at eradicating existing vegetation in the first year. See the sidebar, "Fall vs. Spring Seeding" to help in making your decision on this topic. Regardless of when you decide to seed, let's get down to the business of actually putting seed to soil.

Spring vs. Fall Seeding

The Ernst Conservation Seeds website offers the following points to consider when deciding between fall or spring seeding:

Fall or "Dormant" Seeding

- Fall seeding imitates natural reseeding.
- Some natural stratification occurs (i.e. natural changes occur to the seed and seed coat during the Winter that enhance germination)
- Good seed to soil contact occurs through moisture and frost action.
- Germination will most likely not occur until Spring. Some cool season species will establish during the Winter, however, warm season grasses and most forbs will germinate in the Spring.
- Some seed can be lost to decay and wildlife consumption during the Winter.
- Establishment may be hindered by weed competition that starts during the Winter.
- Mulching is an important element of seeding to protect both the seed and soil and retain moisture

Spring Seeding

- Cool season species germinate soon after seeding. Germination of warm season species generally occurs within three weeks of the soil temperature reaching 55°F.
- Seed loss due to decay and wildlife consumption is minimized.
- Seed to soil contact should be accomplished by working the seed into the soil.
- Seeding can be delayed until weed control can be accomplished to improve establishment.
- Irrigation during periods of dry weather is needed for proper germination.
- Mulching is an important element of seeding to protect both the seed and soil and retain moisture.

How to Plant

Here again, the methods used to prepare the ground for seeding and then to actually perform the task is largely dependent on the size of the site, availability of sufficient equipment and the amount of time and money you have to spend.

As a general rule, native meadow sites should require very little tilling or disturbing of the soil beyond what was done during the eradication of old vegetation. However, a slight disturbing of the soil is good for seed germination, seed-to-soil contact and control of seed wash-off from rain. This can be accomplished with anything from a garden rake for small sites to a disc pulled behind a tractor on larger sites.

When it comes to seeding, sometimes machines just won't cut it if your site is compromised by difficult terrain or other limiting factors. In these cases, good old hand-seeding is the go-to tactic. The greatest challenge is coordinating the step-and-throw action necessary to ensure the uniform broadcasting of the seed onto the soil. Divide the seeding area into small, easily managed areas, and divide the seed mix into the appropriate number of

WEIGHING THE OPTIONS		
Factor	**Small Meadow**	**Large Meadow**
Site Size	Under 1/2-acre	1/2-acre or larger
Eliminating Existing Vegetation	Digging, hoeing, smothering, soil solarization, cultivating, etc.	Fewer options, including cultivating, herbicides for consideration)
Seeding Methods	Hand seeding, broadcast seeding	Broadcast seeding, drill seeding or even hydroseeding are options
Maintenance	Periodic mowing by hand scythe, string trimmer or rotary mower **(No Lawn mowers!)**	Periodic mowing by rotary mower **(no lawnmowers!)** Periodic controlled burning also recommended

portions to seed each of the areas. Hand cast the seed in broad, sweeping motions in front of you while walking a series of parallel, straight lines across the area. After making your first pass in subsequent, parallel lines, perform a second pass traveling in similar parallel lines at a right angle to your first pass, broadcasting the seed in the same manner. Follow hand seeding with a light raking, rolling or tracking to provide good seed-to-soil contact. Do not roll or track the seed if your soil is wet.

A broadcast seeder generally consists of a funnel-shaped hopper with a mechanism to control material flow onto a spinner that throws, or broadcasts, it onto the soil. This system is commonly used to spread seed, fertilizers, lime and other granular products. Some don't pass easily through the regulating mechanism of some broadcasters. In these cases, kitty litter, sawdust or sand can be mixed with the seed to keep it from clumping and help it pass easier. As with hand seeding, spread half of the seed in one direction and the remaining seed in the other direction. Then roll or track the seed in order to achieve good seed-to-soil contact. *Do not roll or track seed if the soil is wet.* Cover with a light layer of straw mulch.

A drill seeder is an option for mid-sized and larger sites that offers no-till or traditional seeding options. The machine has a seed hopper capable of seeding various swath widths depending on the model, with uniform row spacing. The unit also contains disks equipped with springs to aid in loosening the soil and soil openers, seed boots and press wheels for placing the seeds into the ground and gently compacting them. With the growth in popularity of wildlife food plot seeding by hunters and conservationists, the market has responded with models that can be pulled behind ATVs, small garden tractors and other vehicles. Large drills manufactured by Truax consist of a specialized seed box for handling small or fluffy seed like that of many wildflowers and native grasses. Seeders of this proportion are not likely to be at your disposal unless you already farm grasses and row crops, or have friends or neighbors who might be able to assist your efforts.

First Year Maintenance

One of the great things about native perennials is that they don't require seeding each year. Generally, once you have successfully planted your seeds in the first year, subsequent years should consist mainly of simple maintenance activities.

A keen eye for the growth of your new plants and for competition by those you don't want are key factors in making decisions about maintenance moving forward. When undesirable vegetation reaches 12 to 18 inches in height, mow it to no less than six inches high (with a mower or string trimmer) to prevent the weeds from developing seed. Generally, native plants will grow more roots than tops in the first year; therefore, mowing to six to eight inches high should not cause harm. This

A good example of a diverse pollinator-friendly meadow in northern virginia.

practice allows sunlight to reach desired species. *Do not mow with a lawnmower*, as mowing too close encourages weedy grass species.

Second Year Maintenance

In the second year, plan to mow once, close to the ground, in early Spring. This allows young native plants to emerge and promotes more rapid warming of the soil. By waiting until early Spring to do this mowing, you will allow upland game birds, songbirds and other wildlife to enjoy your native site throughout the Winter months.

General Maintenance

Grassy weeds or persistent perennials can often re-establish. Monitoring and controlling weeds is essential in the first and second years. Burning (by experienced professionals) about every three years in early Spring can prevent shrub invasion.

The process of establishing a diverse and bee-friendly native meadow is no small task. But the fruits of your labor will be evident in short order. You will have the satisfaction of knowing you restored a patch of ground from something largely useless to something of great worth and tremendous beauty. Your bees will be foraging on a vast selection of pollen- and nectar-yielding treats throughout their active months. Your customers will be asking how in the world your honey tastes so much better than others they've sampled.

As you plop down in the midst of all this sweat and toil one pleasant August afternoon, soaking in the myriad fragrances borne on that warm Summer breeze and listening to the steady drone of happy bees, you'll have no regrets. BC

DOWNTOWN

There's More Than One Path To A Community Apiary

The garden editor of the local paper pointed something out this week that was kind of obvious, clearly a part of city beekeeping, and lost on me until that moment. Our sold out downtown short course student body is about two-thirds female, and about two-thirds our age. Paging through the records of the past few years' worth of workshops, this is not an anomaly.

Because I signed most of the students up, we had some other facts at hand: of the young men present, a good half of them had been signed up by a female associate, and in a dozen cases, parents had gifted the course fee. In comparison, region wide the median age of a beekeeper was 56 years in 2010 (Burdick & Caron) and 52 nationally (Schweigert & Krengel). Across North America, beekeeper gender goes the opposite way from our club: 66% male and 34% female.

The statement that "There are lies, damn lies, and statistics" seems to have an even more mysterious history than spurious quotes attributed to Einstein, but this is one place where the numbers are actually driving our urban beekeeping club to consider projects and services that suburban neighbors might find crazy. My beekeepers (if it is OK to call them that) are younger, less likely to own their homes, smaller in stature, and more transient than the average hive wrangler you would meet at ABF. They need an appropriate, accessible, and inexpensive place to set up and manage their colonies.

Because cities are expensive, these newbees may be a decade away from an urban rooftop to call their own, but they are at the prime age to get engaged in environmental, social, and healthy eating causes. These are the active and intelligent folks with lots of energy and free time that my new city club needs, and they need our help if they are ever going to experience their first nectar flow. I'm pretty good at finding hive sites around town, but maybe a shared apiary scheme might be the most efficient, sustainable, inspiring, and educational way to go? Chasing sites for one or two hives can take hours of persuasion and a couple one-on-one meetings each time: why not pile a bunch of that work into building something bigger and more permanent?

This article is intended to take you along as we break down the problem, look at how other awesome clubs have solved it, and weigh the potential value of each approach. We are also watching the horizon for potential opportunities and pitfalls that come with a dynamic urban environment, and trying to prepare for both.

Nothing new!

First, it helps to specify what we mean by a club apiary, because they have a history and have taken different forms over time. In fact, British beekeeping associations quite commonly own or lease a chunk of land, and even a clubhouse, on a site where members can convene for beekeeper education and other cooperative activities. Sometimes the club owns and manages all the hives in common, more frequently a set of hives is maintained by a team of volunteers for teaching purposes, and recently more clubs have been looking at an "allotment" style beeyard, where the

Give City Beekeeping Some Space

hives are individually owned and managed, but the beekeeper is required to live up to certain standards and practices. The latter is what my members seem to want.

An "allotment" is a very familiar concept across the pond, and increasingly in community gardens and urban farming projects in the US. To get one is to have a small share of space where you can pursue an agricultural activity for which you might not have room at home. Here, there is usually some kind of yearly fee: there is almost always a lengthy waiting list. The truly cool British Beekeeping Association (http://www.bbka.org.uk/) has a downloadable pamphlet on "Allotments and Beekeeping" that takes its members (and you) through a helpful Q&A for persuading community gardens to allow a hive or two. It turns out that beekeeping has been legally included in the framework for allotment gardening there for over a century, though individual gardens can decide whether or not to permit it.

So there are already a few different tried and true strategies emerging:

- One where a club literally takes ownership of both space and beekeeping activities, which are then run as a group with either a goal of education or of just keeping lots of shared colonies of bees;
- Another where beekeepers set up one- or two-hive apiaries in community-owned agricultural space on an allotment, though these sites host mostly non-bee gardening activities; and
- A third where the club owns or leases property that is dedicated just to beekeeping, and divides it into individually managed hive sites that site holders run under shared guidelines.

In the U.S., we have powerful and inspiring examples of each. Hugely successful cooperative and allotment-style community beekeeping can be found at the Chicago Honey Co-op (www.chicagohoneycoop.com) and the Burgh Bees (burghbees.com) community apiary program (featured in *BeeCulture* September 2012). The Kalamazoo (MI) Bee Club (kalamazoobeeclub.org) maintains a classic educational and outreach apiary. According to Kalamazoo's Caroline Abbott, "We quickly learned that beekeeping needs to be inter-generational both for the kids and the adults, so our club apiary program grew into a club-wide program...I run the field days and I appreciate that I can mentor a whole group of people at once, which is nice for both me and them."

Here in DC, our club members maintain hives at ten community gardens (so far) in allotment-style set-asides. So they all work, but what works for you?

Running our own show

For our city, which has an extremely transient population, the Burgh Bees example is the most tempting, and the one we have chosen to explore further. It is very difficult to maintain a stable educational yard or cooperative business with a constantly shifting population of collaborators, and our scattering of hives around the city does not offer the right level of trust and collaboration between the community garden managers and the club if the one person who owns the stinging insects keeps disappearing and being replaced. Not a helpful form of supersedure.

Anyone who is looking to set up an allotment-style community apiary should probably put Steve Repasky–EAS Master Beekeeper and President of the Burgh Bees–on speed dial, though please don't tell him I said so. He emphasizes the richness of the talents and opportunities available to beekeepers in large urban

areas, but also flags key relationships and concerns that all of us should think over.

"Education before intention"

Burgh Bees discovered that it was most important to have a relationship with the neighborhood before arriving in the forefront of a city-sponsored project. In the past in Pittsburgh, a single resistant constituent could derail a project costing hundreds of dollars and as many volunteer hours right at the end of the permitting process. Repasky recounts, "We fought it door to door: we set up 'bee curious sessions' for the neighborhood, cleared up misconceptions...We set up several meetings, starting from a first reaction of 'no way in heck!' to success with education (and free honey)."

They found that they already had some traction with city officials. At least at the moment, beekeepers can point out their important connection to the health of green spaces and the popular home gardens that spring up more and more each year. The Burgh Bees connected with city staffers using carefully thought out landscaping plans, cost estimates that showed reductions in city mowing and maintenance, and program plans that benefited the neighborhood.

But friendly relations need tending as much as beehives do: even with a successful first community apiary launched, serving more members meant establishing more apiaries, and it is not necessarily easier the second time around.

Location, Location, Location

It nonetheless took two years for the Burgh Bees to open their first community apiary in 2010, after a process spent identifying potential locations and working with official counterparts to make it happen. Urban land costs a lot of money, so to find affordable options, the Burgh Bees spent a lot of time identifying and analyzing government owned lots around the city, especially those belonging to the redevelopment authority. Among key concerns, they analyzed whether the lot was tucked among lots of residences or had a set back, whether fencing was allowed, was it large enough to do a pollinator garden and to host activities, was it possible to get a water source at the site?

Like minds make solid agreements

The legal part turned out to be the easiest. Looking for a situation that was comfortable for everyone, the club sat down with the city's lawyers to negotiate a lease with their must-haves, like a fence, a shed, a maximum and a minimum number of hives. The lawyers contributed the basics. Liability insurance was not hard to find: a local agency with ties to a national farm insurance company was already familiar with site visitor, product, volunteer, staff and officer coverage. No need to reinvent the wheel.

Establishing member responsibilities and standards also turned out to be relatively straightforward. Because the community apiary opportunity is so valuable, members have incentive to make it work. Each beekeeper signs a lease that specifies rules designed not to interfere with individual management decisions but to ensure a basic level of site and bee care. Hives must be registered with the state, available for educational activities, and gentle, among other reasonable requirements. Importantly, the lease requires 20 hours of volunteer activities, a huge benefit to managing a large club program. They waive club liability, and are not allowed to use synthetic miticides.

Most cities will have a mix

While the path followed in Pittsburgh is most inspiring given the priorities of my club, there will always be beekeepers who choose to go it alone, or in the context of an organization–like a community garden–that they already call home. With hundreds of thousands of people around, and a hundred or more beekeepers joining the ranks each year, one size is unlikely to fit all. It would be an immense accomplishment, however, for US urban beekeepers to establish the kind of community organizations that have been typical in Britain for a century, and in the very dynamic communities mentioned here just over the past few years. BC

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

Got A Question?

Ask Phil

Phil **Craft**

He Knows!

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

A beekeeper in Washington state writes:

I just completed my first inspection of the year yesterday. I started the Winter with 12 hives. One is dead and appears to have starved. One has a Carniolan queen from 2013, but very few bees left, and I am certain will die. I did not see eggs or brood, and not enough bees to keep brood warm. I found diarrhea on the tops of the frames and am guessing that Nosema is likely cause of dwindling. All other hives seem to have a lot of bees left, and likely to survive. However there was one hive I was concerned about and thought was odd. There are three deep brood boxes (eight frame boxes) and there seemed to be a lot of bees in all three boxes. I found the queen in the top box, and she was marked yellow from May 2012. I did not inspect every frame, but I saw only a few larva, and not a solid egg pattern like I saw in other hives. I did see some capped brood, but oddly I think it was domed in appearance and was probably drone brood. I also saw drone in the hive. But they seemed small. It seems way too early for drones in my area, and I would not expect them till May. What is your thought and what I should do about this? Do I have laying workers because I have an old poor queen? Is my queen worn out? And what should I do? I was thinking I could take the younger queen from the dwindling hive and put her into the hive with a lot of bees, but I would risk Nosema? What do you suggest?

Phil replies:

This is an interesting question and, based on your detailed observations, I think I have an answer for you. First, a short, simplified, review of honey bee reproductive biology. A queen has only a brief period during the first few weeks of her life in which to mate. She accomplishes this during mating flights away from the hive, typically with more than a dozen drones. The sperm she collects from these multiple matings are stored in a sac called the spermatheca, and are used to fertilize eggs, one at a time within her body, as she prepares to lay them. However, she only fertilizes those which are intended to develop into females – either workers or queens. Unfertilized eggs become drones. The millions of stored sperm which result from that one intensive period of mating can be enough to allow a queen to lay fertilized female eggs for as long as four years. However several factors can negatively affect her fertility, such as a lack of available drones, inclement weather during the few days when she needs to make her mating flights, or abnormalities in the her early development. If any of these limit the amount of sperm she is able to store, her productive lifespan will be greatly reduced. After the sperm is exhausted, the queen will continue to lay eggs but, unfertilized, they will all develop into drones.

You mentioned observing *small drones* in this colony. Normally, queens lay unfertilized eggs in slightly larger cells, built by the colony specifically for the production of drones, which are bigger than worker bees. Whether an egg is fertilized or not is thought to be determined by the queen's physically measuring, with her forelegs, the size of the cell into which she is about to deposit it. Smaller cells receive fertilized eggs – larger ones, unfertilized. Pretty neat system! When a queen's spermatheca runs out of sperm, she is unaware of the fact. She continues to lay her eggs, as usual, in both worker and drone cells, with the difference that all now develop into drone brood. The sealed cells, like the ones in your hive, will be domed in appearance – like typical drone cells, but narrower. The drones which mature in those cramped quarters will emerge smaller than normal. From your description of the brood in your hive, the fact that you saw the queen, and the mark indicating that she is almost two years old, it is probable that you have a queen that has run out of sperm and is now infertile.

You also mentioned the possibility of laying workers. Laying workers are another, not uncommon, type of queen problem, which occurs when the queen is absent. All workers have the ability to lay eggs, but normally don't, their impulse to do so being suppressed by the presence of pheromones produced by queen and brood. In the absence of a queen, and after the brood in the

Multiple eggs. (photo by Mary Parnell Carney)

Queen by Mary Parnell Carney.

hive has emerged, some workers will begin to lay. The interval is usually three to four weeks from the loss of a queen to the onset of laying workers. This is a problem for beekeepers because, though workers can lay eggs, they do not possess the reproductive organs necessary for mating. Like infertile queens, laying workers can produce only unfertilized eggs and drones, including some reared in worker sized cells. Unlike a hive with a drone laying queen, laying worker colonies contain multiple workers laying in an uncoordinated pattern, often with multiple eggs in a single cell. Your observation of scattered brood could be a sign of laying workers, but since you actually saw her, a drone laying queen is most likely. A look in the cells to rule out multiple eggs will help confirm that diagnosis. Determining whether a colony's production of all-drone brood is the result of laying workers or of a drone laying queen is important in deciding your next step. Laying worker colonies are very difficult (impossible in my opinion) to re-queen, due to social disruption in the colony created by this situation, whereas drone laying queens can normally often be replaced with good results. I usually recommend combining a laying worker colony with one which is queen-right.

What should you do in your specific case? Assuming that you do not find cells with multiple eggs (indicating laying workers) when you check your hive again, requeening it with the queen from your weak colony may be your best solution. You will probably not be able to purchase a queen until April or later, and possibly not then if you have not already ordered one. Early season queens are often in short supply. I understand your concern about the possibility of the weak hive's suffering from nosema disease, however diarrhea symptoms may also result from other causes, such as the bees' inability to fly from the hive to defecate during cold weather. You can send a sample of bees from the weak hive to the USDA bee lab in Beltsville, Maryland for a diagnosis. Go to **http://www.ars.usda.gov/services/docs.htm?docid=7472** for information on submitting samples. This is a free service. If the report is negative for nosema, you have the option of combining the two colonies. (Remember that you MUST remove the queen from the drone laying colony before either introducing a new queen or making a combination.) If you send a sample to Beltsville and the results are positive, at least you will have more information on which to base a decision. If the weak hive has nosema, or if you use the queen from it without confirming that it does not, you can always feed the re-queened colony with sugar syrup containing fumagillin, the antibiotic suggested for treating nosema infected colonies. If there is a possibility that the weakened colony is infected, I would suggest that you not combine the colonies, to avoid the risk of spreading the disease. Other options could include combining the drone laying colony with a stronger colony in your apiary, or perhaps you might find a queen from a healthy, but weak hive belonging to another beekeeper. In the end you have to make the decision on how to proceed. You might not be successful, but if you do nothing, you're sure to lose both colonies.

To *Bee Culture* readers: a comment about trying to save hives with laying workers. By the time workers begin to lay eggs, a colony is often fatally weakened, with few adult bees and little or no worker brood. Even if it can be induced to accept a new queen (a big if), by the time she begins to lay, it is likely that there will not be enough bees left to tend to the brood. I normally disassemble such hives, shake the bees from the frames, and store the comb before wax moths or small hive beetles finish them off. I understand why beekeepers, especially those with only a hive or two, will go to great lengths to try to save such colonies, but I would not recommend buying new queens to that end. Queens are too expensive and the chances of success too small.

A beekeeper in Kentucky writes:

I received a decent tax return and would like to try keeping bees again, but I would like to try top bar beekeeping. As you know, I had bees in Langstroth hives before I moved, but sold them when I relocated. I've been researching it and besides being more affordable than the Langstroth method, it will be better for my back. So my questions for you are:

Should I start with nucs? I have always heard that it is better to start beekeeping with nucs.

Can I purchase a pre-made top bar hive? I understand they are relatively easy to build, but I would need help with it or might prefer to buy a couple that are pre-made.

Any advice you could give me would be greatly appreciated!

Phil replies:

I'll be honest. As you know, I'm a Langstroth guy, rather old fashioned (a stick in the mud, my wife says), and I've never had a top bar hive. However, I know lots of folks who have them, like them, and prefer them. I inspected them when I was a state apiarist, and I've looked into them with beekeepers in recent years, so they are not new to me. I can see the appeal for people who want bees for certain reasons. Though they're not for me, I'm always ready to talk about the merits of top bar hives, and to point out what, in my opinion, are their drawbacks.

I know you're interested in buying them pre-made, but one reason for the popularity of top bar hives is that they are easy to build yourself, requiring few tools and little in the way of woodworking skills. And the cost is pretty low. All you need is a handsaw, hammer and perhaps an auger or drill to make entrance holes. (You might be able to borrow a drill, or figure out how to get around using one.) I've been told by folks who have made them that materials run about $75 per hive – less, if you have

Top bar hive. (photo by RJ)

any scrap wood around. The cheapest price I've noticed for a new, unassembled, Langstroth hive is about $200. A friend of mine used to make and sell top bars for $130, put together and painted.

Another advantage, as you mentioned, is to your aching back. Top bar hives are horizontal, with 10 or more frames – no boxes on top to lift and remove. In addition to relieving the strain on your back, not having to remove upper boxes saves time. Inspections go more quickly with a top bar hive.

On the other side of the ledger, the greatest disadvantage to top bar hives is that they will never yield as much honey as Langstroths. Personally, I need my beekeeping to show a profit, and honey is the way I do it. The only way to harvest honey in a top bar is by cutting off the comb, crushing it, and allowing the honey to drain out; no frames means no extractor. That means that the bees will have to draw out comb again before they can store more honey. Of course, you will save money by not having to buy an extractor, and you could sell cut comb honey and market it at a premium price. Still, if honey production is one of your goals in keeping bees, a top bar hive is not the most efficient way to do that. Proponents argue that top bar beekeeping is more natural, but consider bees in a hollow tree. Their natural tendency is to build up, utilizing the space above the brood area for additional honey storage as needed. The Langstroth hive echoes this natural architecture. There is an advantage to stacking those honey supers.

Another drawback to top bar hives is that the comb attaches only to the top bar. There is no frame, sidebar or bottom bar. I've seen brood combs break when removed from some hives. Being careful enough to prevent damage to the comb can take time and negate the advantage of being able to work the hive quickly. I've known top bar beekeepers who avoid working their hives in very hot weather.

Though a top bar hive is uncomplicated to build, it may not be quite as easy to start a colony in one. The problem with buying a nuc and putting it into a top bar hive is making it fit, since top bars are not built to standard measurements. One of my top bar friends made her own hive and then was unable to place the frames from a nuc into it. The top bars on her hive were longer than those of a regular Langstroth frame. She was lucky; the beekeeper from whom she bought her nuc measured her top bars and extended the frames of his nuc so that she could transfer them. That is a problem you may have to work out. One way around it is to find someone who sells top bar nucs, though I don't know of any in our area. If you do find someone, their top bar hive dimensions will still need to match yours. Colonies in top bar hives can easily be started with packages, and this may be your best option.

Best regards and good luck. BC

The Voice Of The South

Measuring Time, Speed And Profitability

As beekeepers, we tend to think about honey bees in terms of the collective efforts of the colony. The important economic characteristics of bees derive from colony-level measurements of honey production, pollination effort, disease resistance and defense behavior. Those focused on the bottom line must gauge the quality of their bees as a group, but sometimes such a perspective keeps us from appreciating the beautifully complicated mechanisms that guide the activities of individual worker bees.

Gazing out my office window, I watch worker bees visiting the flowers of dandelion and henbit. The food collection bouts remind me that Spring is finally here, but if I take a moment for quiet thought, some basic questions percolate to the forefront of my mind. Usually, these questions relate to how it is that bees do the things they do. For example, how does a worker bee measure distance? I know that they communicate distance and direction of a food source to hive mates using dances. The distance is translated by the duration of the waggle portion of the dance. Direction is translated by the angle of the food source relative to the hive and the azimuth of the sun, with the vertical vector pointing up on a comb surface representing the position of the sun. Additionally, odor cues provide another navigational aid to help recruited foragers find a food source. But how does a bee know how far she has flown from her hive?

I briefly investigated what is known about bees and distance and discovered that there has been a lengthy scientific debate on the subject. Some scientists felt that bees gauged distance by quantifying the energy consumed during flight to a food source. Others thought that bees could somehow judge their flight speed and estimate distance from that ability. It turns out that most evidence supports this latter notion. Using a simple equation for calculating distance for a moving object, distance equates to the product of the time spent moving and the average rate of speed. This relationship implies that not only can bees measure their rate of speed, they can also estimate the time spent flying to the food source. Wait – bees can track *time* and *rate of movement*?

First, let's consider the ability of bees to track time. Forager honey bees exhibit circadian rhythms of activity similar to most other animals and plants. What is a circadian rhythm? A circadian rhythm is a physiological process or behavior that repeats itself on roughly a 24-hour interval. Your own sleep-activity cycle is a good example. Young hive bees (nest cleaning and nurse bees) do not exhibit regular patterns of sleep and activity. Instead, they work and rest throughout the day and night without a repeatable pattern. Foragers differ and exhibit a distinct sleep cycle. They are most active during daylight hours, and they sleep after dark and into the night. Scientists actually put electrodes into the neck muscles of foragers and showed that the electrical activity of the muscles supporting their heads decreased as the bodies of the bees relaxed during sleep. The heads drooped and the chins of sleeping bees rested on the comb surface.

The existence of circadian rhythms in organisms suggests internal mechanisms for measuring time. The regular opening and closing of the leaves of certain plants like the Mimosa tree (*Albizia julibrissin*) follow circadian rhythms. These circadian rhythms derive from internal clocks from within the plant. Alternatively, it could be argued that plants open and close their leaves in direct response to sunlight. For example, when evening approaches, a plant closes leaves in response to decreasing light intensity, but the leaves open in response to renewed exposure to light at sun-up. Experiments in the early 1900s showed that plants continue to open and close leaves on a 24-hour cycle even when the plant was placed deep into a salt mine and kept in either total darkness or total light. In other words, the process occurred on a regular interval in the absence of any regular external cycle of light and darkness. Something inside the plants controls the activity.

Similar experiments were conducted on bees to show that they also had internal clocks that tracked time. Two distinct features of bees were exploited to demonstrate the existence of the internal clocks. First, the ability of honey bees to navigate relative to the position of the sun was found to be time-compensated. Experimenters would train bees to forage at a feeding station at a set distance and at a set time of day for a few days. On the day of the experiment, marked foragers were captured at the feeding station and held in complete darkness for three hours. The question was where will the bees go when finally released at the feeder? If they back-tracked based on the original angle between the food source and the azimuth of the sun's position (relative to the hive) at the time that they had originally flown, the bees would navigate away from the hive and possibly be lost because the sun had "moved" during their confinement. The bees actually flew directly to the hive without waiver! This result suggested that the navigational systems of bees had adjusted for the three hours of elapsed time – which

suggests a clock inside the bees.

The second line of evidence for clocks inside of bees came from what have been termed translocation experiments. The early experiments were identical to the salt mine experiments with plants. Foragers from a colony of bees were trained to visit a feeding station at 550 feet from their hive at a specific time of day. After a few days of training, during the night the hive was moved underground into a salt mine kept under constant light. The feeder was positioned 550 feet from the hive in the same direction as above ground. When would the foragers visit the feeding station? They came at exactly the time of day that they had been trained. The significance is that they remembered the time when food was available, and they could not have relied on external cues from the sun to sense the actual time while in the salt mine.

More evidence of an internal clock in bees came from translocation experiments in which bees were trained in New York City and then flown overnight to Davis, California. The bees were trained to availability of food at feeders during a specific two-hour window (12:50 - 2:50 p.m. Eastern Standard Time) in the east. After being flown to the west, the feeders were arranged as closely as possible to mimic the training position from the hive. When would the bees visit the feeders? If they reacted based only on the visible position of the sun, they would adjust to the new surroundings and visit at 12:50 – 2:50 p.m. Pacific Standard Time. The foragers flew to the feeders at 9:35 a.m. – 12:35 p.m., which was the correct time if they were relying on an internal circadian clock. This time was exactly 24 hours after their last visits to the feeders while in New York.

The evidence from these experiments suggests that behavior in foraging honey bees is controlled by an internal clock. One feature of these internal clocks is that like a mechanical pocket watch, the machinery tends to drift and slowly lose the ability to track time reliably. However, as with the pocket watch, the internal clocks can be reset. Stimuli that reset circadian clocks include photoperiodic cycles, temperature and humidity cycles, pheromone cycles, etc. These stimuli are used by animals to keep their internal clocks synchronized to the external environment, which is usually important for the very survival of the organism.

It is now understood that primary circadian clocks are located within the optic lobes of the brains of bees. Many physiological processes and behaviors follow 24-hour cycles, and it is believed that secondary or slave clocks that regulate specific processes are controlled hierarchically by the primary clock. For example, one could decapitate a honey bee, and physiological processes in the fat body (analogous to our liver) of the abdomen will continue a rhythmic cycle. However, eventually, the pattern of activity of these processes will gradually slip and become arrhythmic over a few days. Without the head, the slave clocks cannot be reset to external stimuli. The physiological mechanisms for tracking time at the molecular and genetic level are still not well understood. Genes have been found in fruit flies that exert significant control over various aspects of circadian rhythms, and special proteins within neurons of the primary clock react to light.

Bee in a flight tunnel, from Jürgen Tautz's book The Buzz About Bees: Biology of a Super Organism.

Accepting that bees can measure time, let's consider measurement of their flight speeds. Bees and other insects can detect the rate by which images of their environment pass across their eyes. The flicker frequency directly relates to how fast a bee is flying. Imagine you are a passenger in a moving car. When you look out of the side window, the trees and objects along the road pass through your field of view in an irregular pattern that is related to the speed of the car. If the car is moving slowly, you might be able to easily count all of the fence posts as the car moves along a fenced pasture. At higher speeds, it becomes difficult to discern the actual image of each fence post, but you sense a repeatable pattern of light and darkness as the fence posts rapidly pass your eyes.

Imagine being able to detect that high flicker frequency and think, "I am moving at 70 mph." This is in essence what honey bees can do. The flicker frequency detected by the eyes as the bee moves through the environment is interpreted by the brain as rate of movement. Bees also have sensory hairs on their eyes and body that can detect instantaneous speed of movement, but the average rate of flying is determined by visual processing of the flicker frequency. Scientists can mimic the moving environment by rotating a pattern of black and white stripes on a drum either beneath or beside a tethered bee in wind tunnels.

Scientists have also manipulated the external environment around free-flying foragers in ways to make them think that they have flown distances different than the actual distance to a feeder. For example, a bee can be made to think she has flown farther than she really has by artificially increasing the optic flow (or flicker frequency) experienced when she flies to a feeder. A simple way to deceive foraging bees is to fly them along a flight path at different distances relative to a checkered or patterned wall of a flight tunnel. When positioned so that she must fly close to the walls of a narrow tunnel, a bee will have the sensation of a high flicker frequency. She will report a longer distance with her dances than if she had flown

in a wider tunnel having the same checkered pattern (and at the same real distance to the feeder). Pretty cool stuff!

One other aspect of dances that we might consider is how foragers convey the quality of the food source. When the food source is rich or highly concentrated in sugar, bees will perform many more circuits of a dance than they will perform for a more dilute food source positioned at a similar distance. This ability helps a colony to optimize their foraging strategies and to target the most energy-rich food sources first.

But how do bees evaluate the profitability of a food source? The cost-benefit analysis of food quality could include a measure of distance to the food source as one measure of the energy costs associated with gathering the food. Scientists have conducted experiments which show that optic flow measurements of distance are not associated with judging the cost-benefits of a particular food source. They do not know what factors affect this evaluation, but the duration of time of flight could be a better measure of the energetic costs. There is still much to learn about the physiology and behavior of these insects that have brains so much smaller than our own (80,000 cells versus three billion cells). BC

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What I Thought I Knew

Ross **Conrad**

. . . that wasn't true

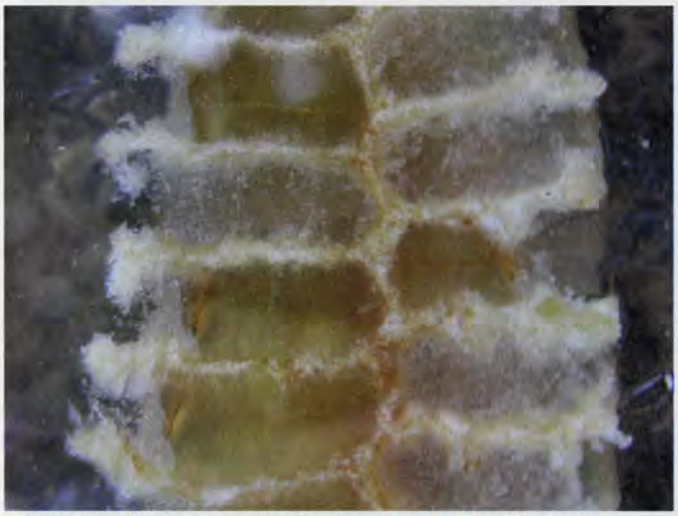
In the February 2014 issue of *Bee Culture* I reported on the results of a trial that looked at the development time from egg to adult of bees raised on combs derived from both small cell and standard sized foundation. I was surprised by the results of the trial that revealed that irrespective of whether the comb was small cell or large cell, worker bees were taking about 20 days to mature and leave their birthing cells rather than the 21 days that I had always read about and been told about in beekeeping classes. It turns out that while 21 days may have been the average that occurred during one or more specific trials at an earlier time, there are numerous variables that can impact the development time of a worker bee. These variables include genetics, brood nest humidity and temperature levels, and chemical contamination of brood comb. The cell size of the comb did not appear to be a significant factor. This observation was just one of many that occurred during the trial that contradicted what I thought I knew about bees.

A large part of the small cell trial consisted of watching bees that had fully matured in their capped cells, chew their way out of their birthing cells to join the rest of the colony. I had always thought that the process of chewing its way out of a cell would take a bee 10-15 minutes. Indeed most of the time this is how long it took for a bee to crawl out of a cell after the first pinhole sized opening appeared in the capping of the birthing cell containing the now mature bee. However, there were numerous occasions where after a small hole appeared in the capping, a worker bee took much longer to finish chew its way out of its birthing cell and evacuate the chamber. In one instance it was almost 12 hours longer!

What would account for this occasional difference in behavior of newly emerging bees? Were these bees malnourished and lacking the energy they needed to chew away the capping on their cell quickly? Did temperature or humidity play a role in the speed at which a mature worker evacuated a cell? While there are clearly behavioral patterns that are typical for honey bees, apparently not all bees are typical.

In order to accurately measure the time it took for an egg to develop into a mature bee that evacuated its birthing cell, the queen bees in the hives had to be observed laying their eggs. The queens would typically inspect a cell before backing into it to deposit an egg. Part of this inspection process is believed to include confirmation on the queen's part that the cell is empty, clean and ready to accept an egg. The other purpose for the pre-laying inspection is to determine the size of the cell. When a queen bee sticks her head and front legs into an open cell, her legs act like calipers to provide the queen with a rough measurement of the size of the cell. By determining if the cell is a regular worker cell or one of the larger drone cells, the queen will know whether she should deposit a fertilized or unfertilized egg respectively.

There was one queen bee during the trial that was observed to remove her abdomen from a cell after laying an egg and then immediately thrust her abdomen into an open cell nearby without inspecting the cell first. Was this behavior what caused an egg to be observed to be laid in a cell that was also being filled with honey? (see photo) Presumably worker bees inspect a cell before depositing nectar in it and would avoid filling a cell with nectar if it already contained an egg. If this unusual behavior by



This egg sits in a cell that had been partially filled with nectar that was in the process of being ripened into honey. For a few days the egg could be seen to slightly bend and flex back and forth in convulsions. After about three days the egg disappeared apparently after hatching and promptly dying.

Observe bees in an observation hive long enough and you are likely to see things that are unexpected and surprising.

the queen of this particular hive was responsible for the egg sitting in a cell of partially ripened honey, it would mean that the adhesive substance on the end of each egg that allows it to stand on end after being laid is not affected adversely by the presence of nectar or honey in the cell.

Another observation of queen behavior that was new to me was to see a fertile mature queen emit a piping sound. I had always associated queen piping with virgin queens battling it out for dominance in a hive as piping behavior by queens is most common when there is more than one queen in a colony. In this instance, a fertile queen that was over a year old had been removed from her hive and placed on an empty comb above five frames of eggs, brood, pollen, honey and bees with a queen excluder separating the queen from the bees and frames below. Before a large number of worker bees had worked their way up through the excluder to join the queen above, the queen could be seen running all over the empty frame of comb as if searching for the rest of the hive. At one point she stopped running, pressed her abdomen against the comb surface and emitted the familiar tooting sound associated with piping. I had read that queens could be induced to emit the piping sound when under stress, but this was the first time I had observed it. Perhaps the piping sound virgin queens produce when there are more than one queen in the hive is also a form of distress call rather a kind of battle cry announcing to other queens and workers their willingness to fight, or as has been postulated, a signal to worker bees as to which queen is the most worthwhile to support.

During the small cell trial I would bring the observation hives I was working with inside at night in order to keep them from falling victim to a bear attack. This meant closing the entrance to the hive in the evening after it was dark before moving them inside. I didn't want to move the hives during the daytime because it would mean foraging workers would be left outside overnight and so I always waited until dark before moving the hives because I believed that all the workers returned to their hives at night. And yet most mornings after sunrise when I was returning the hives to their positions in my yard, there was a bee and sometimes several bees, flying around the area as if searching for something. Sure enough, as soon as the hives were put back into their places and the entrances opened up, these bees could be seen quickly entering the hive as if they belonged there and had been searching for the hive entrance that had been misplaced.

Beekeepers like to explain honey bee behavior in simplified terms in order to make them easier to understand and allow for predictable expectations. The fact that most hives of bees have the tendency to behave in similar ways encourages this approach. My observations have made it clear to me that while there are certain honey bee and hive behaviors that are typical there are always honey bees and bee hives that act in atypical ways. Just as people who share similar cultural customs typically act in similar ways, there are always individuals who don't behave in ways that are considered normal and march to the beat of a different drum.

When it comes to really learning and understanding bees, there is nothing that can compare to sitting down and simply observing bees for hours and hours as they go about their daily routines, to provide one with a deeper understanding of how honey bees behave. What can be observed from such an activity is a reminder that despite everything that we humans have experienced and discovered about honey bee biology and behavior, there is still much to learn and many surprises in store for those engaged in the ancient craft of beekeeping. 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.*

ABOUT HONEY

This Year, Become A Honey Connoisseur

Alice **Eckles**

If you've got it flaunt it

According to The National Honey Board there are more than three hundred varietals of honey in the United States. American beekeepers are now learning to apply the French concept of *gout de terroir*, roughly translated as "the taste of place," to our honey. As the popularity of local food grows beekeepers can encourage honey appreciation by educating the palate and developing a descriptive language for the taste of honey.

Honey

Bees make honey from the nectar they gather from flowers. Honey is a pure product that comes directly from the producer – the beehive – to us without any transformation or additives.

The public is aware that some companies ultra filter honey to hide the country of origin and then dilute it with fructose and/or glucose. As beekeepers we can point out that: It's better and safer to buy honey that has been bottled by the beekeeper, with his or her name, city, and state right on the label. That's accountability, and that's knowing more about the honey you eat.

Raw honey

Unheated honey, raw honey, is best for culinary and medicinal use. Heating compromises flavor, changes color, texture, kills enzymes, and healthy benefits are lost.

Honeycomb

Instead of extracting the honey sometimes it is cut into squares and sold in containers to be eaten wax and all, or the wax can be chewed like chewing gum and spit out after a while. Honeycomb is even better for alleviating allergies. Honeycomb in round pieces can also be created in the hive by the bees using frames with round sections of foundation called Ross Rounds, or Hogg half comb plastic cassettes can be used in the hive for bees to fill with honeycomb.

Terroir

Terroir is a French term literally meaning "land." The fuller meaning encompasses all the elements of the unique environment affecting the taste of food produced from a certain place. Climate, rainfall pattern, soil type, topography, and geology affect the taste of the food produced there. The soil is especially important. Different soils contain different minerals, and the soil determines what plants can grow in a region. The minerals in the soil affect the flavor of nectar from the flowers that grow in said soil. Which in turn contributes to the flavor of honey. Even so the honey from different apiaries in the same region will taste different. Whether this is because of microclimates or because each beekeeper has her own "bee culture" is hard to say. As a beekeeper I know this: When you see a rainbow you feel special, and the honey from your bees is evidence of a special relationship. The terroir of honey is the taste of place, but it is also the taste of the beekeeper!

Artisanal honey

A large quantity of uniform product is not the goal of artisanal beekeepers, instead they use traditional methods to highlight the quality and character of nature's gift. In contrast to the artisanal beekeeper, larger distributor/producers may buy and blend honey from various sources to get a uniform product. Of course all beekeepers hope each year for a bumper crop, but quality is more important than quantity and an artisanal beekeeper must put the bee's welfare first, the hives have to be strong to get through the Winter. Leaving a super or two of honey on each hive helps achieve this. Honey is first a food for honey bees.

Varietals

Honey bees tend to work one species of flower at a time. As long as a certain species of flower is in bloom, and is producing nectar, the bees will continue working ⇨

it – so long as the weather is favorable for flying. Thus a beekeeper can remove honey from the hive just after the honey flow of the desired species is over. Especially if the apiary is located in an area where a certain flowering plant, blueberries for instance, is predominant, then they can harvest in such a way as to get a single varietal honey, blueberry honey in this case. It makes sense that a highly effective pollinator and nectar gatherer, the honey bee, would have such a thorough method. Some beekeepers rather than producing a single varietal will harvest a Spring, Summer and/or Fall varietal(s). The difference in taste makes good conversation, about the different flowers in bloom at different times.

Vintage

Each year the amount of sun and precipitation is different, and this affects the character and quantity of honey. Like wine, honey sums up a certain place in time, and it's a sensual record of a season that will never be repeated in exactly the same way. When the honey harvest is small it may be more expensive for the customer, but stress on the bloom can also mean greater flavor. Beekeepers often preserve small amounts of honey from year to compare and enjoy the taste years past. Honey never goes bad. If moisture gets in it can ferment, or if the moisture level was higher than 18% at harvest due to too much of the comb not being capped. Fermented honey is not necessarily a bad thing, as mead makers know, and some people like the fruity taste. Crystallization in honey is a natural process and does not indicate any diminished quality. Texture and mouth feel are part of a honey's character. I look forward to seeing honey labels in the United States identifying these vintages and provenances.

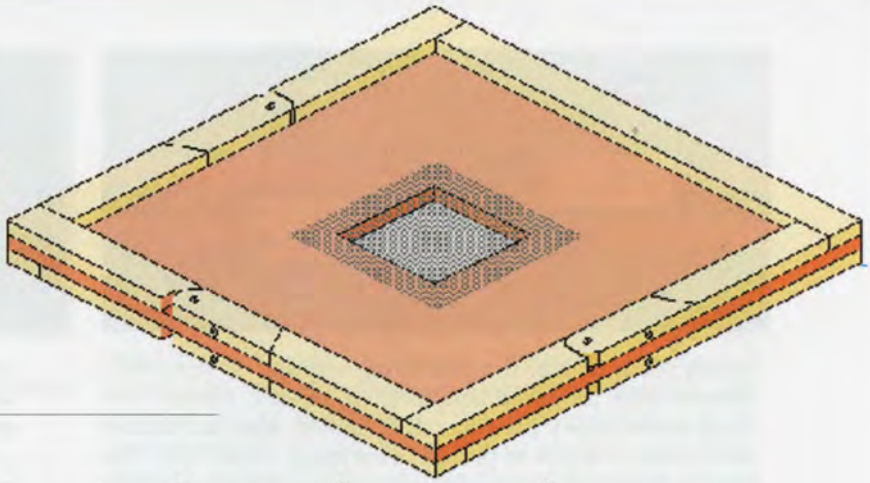
Creating a honey connoisseur

Anyone who loves flowers, and has a sweet tooth might enjoy becoming a honey connoisseur: the main requirement is tasting as many varieties of honey as you can! Ask your customers before tasting the honey to notice its color and clarity. Is it opaque, clear, or somewhere in between? Is the color water white to light yellow, gold to amber, or dark amber? Next ask them to use their nose, 75 percent of what we perceive as taste actually comes from our sense of smell. The flavorful aroma may be flowery, fruity, spicy, or something else. One has to keep tasting until they think of the right descriptor. To taste the honey one should let it melt on the tongue, spread it around in the mouth and think about the feel, taste, and aroma. Another thing to appreciate about the honey is the texture. Is it drippy, velvety, creamy, buttery, grainy, or something else? Keep tasting and notice the body of the honey, thick, thin, heavy or light? One could make an entire career of this, traveling to the honey spots, learning about honey pairing, how it goes so well with dairy products, fruits, nuts, bread, and cheese. BC

Resources

Your local beekeepers: find them, and buy some honey!
The Vermont Beekeepers Association
The National Honey Board
Honeybee: Lessons from and accidental beekeeper by C. Marina Marchese
The Honey Connoisseur by Marina Marchese and Kim Flottum

MAKE A SNELGROVE BOARD



Lucian **Costanzo**

Maybe swarming isn't in the cards.

I have been keeping bees for 15 years and, in that time, have learned that healthy hives swarm. This is not a theory, but a fact. As Richard Taylor points out in his book, "The How to do it Book of Beekeeping,"

To ask why bees swarm is like asking why birds nest or spiders spin. Swarming is essentially a means of reproduction by division, essential to the survival of the species (Fifth Edition, p. 95).

I always smile when I hear beekeepers say, "My hives don't swarm," or "I rarely ever have swarms." My contention is that these beekeepers either do not have hives at their homes or they visit out yards very infrequently and are never on hand when colonies swarm. Quite simply, they're not there to see them and, consequently, never know they happened.

As a schoolteacher, my days begin and end early. In the Spring, I walk out to my hives every day when I get home, as a matter of course. As a result, I see many swarms hanging from limbs and branches in the trees around my beehives. I always do my best to capture and re-hive these swarms and am almost always successful. As a matter of swarm prevention, I reverse my hive bodies as soon as we have warm nights in the Spring and do so almost weekly throughout the swarm season. I also clip queen cells, re-queen, get supers on the hives in enough time for the swarm season, and switch the places of all hives in the yard. The result? Happy, healthy hives that swarm! I have told veteran beekeepers this and they almost always tell me that I "...must be doing something wrong." As far as I can tell from reading the literature, I am doing nothing wrong. The most successful thing I have done in the past to prevent swarming was to run hives consisting of three deep bodies and then supering above, but this is a lot of heavy lifting and a pain in general. I have also experimented with queen excluders, i.e. "to use or not to use" and have found little, if any, difference with regard to swarming.

Two Winters ago, however, I stumbled onto something new to me, but certainly not new. I had read about British beekeeper L.E. Snelgrove and his "Snelgrove Board," but had never actually read anything by the man himself. I decided I should do that and, as is today's custom, I went to the Internet and got my hands on a copy of his celebrated work, *Swarming: It's Control and Prevention.*

My edition of Mr. Snelgrove's book is the fourth edition, published in 1939. I soon learned that Mr. Snelgrove, *L.E. Snelgrove, M.A., M.Sc.* was President of the "Somerset Beekeepers Association," Vice President of the "British Beekeepers Association," an *Expert* as deemed by the "British Beekeepers Association," a member of the "Apis Club" and, most importantly, a beekeeper like you and me. What his book proposes, ultimately, is *A New Method of Swarm Prevention.* As I read his book, I had the feeling I was not reading a new method at all, but a different description of "Demareeing." Mr. Demaree, of the U.S.A., devised his plan in 1892 of which Snelgrove describes thus:

> *The underlying principle of the method is as follows: if brood is removed from the vicinity of the queen and placed over an excluder in the part of the hive remote from her, whilst at the same time she is given ample additional laying room, swarming is discouraged.*

In other words, by separating the queen from the brood and giving her

much room to lay, the swarming impulse is thwarted. Others have proposed this method as well. Famed New York comb honey producer C.C. Miller, who did almost everything possible to prevent swarming, called this "The Put Up Plan," as the brood was separated from and "put up" above the queen.

However, what become of the brood several boxes above the queen? Do you lose their work as field bees, thus undermining your own purpose as a beekeeper? Snelgrove's *New Method* provides the answer. With the use of a purposefully constructed board, the brood is added back into the lower deeps at specific intervals at the exact time they "graduate" to field bees, hence gathering nectar to be added to the beekeeper's harvest. Sensing they are queenless, the "put up" bees raise a new queen. Now a two-queen colony can be maintained and split after the honey season or, if one wishes, recombined with the parent hive below.

Thinking this all seemed very logical, I decided to make four Snelgrove Boards for my four home hives and test Snelgrove's proposition. With half-inch plywood I already had, I eagerly began constructing my Snelgrove Boards with the help of my 19-year-old son, John. The board is very simple by Mr. Snelgrove's own admission and is constructed thus, as described in his book:

> *The screen-board is simple and easily made. It consists of a sheet of three-ply wood of the same dimensions as the top of a brood box. Around its edge and on both sides of it are nailed batten 1 ¼" X 3/8". A hole is cut in the middle of the sheet of plywood of the size of an ordinary Porter bee-escape . . . a larger hole (e.g., circular, of 3 ½"diameter) may be cut at the centre. On each of three edges of the screen-board rectangular or wedge-shaped pieces, about 1¼" wide, are cut from the middles of the upper and lower battens. On the fourth side the battens are not cut. There will thus be three openings above the plywood diaphragm and three below it when the wedge-shaped pieces are removed. These openings are to serve as entrances for the bees . . . No bee escape is used but the [center] hole is covered by a piece of wire cloth or perforated zinc fastened to the board by drawing pins.*

The width of the battens really isn't important. Mine are 3/4"" wide and ½" thick. Proper bee space would dictate their thickness to be 3/8" so as to prevent the bees building bridge comb. This was not an issue, as my bees never built bridge comb although, again, the thickness is ½". I had everything necessary to construct my Snelgrove Boards with the exception of the battens. I found the ¾" x ½" molding at my local lumberyard at the final cost of $1.50 per Snelgrove Board.

With the construction of our Snelgrove Boards complete, my son and I had only to implement them and test Mr. Snelgrove's proposition. The four operations to be performed, as spelled out by Snelgrove, are thus:

Operation I.

Separate the combs of the double brood chamber into two sets. Place in box A the comb (with bees) containing brood, and in box B the remaining combs (with bees) which do not contain brood. See that the queen, and also a comb containing a little unsealed brood, are placed in the centre of B. Now rebuild the hive, putting box B on the floorboard, an excluder on B, the super above the excluder, and box A above the super.

Operation II.

Three days after the first operation place the screen-board under box A, that is, between it and the super. Place it so that the edge with no small entrances is towards the front of the hive. Withdraw No. 1 wedge, leaving all the others in their positions in the board.

Operation III. (7th or 8th day)

Replace wedge I and remove wedge 2. Remove wedge 3 on the opposite side of the hive.

Operation IV. (14th or preferably the 15th day)

Replace wedge 3 and remove wedge 4. Remove wedge 5 at the back of the hive.

What you have, again, is a system of adding bees at specific intervals from the top supers when they are ready to begin foraging as field bees. For instance, Operation II has you withdrawing wedge No. 1 and leaving all the others in their positions. After four or five days, when the bees have become accustomed to leaving from opening one, opening 1 is closed; opening 2, directly below it, is opened and, opening 3 is opened as well. The bees above are now forced to leave at opening three. However, when they return, the bees automatically return to opening No. 1 to re-enter the hive. As opening No. 1 is now closed, they enter opening 2 directly below, fooled into thinking they are entering opening No. 1. Hence, these bees are now added to the original colony below to begin their stint as field bees just as the honey season is beginning. In another seven or eight days we do this again, now closing opening 3 and opening wedge 4. We also remove wedge 5 at the back of the hive. Again, bees are leaving a new upper opening and re-entering what they believe is the opening they have been using all week, only to join the colony below.

Sound confusing? Perhaps, but this is a very simple plan with only four operations throughout the entire nectar-gathering season. By looking at a drawing of the Snelgrove Board and reading through the four operations, one can understand the logic and ease of the plan very quickly.

In 2012, when we opened our hives to perform operation I, John and I found one hive to be very small in population and queenless, and simply combined it with another one of our hives. Of the three remaining hives, we performed Mr. Snelgrove's plan to the letter. What was our outcome? Zero swarms the entire season. During regular hive inspections, we found no queen cells, only queen cups which had been left empty or torn down by the bees themselves. Additionally, our honey crop was good as a result of not loosing field bees to swarms. In 2013 we again treated four hives with the same outcomes . . . no swarms, no queen cells, abundant harvest.

In the final analysis I cannot conclude that this plan is infallible. However, in 15 years of beekeeping I can claim only three swarm-free seasons: my first season in which I started packages on foundation and, elatedly, the last two seasons in which I employed Snelgrove boards.

One of the fun things about beekeeping is that we can look forward to each new season with a new plan, a new product, etc., to set our hopes on. Perhaps Mr. Snelgrove has something to offer in this regard. If so, I would strongly suggest purchasing a copy of *Swarming: Its Control and Prevention* and constructing a board or two. You might just have an anxiety-free Spring! BC

Feel free to email me if you should have any questions:
costanzohhs@yahoo.com

Storing & Dispensing Pollinator Seeds

Collected With Care And Stored Correctly, These Seeds Promise A Healthy Future For Your Bees

Bethany **Caskey**

After you have collected and prepared your favorite pollinator plant seeds, you will need to store them properly before sowing and distributing them.

There are several ways to store collected seeds but the basics remain the same. Seeds should be stored in consistently cool, dry, low humidity areas.

Storage containers can be for long or short-term storage. When in doubt, pick a storage solution that is long term since you may not be able to replant those seeds in the season or even the year you originally planned.

There are several acceptable materials that can be used for short-term seed storage. The materials used for short-term storage are usually porous and will contain the seeds for separation and transportation purposes, but do not provide much protection from moisture or seed viability loss. They are not protective against insects and rodents, but they will allow for air circulation.

Burlap bags are very durable, tear resistant, stackable and can be reused over and over. Cotton bags are also usually reusable, but are only as strong as their seams and their strength depends on the weave thickness and thread count. Woven plastic bags are durable, but cannot be piled high without slipping and are harder to reclose securely. Any woven material will not offer protection from insects or pests so any seed stored in a woven fabric will need to be inspected regularly for infestation or damage.

Multi-wall bags are composed of several layers of paper but are prone to bursting when stacked or dropped and become brittle with repeated use.

Paper lunch bags are inexpensive and handy for small seed lots. The seams are not always secure and a double or triple bag system should be used. One seed collector I know strings several rows of clothesline in his garage and hangs his labeled lunch bags with clothespins from the line, high enough that they are not in his way, and uses this method for short-term and long-term storage.

An easy way to store small quantities of seed is to package them in paper envelopes. Paper envelopes allow for air circulation. You can make your own paper envelopes, use any of the many size varieties available premade at any office or craft supply store or use plain postal envelopes. Envelopes sold as coin or bead envelopes are also a good choice. Your small envelopes can then be saved inside a larger envelope or container.

Some storage options are better than paper or cloth for short to long-term storage.

Barrier pouches are a laminate of paper, plastic and foil that can be sealed with a heat sealer or a household iron set on the wool setting and are available in many sizes.

Prescription medication plastic vials can be used but are not recommended for tiny seeds. Static from the plastic will cause small seeds to cling to the container sides and lid and make handling them difficult.

Cellophane, acetate and polyethylene zip-lock bags can only be used if the seed is completely dry. It is a better idea to not use any of these for seed storage. Film canisters (even if you can find them in the digital photography age) are not recommended because the plastic can encourage humidity and stagnation.

Seed Saver Vials ™ are a manufactured high-density polypropylene container with a patented inner and outer valve that creates an airtight seal.

Some seed collectors prefer to use the 'Food*Saver' vacuum bags and vacuum packing the seed. This requires the use of a special appliance that will cost anywhere from $99 to $200. The vacuum-sealed bags are then organized and placed inside another container.

If you want to save your seeds in style, Seed Keeper from Lee Valley is a fun option for small quantities of seed. The binder comes with six plastic sleeves (enough to hold 36 seed envelopes), 20 envelopes, and the seed information sheet. Each seed keeper binder can add up to 30 plastic sleeves (180 seed packages), depending on the size of the seeds.

Another seed binder idea is to repurpose a worm or bait binder available at sporting good stores or your local Walmart. There are a multitude of styles and options available

When choosing a container, remember that humidity and a lack of air circulation will cause mold or premature seed germination.

for the bait binders but most will offer several zippered pockets on the covers of the binder and zippered pocket sleeves inside. A spinnerbait binder offers more divided interior zippered pockets. All of these binders allow for the addition of more page sleeves and are inexpensive.

When choosing a container, remember that humidity and a lack of air circulation will cause mold or premature seed germination. The more a container inhibits moisture release the drier your seeds will need to be.

Long term storage materials include properly sealed metal and glass containers. Metal and glass are the most reliable ways to protect your seeds against humidity, insects, rodents and environmental damages. Plastic should not be used for long-term storage. Five-gallon metal cans with a rubber gasketed lid and pressure ring are good containers for large seeds. One-gallon glass jars with a gasketed lid seal are also good. A plastic lid that is flexible enough to form a tight seal when tightened will not need a gasket, but a metal lid will. You can cut your own gaskets from a neoprene sheet of rubber or used bicycle inner tubes. Baby food jars are excellent storage options as long as the inside gasket is in good condition. Watch for any seeds trapped between the lid and the rim of the jar that will ruin the efficiency of any gasketed seal.

You can combine storage options by placing your seed filled envelopes inside a glass jar or metal container along with a packet of silica or powdered milk. You can reuse the bags of silica gel that arrive in various products by drying them for a few minutes at a very low temperature in the oven or purchase the packets from places like Amazon.com. To use powdered milk, pour a small pile of milk into the center of a breathable fabric or tissue paper and fold up the corners and secure those with a string or elastic band to make a sachet. Wide mouthed jars are easier to fill and remove your seed envelopes. Metal ammo boxes can be repurposed to hold a collection of seed filled envelopes. With the proper airtight seal and storage in a cool place, your seeds can last for several years. Seed storage longevity varies from species to species. Some seeds may be viable after 10 years or more of storage, while others may not germinate after two years in storage.

Be sure to write the date, name and type of the plant, the variety name, the seed's original source and any specific instructions you might need later on, whatever packaging option you use. Not only is it handy when a year later you try to remember what you intended to do with that species, it will also be appreciated if you give seeds to someone else to use. Many seed savers put labels both on the inside and the outside of their storage containers just to be safe.

Your packed seeds can be organized into jars or coffee cans and stored in a refrigerator until planting time. If using an unbreakable container, some seeds can be left outdoors in a protected area through the Winter if you don't sow them in the Fall. The alternating freeze and thaw of the temperature outdoors can increase the percentage of germination for some seeds. But check the recommendations for each seed species. Most wildflowers from cold climates require a dormant period of cold Winter-like temperatures followed by Spring-like warmth to germinate. This adaptation prevents the seeds from germinating in the Fall when the following Winter temperatures would destroy them. Wildflowers do best when planted in the cool and wet Fall weather. If you do freeze or refrigerate your seeds, allow the container to warm to the ambient temperature before opening or moisture will condense on the chilled seed.

If it is not practical to store seeds in a refrigerator, store them in a place that is cool, dark and dry and do your best to protect them from insects. Sometimes freezing the seed for a brief period will kill any insects or eggs hidden in your seeds. To determine if a location is cool and dry enough to store seed, use this general guideline:

The sum of the storage area temperature in degrees F, plus the relative humidity, in percent, should not exceed 100. The formula looks like this: Temperature F + Relative Humidity % = <100.

If you have saved your seeds for a longer period of time, you should test the seeds before sowing to see if they will still germinate. Place five to 20 or so seeds onto a piece of dampened paper towel. Fold it over to cover the seeds and place the paper towel and seeds into a plastic bag with a few pinholes in the bag and place it in a dark, warm place. Know your seeds well enough to be sure they don't need light or stratification to germinate, but most will respond to this test. Check in a week to see how

many of the seeds have germinated. Some seeds will take longer, so if after the first week germination has not occurred, wait and check them again in another week. If the seeds have a high percentage of germination, you know they are good to use. If just a few seeds germinate, increase the number of seeds you sow per inch.

You can sow pollinator seeds directly outdoors onto a prepared seed-bed or sow into trays of peat free seed compost outdoors under a sheet of glass. If planting in trays, after the seeds have germinated, wait for the three-leaf stage and then place them into individual pots or places in the garden. The following varieties of wildflower seed should be sown directly outside onto soil and not in trays of compost : Corn Poppy, Corn Marigold, Cornflower, Long Headed

Poppy, Wild Pansy, Yellow Rattle, Sweet Cicely, Violet and Meadow Saxifrage. Yellow Rattle should always be sown together with seeds of grass, which it feeds on as a partial parasite.

Wildflower and pollinator seeds can generally be sown at any time of year, but it is better to avoid periods of drought or excessive rain. Varieties requiring stratification are best sown in trays of seed compost in the Autumn and placed outside for germination the following spring. Small seeds can be sown straight onto the surface of the soil or compost and left uncovered. Larger seeds should be covered with a light layer of compost or soil.

Don't fertilize wildflowers, since most have adapted to poorer soils and don't expect everything to come up the first year.

You can have fun making and using "seed bombs" or "seed balls" to distribute your saved pollinator seeds. It is not necessary to prepare a seed bed for your seeds. An Internet search will give you several step by step sites on how to make a seed bomb. Seed bombs are designed to allow seeds to be sown in hard to reach places and in areas where you are not able to spend time preparing the ground for conventional sowing. Seed bombs are usually made of compost, clay and seeds and formed into a little ball. The compost and clay are the carrier for the seeds and allow them to be launched into the area to be sown. Most seeds are very light and would blow away in the wind without the bomb carrier. You can use just the seeds from one pollinator species or a combination of compatible seeds. Using plants that grow well together is called "companion planting."

Seed bombs are actually an ancient Japanese technique called Tsuchi Dango ("Earth Dumpling"). Seed bombs are an excellent way to distribute pollinator species in roadway ditches and medians, or any location that will benefit bees and is difficult to prepare.

Be sure to reserve some of your saved pollinator seed whenever you sow a variety you especially like or may be difficult to find again. If there is a failure of the seed to germinate or prosper, you will still have some seed to try again in another location and different conditions. BC

Cuphea Plants For Bees

Connie **Krochmal**

Cupheas are among the most rewarding bee plants I've ever grown. Blooming freely, these require minimal care. Widely known for their odd-shaped flowers, they're a great choice for bee gardens. The plants readily self sow.

Background and General Description

This group is related to loosestrife, crape myrtle, and henna. Worldwide, there are around 250 species of cuphea. Some of these are native to the U.S. where they occur in pastures and woodland clearings. However, most are found in Mexico, the Caribbean, Central and South America.

Some cupheas were introduced to the U.S. as a potential agricultural crop in recent decades. The oil-rich seeds are added to animal feed. The oils are used in detergents, soaps, and cosmetics, while the flowers of at least two species are made into leis. A lei can contain 2000 or so cuphea blooms.

Cupheas are typically grown as annuals. Their hardiness varies somewhat, depending on the species. Most will survive Winter in zone nine. They generally tolerate light frost along the Coastal South. In cold climates, these can be overwintered indoors or in greenhouses. I brought mine into the sunny unheated basement before the first frosts hit in the Fall.

Cuphea is from a Greek word meaning 'curved', which apparently refers to the seed capsule. This group includes shrubs, sub-shrubs, perennials, and annuals. The perennials, often woody or shrubby, can be short-lived.

As annuals and perennials, they're grown in flower beds and borders. Widely used as bedding plants, cupheas are also great for containers – especially hanging baskets. Low growing types make good ground covers and edging plants. In warm climates, these bee plants are also suited to foundation and mass plantings, and rock gardens.

With sticky hairs, the foliage, sometimes toothed, can be whorled or opposite. The leaves are typically lance-like to egg-shaped.

The brightly colored blooms open singly or in leafy clusters from the leaf axils. The flower shape and size differs widely, depending on the species or cultivar. Some are tubular, while others have an irregular shape with an open face. Several species feature intriguing, ear-like petals.

Growing Cupheas

These are adapted to full sun and dappled shade. Cupheas thrive in a reasonably rich, moist, well drained soil. Although they're generally drought tolerant, these produce more nectar and pollen when ample moisture is provided during prolonged dry spells. The plants benefit greatly from regular applications of fertilizer throughout the growing season.

Most of these plants can easily be grown from seeds,

Bat faced cuphea (Cuphea llavea).

which should be scattered on the soil surface. Then, gently press the seeds down slightly to hold them in place. Avoid covering them as they need light in order to germinate. Germination is best at around 70°F.

Cupheas can also be grown from cuttings. This can be done from Spring through the Fall. The plants are also propagated by divisions.

In warm climates, cupheas can be pruned in Spring or Fall. Normally, these encounter few serious insect and disease problems. However, aphids and whiteflies can occasionally occur. Powdery mildew, root rot, dieback, and leaf spots are the most common diseases.

Cupheas as Bee Plants

Bees collect nectar and pollen from cupheas. They're especially fond of these flowers, particularly those of Mexican heather and the David Verity cultivar. Although cupheas produce quite a bit of nectar, the plants are seldom plentiful enough to yield a honey surplus.

Recommended Cuphea Species

Of all the hundreds of cupheas, the following species are among the most commonly grown.

Bat faced cuphea (*Cuphea llavea*)

Hardy to zone nine, this is native to Mexico. It often self sows and spreads locally. All parts of the bat faced cuphea are hairy. This vigorous, shrubby, erect species is three feet in height with an equal width. It features sparsely branched stems. The foliage, three inches long, is medium green. The upper leaves are almost opposite.

The showy blooms, 1½ inches long, remotely resemble a bat's face. These can be purple, vermilion, or red with colorful green and purple calyx tubes. With white throats, they feature two, crinkled, vivid red or reddish-orange petals. The blossoms open from early Summer into Fall on leafy terminal clusters.

Outstanding cultivars include Tiny Mice, which is slightly over a foot tall. It is named for the extremely large, spectacular, novel-shaped, flame red blooms with purple calyx tubes.

The Flamenco series is hardy to zone eight. Just over 1½ foot in height, these feature particularly large, spurred blooms. Flamenco Cha Cha bears hot pink or fuchsia blooms with white and purple centers.

Several new cultivars of bat faced cuphea were released in 2013. The Sriracha series includes three flower colors – Rose, Violet, and Pink. These plants do especially well in areas with hot Summers. Gardeners will love the fact that they can be grown from seed, which are available from various sources.

The compact Sriracha plants are well branched and covered with intriguing flowers from Spring throughout the growing season. Sriracha Rose blossoms feature a whitish, bat faced center and rose, paddle-shaped petals with intriguing ears.

A dwarf version of this species (*Cuphea miniata* or *C. llavea var. miniata*) is also native to Mexico. Hardy to zone 10, this is a bushy sub-shrub or perennial with bristly stems. It is only 1½ to two feet in height. Numerous cultivars are available.

Firecracker is an excellent hybrid cultivar of bat faced cuphea. This thrives in the South despite the high humidity and hot Summers. It can bloom year-round in warm climates, and is especially suited to Texas, California, and Florida where it is treated as a perennial.

When grown in areas where it is marginally hardy, Firecracker typically dies back over Winter and produces new shoots in the Spring. Slightly over a foot tall, this is named for the deep red and purple blooms that contain several red, ear-like petals. This plant prefers a slightly dry soil.

Candy corn cuphea (*Cuphea micropetala*)

Native to Mexico, candy corn cuphea is hardy to zone 7b. Evergreen in the South, it will drop its leaves in colder climates. This is a freely branching sub-shrub or shrub, two to six feet in height with a spread of four feet. The strong, arching, vivid red stems are usually hairy.

The medium green, densely crowded leaves range from oblong to lance-like. Often scale-like or willow-like, they're up to six inches long.

When grown as a perennial in warm climates, candy corn cuphea blooms most heavily in the Spring and Fall. The slightly hairy, tubular blossoms are one to 1½ inches long. Constricted at the top, these are bright red or pink at the base with yellow or green shading towards the tips. The six, small petals can be red, yellow, or white. The flowers appear in long, leafy, terminal, spike-like clusters that emerge from the leaf axils.

Cigar plant (*Cuphea ignea*)

Also known as cigar flower and firecracker plant, this is one of the best known cupheas. Native to Mexico and Jamaica, the species was introduced to the U.S. in 1845. Hardy to zone 8b, it is often grown as an annual bedding plant and houseplant. In warm climates, cigar plants are treated as perennials.

This leafy, compact, much branched sub-shrub has a spreading growth habit. Under good growing conditions, it generally ranges from 2½ to four feet in height with a matching width, depending on the cultivar. As an annual or indoor plant, cigar plant is around a foot or so tall. Dwarf varieties are slightly shorter.

Cigar plant (Cuphea ignea).

The glossy, bright green foliage is 1½ to three inches in length. The leaves can be oblong, egg-like, or lance-like. A variegated cultivar is available.

The showy blooms, 1¼ inches long, open singly in the leaf axils from late Spring into Fall. These slender, flaring, tubular blossoms are mostly flame red and orange with a white mouth. The distinctive, dark black or purple ring around the tip explains the common name. If present, the small petals are deep purple.

Various cultivars of cigar plant are available with the flower color varying. Lutea features pale pink blossoms, while those of Petite Peach are true to their name.

David Verity, which can be grown from seed, is an outstanding, reliable, award winning cigar plant hybrid. About three feet tall, it bears exceptionally large blooms. This cultivar has been described as a 'solid performer' in plant trials around the country.

Clammy cuphea (*Cuphea petiolata or Cuphea viscossima*)

Also called blue waxweed, this native was originally found in a limited area, particularly from Georgia to Louisiana. Now its range extends over much of the East

Mexican heather (Cuphea hysspoifolia).

Cuphea Summer Medley.

and Midwest. Clammy cuphea occurs in dry open woods. Adapted to full sun and partial shade, the species grows in most any soil type, including clay.

Clammy cuphea is a very sticky, hairy annual, which accounts for the common name. It can reach 1½ to 2½ feet in height. The opposite leaves, ½ inch long, range from egg-like or lance-like to almost triangular.

This blooms from mid-Summer into Autumn. The purple-rose blossoms are spurred at the base. They feature six, short, clawed, purple to purple-rose petals. The two upper ones are the largest of all.

Lanceleaf cigar flower (*Cuphea lanceolata*)

Native to Mexico, lanceleaf cigar flower is hardy to zone 10. This bushy, hairy sub-shrub can reach four feet in height in warm climates. When grown as an annual, it is 1½ to two feet in height.

This plant has attractive purple stems. Both the stems and leaves feel sticky. The tapered to lance-like foliage grows to three inches in length.

Lanceleaf cigar flower blooms from Summer to Fall. The flaring blossoms open singly in the upper leaf axils. With six petals, the 1½-inch-long flowers can be purple, purplish-red, deep violet, or red.

Mexican heather (*Cuphea hyssopifolia*)

Of all the various cupheas, this is by far my favorite. Mexican heather is a very popular and commonly available cuphea. Described as 'tough as nails' by some gardeners, this is also known as Hawaiian heather, elfin herb, and false heather.

Hardy to zone 8b, it is native to the highlands of Central America, Mexico, and Guatemala. When grown in warm climates, this evergreen shrub can reach two to 2½ feet in height with a slightly larger spread. As an annual, it is usually about a foot tall. This has a moderate growth rate.

Mexican heather features attractive peeling bark. This fine textured, erect, round, bushy plant is densely branched. The plant shape or growth habit can vary somewhat from one kind to another. The compact, flexible, leafy stems are low branching, hairy, and slender.

The narrow, leathery, scale-like leaves crowd together on the stems. These can be whorled or opposite. Only ¼ to ½ inch in length, they resemble hyssop leaves, which accounts for the Latin species name.

Very free flowering, Mexican heather is particularly showy when in full bloom as the stems are clothed with flowers arising from the leaf axils. This can bloom almost year-round in warm climates. As an annual and tender perennial, it blooms from Spring until frost.

This bears small, short clusters of tiny, star-like flared blossoms. The miniature flowers are about half the length of the leaves and slightly wider. They feature colorful, green calyx tubes. The six, paddle-shaped petals vary widely in color, depending on the cultivar. They can be reddish-purple, white, red, lilac, pink, or purplish-pink.

Violet cuphea (*Cuphea cyanea*)

Also known as black eyed cuphea, this is native to Mexico. Violet cuphea is hardy to zone seven. It is grown as a bushy perennial or freely branching shrub or sub-shrub. In its native habitat, the species can reach six feet in height. As a cultivated plant, this is typically 1½ to three feet in height.

Violet cuphea feels hairy and sticky. It has flexible pink stems. The deep to medium green, egg-shaped leaves grow to three inches in length.

Flowering occurs from late Spring to Fall. The tubular blossoms, 1¼ inches long, form terminal clusters. Vivid pink with yellow or green tips, the intriguing blossoms bear small, ear-like petals, which are violet-blue or burgundy. BC

Connie Krochmal is a writer and beekeeper in Black Mountain, North Carolina.

BIGGER PICTURE

Jessica **Louque**

Berry Crazy About Bees

I keep hearing this internet meme from both my Facebook wall and from daily conversations that's been bugging me. Supposedly, Albert Einstein (or someone) said that without honey bees, we would all die within three years from a lack of food. First of all, Albert Einstein was a cool guy, but he was no biologist. Second, what would he know about pollination in North America in 2014? The most important thing to remember here is that honey bees are not native to North America. That means all of the plants that *are* native were originally not pollinated by honey bees. Some of these plants have adapted to the ways of the social bee, like cranberries, while others, like blueberries, still benefit from bumble bee contact.

"What were some of these indigenous plants?" I hear you asking me. Of course, I am happy to oblige. My favorite fruit/vegetable, tomatoes, along with most of its cousins in the nightshade family are from the Americas. Corn is another big producer that is American, even though we wouldn't recognize the original version of corn anymore. A horde of our berry population and their counterparts are of American origin. Muscadine and Concord grapes, blackberries, black raspberries, blueberries, cranberries, and strawberries are some of the many types of "berries" (I am using the term loosely, not botanically) that were around before Columbus visited America.

If you are already a beekeeper, it should be a natural progression to be at least a small-time gardener. If you begin to question the availability of fruit through all seasons, you may wonder if it's really a feasible option. Besides the insane prices, when fruit is grown in other countries, it can be sprayed with pesticides that aren't even registered in the U.S. that may have questionable side effects (or not, who knows?) but I doubt you'd ever even be able to find out the pesticide history. Let's say that big plastic box of blueberries says "organic" on the wrapper. That still doesn't mean they weren't sprayed

Massive blueberries.

Ripe blackberries.

Blueberry pollination by a honey bee.

with something, and those limitations can depend on the locale of the farm. I personally think the benefits outweigh the negatives because the kids need some kind of nutritional sustenance in their lunches (as mentioned in the previous article) even though we are spending $3.50 for a carton of blackberries and/or blueberries that's not even one full serving for four children. With this in mind, we are hoping to be able to grow enough fruit for the Summer to provide a minimum of one cup of fruit for each kid for lunch.

If you're going to grow a berry-ish fruit, there are some basic rules that apply to all of the fruits in this category. First of all, most of the plants are purchased as some sort of rootstock. Strawberries can be purchased at most home garden stores as plugs, which are much easier to start than seeds. Blackberries, blueberries, raspberries, and other bush or vine crops are purchased either as small potted stems or occasionally bare root if shipped from an online supplier. That means when you buy them, the soil must be ready to go. The soil should be easily drained, loosened, and have a decent quantity of organic matter readily available for the plants. A sunny spot is the best for fruit production, and most of your plantings should occur in the Spring. Your berry crops should be perennial, assuming you don't kill them, but it means they will need a lot of water in their first year to establish roots with little to no return. Most blueberry bushes won't give you more than a few pounds of berries even by the fourth year, but will eventually hit the 10+ pound mark after six to seven years. I also like to plant pre-rooted purchases with chopped up banana peels to add potassium to that area to aid in the root formation. This will decrease the shock time and help establish the plant faster. If you plant a lot, you either need to buy some sort of fertilizer mix or eat a lot of bananas. You should dig a large hole for bushes and vines so that the roots have less resistance when growing in the first few years. You want them to have support, but not to experience root compaction.

Alternatively, some of these, like blueberry bushes or strawberry plants, can be grown in containers if you are unable to plant them in the ground. Strawberries can also be planted in something like an old gutter screwed into a wall at a slight angle for draining, and it keeps them ventilated while recycling the gutter!

When your plants start to grow, the vining ones will need a trellis or some sort of support system. It's a good idea to have your lines or trellis already in place for your plants to use. Even if they don't vine, but especially if they do, they will need pruning on a regular basis. Any plant material or fruit that is dead, damaged, or diseased needs to be removed as soon as it is discovered. Leaving it just adds fuel to the fire and spreads like a cold in kindergarten.

Rotting fruit also attracts all sorts of pests to the area that will eventually move on to the not rotting fruit. Thinning plants for air circulation keeps some diseases from growing, and it gives room for sunlight to ripen hidden berries.

Blackberry and raspberry canes won't produce fruit again after they have completed their second season (they grow a year, then produce berries the next) and those spent canes can be removed. Strawberry runners can be removed and used to grow new plants, or just composted or fed to chickens.

Blackberries and blueberries are my current favorites for long-term fruit production because they are expensive in the grocery store and the kids love to eat them. Bumble bees are a little bit better at pollinating blueberries, and there is enough diversity in the landscaping (or lack thereof) to attract multiple solitary pollinators as well as bumble bees.

Beware of the flowering times when you purchase plants because you need to make sure your varieties bloom simultaneously or you won't have cross-pollination. Planting blueberries can be a little bit of a struggle because they are not supposed to be hard to grow, but I often neglect my first year babies once new plants take the stage. The blueberries in particular often fall far short of their watering requirements, and only the strongest, best planted, or just lucky, survive. Rabbiteye blueberries do well here, along with a few other varieties, especially if they are planted with compost. They prefer an acidic soil like azaleas, and will really struggle with production if the pH rises above six. Some of their weak points are their susceptibility to wind damage and their dislike of hard water while needing excessive watering. Finding an open sunny spot to plant bushes that is also protected from wind can be tricky, but sometimes not as hard as maintaining a rigorous watering schedule to keep the bushes happy. Mulching with an acidic substrate will keep water in and maintain the acidity of the soil. Whenever you fertilize blueberries, use a lime-free mix or it will raise the pH.

If you are planting blackberries, do some research on the variety that best suits your available habitat and taste. We like large sweet berries that are preferably thornless. Your preferences might lean more towards the length of

time before you have fruit, or the size of the berry, or it may be as simple as choosing a variety that grows well in your area. Similar to blueberries, blackberries will do better if they have a windbreak, but they can be partially shaded and still produce good fruit. They can also grow in nearly any average soil as long as it doesn't retain water, although they prefer organic matter and a more balanced pH if possible. You also need to water the plants well in the heat of the Summer if the rain isn't coming your way. The most important time is when the berries are turning black, as this is the essential time for the plant to need water. You need to do it as close to the roots as possible or you run the risk of splashing the fruit and canes and spreading fungal diseases. Blackberries are awesome because they freeze well for later use if you don't plan to eat them fresh, and you can freeze them whole with relatively little loss from the fresh version.

A bit of botany for those of you who want more accuracy, or have that haunting fight of The Tomato: Fruit Vs. Vegetable? A strawberry, for example, while considered a "soft fruit" is actually an aggregate achene, similar to blackberries, but with the seeds contained in achenes. When you look at a strawberry, each of the seeds you see is actually the fruit and the fleshy red part is the carpel, or what would be the equivalent of placenta in a mammal (ew, maybe not as tasty now). A berry is a fruit produced from a single ovary, and contains a few foods that a lot of people would have never considered. Some of the more common ones include the blueberry, gooseberry, elderberry, currant, goji berry and grapes. Some of the not so commonly known (as a berry-type fruit) include my beloved tomato, bananas, avocados, persimmons, pumpkins, watermelon and coffee.

A wild-occurring salmon berry (similar to raspberries).

Try some homegrown food production for 2014, and heavy hauls for those of you who started earlier! BC

Jessica Louque and her family are living off the land in North Carolina.

CATCH A SWARM

Al **Avitabile**

Not far from my apiary lies a large patch of jewelweed (Impatiens *capensis).* I watched the bees as they entered the tunneled, dead-ended, tubular throat of these flowers. As they backed out of the flowers, my attention became focused on the sudden and familiar hum produced by a swarm of honey bees. I immediately turned toward my apiary to see that one hive was in the process of casting the swarm. I was, of course, concerned and asked myself - what action will be required to prevent the loss of these bees?

I quickly moved to the hive the bees were exiting. When I reached it, half or more were already airborne. In fact, many were moving toward an old pear tree about fifty feet from their hive. Only by a stroke of good fortune had the queen, destined to accompany them, alighted in a clump of grass close to the hive's entrance.

Most beekeepers are aware that if only one queen is accompanying the swarm, and if she can be captured, the rest of the swarming bees will inevitably come under the beekeeper's control.

I seized the queen by the wings and, with her in hand, quickly headed for a nearby shed where I kept several wooden queen cages. After securing one and removing the cork from one end, I guided the queen in and replaced the cork.

When I returned to the swarm site, I found that most of the bees had assembled 36 feet off the ground on one of the pear tree's branches. From this observation we can learn that swarming bees will initiate cluster formation even if their queen is initially absent and she plays no role in leading the swarm to its cluster site. Actually, it is the first group of worker bees who randomly settle on (in this case a branch) and play the major role in attracting the multitude of airborne bees and their queen to the clustering site.

The process whereby the majority of the bees in the air join those which have alighted is accomplished, to a large extent, by the release of pheromones, chemicals released for purposes of communicating with other members of the same species.

The first worker bees at the landing site raise their abdomens while bending the tips of their abdomens downward to expose the Nasonov gland. They then fan their wings, wafting the pheromone components of this gland into the air. These potent chemicals are the most well-known of the honey bee orientation odors.

The two most attractive components of the Nasonov gland are (E)-citral and geranic acid. In fact, when a large number of bees are releasing these particular pheromones, one can actually detect the scent of lemon. Further, the release of this pheromone complex becomes contagious, stimulating other bees to join in which can be even further accelerated once the queen joins the cluster.

Bees in the cluster become aware that their queen has joined them by detecting two of her pheromones which are produced in her mandibular glands. I should note that we owe a great debt to those researchers who teased out and identified these chemicals and discovered their functions.

Two pheromones produced by the queen's mandibular glands are essential in stabilizing the swarm. These secretions have been identified as 9-Keto-(E)-2-decenoic acid (90DA) and 9-hydroxy-(E)-decenoic acid 9HDA. 9-0DA is also referred to as queen substance.

When the queen joins the cluster, her pheromones not only attract, as already noted, more workers to the cluster, but also stabilize it. Once the swarm has completely settled with their queen among them, (and occasionally more than one), the cluster is said to be stable. At this stage, bees seen flying on and off the cluster are primarily scout bees. Their task is to search for a homesite which, in most cases, will be a cavity with adequate volume and protection to serve future needs of the colony.

If the swarm's queen fails to join the cluster, events will not unfold as have been described. However, by being aware of the components required for a swarm to cluster and stabilize, we can retrieve a queenless swarm, provided we have its queen or even a substitute queen.

In this particular case, a shovel left in the vicinity of the apiary was put to use. The spade end was pushed into the ground and the cage containing the queen was tied to the shovel's handle. Then, there was nothing left to do but wait and observe.

It does not take long for a cluster of bees to recognize that their queen is not in their company because of the absence of her pheromones. Slowly at first, very few bees begin to fly off the cluster; then, with the passage of time, more and more take to the air searching for their queen. At the outset, the cluster expands in size as it loses its cohesiveness. Over time more and more bees become airborne. The cluster begins to shrink into the size of a fist.

Bees departed from the cluster fly in ever-widening circles searching for the queen. Eventually, some of the bees find and alight on the queen's cage (which was tied to the handle of the shovel) and begin the scenting ritual. In a short time more and more alight on the cage, as well as on the shovel's handle. Many, in turn, initiate scenting behavior and within a short time, often less than half an hour, the entire swarm of bees had reclustered and stabilized on or around the queen's cage and shovel handle.

Having now "roped" in the swarm, the problem and question of where to relocate it still remains. Fortunately or not, as in many activities involved in the husbandry of honey bees, there is more than one option. Small wonder that when someone asks two beekeepers the same question, it is not unusual to receive two entirely different answers.

We will briefly offer a few options: The swarm can be used to establish a new colony; it can be used to strengthen a weak colony; or it can be returned to its original colony. It should be noted that if the last option is selected, one must take all the necessary measures to prevent the problem from recurring.

Postscript:

On occasion when a colony is in the process of casting a swarm, the queen fails to exit the hive. Possibly this is due to the fact that as bees commence leaving the hive, bees are running, tumbling and scrambling over one another. The queen may get caught up in this seemingly "chaotic" activity and fails to exit. In such cases two scenarios have been observed. Sometimes the airborne bees return to the hive without clustering. Other times if the bees form a cluster, they eventually return to the hive. BC

Reference

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Acknowledgement

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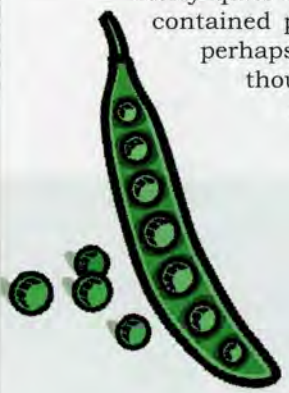
What Will The Label Tell Us?

Ann **Harman**



Many years ago our foods were really quite simple. A can of peas contained peas, some water and perhaps a bit of salt. Nobody thought very much about it – it's just a can of ordinary peas. Vegetables and fruits were bought fresh, in season. However a selection of some of those fruits and vegetables was available. Consumers could buy a sweet eating apple or one that was better suited for apple pie. Several different kinds of tomatoes could be found. Those who grew their own fruits and vegetables eagerly searched the seed catalogs where new varieties were offered every year. Today the seed catalogs still feature a large assortment of new varieties.

New plants and animals have occurred naturally throughout the millennia by forming hybrids. A hybrid can be thought of as a combining of genes within species or closely related species. In the wild the process of hybridization is happening now without man's intervention. One notable example is the coywolf, a breeding population of animals that began as mating between wolves and coyotes living in the same territories. It may be difficult to find new plant hybrids in the wild plants today since plants stay in place and differences can be easily overlooked.

Man has been creating hybrids for a very long time. Consider the mule, a sterile hybrid of female horse and male donkey that produced a strong work animal for the farm. Today we can buy a labradoodle, a popular hybrid of a Labrador retriever and a poodle. We can plant seeds for Iceberg lettuce, now given Heirloom status but was a hybrid back in 1895! Sweet corn was hybridized in 1902 to give us the famous Golden Bantam, again with Heirloom status today. And the grapefruit is an 18th century hybrid! Those hybrids were created by simply performing cross-pollination with different varieties. However, our hybrid automobiles today, gasoline-electric, have nothing to do with genes but we use the word to indicate the pairing of fuels.

Now let us enter the world of genetically modifying the genes for plants, a process different from hybridization. These plants are called either genetically modified organisms (GMOs) or genetically engineered (GE) plants. The Food and Drug Administration (FDA) chooses to use the latter term, (GE). Genetic engineering of an organism was developed about 40 years ago but only became useful in food plants about 20 years ago when scientists found how the actual genes a plant contains could be changed to achieve desired characteristics.

Home gardeners are quite familiar with the insects that nibble and chomp their way into our vegetables, the fungi that cause our beautiful flowering plants to wilt and shrivel, and the gigantic weeds that profited from our compost and fertilizers. Home gardeners have ways to combat these problems, whether growing organically or using an array of products. It is easier to attack problems on a small scale than on hundreds or thousands of acres.

Modern agriculture is quite different from that a century ago. Today food-production farms are huge and are dependent on efficient and profitable ways of growing crops. Just as beekeepers have found with trying to control *Varroa* mites, farmers using pesticides found resistance would develop and an insecticide became useless. Farmers found that weeds hampered growth of the crop plants and gave problems during mechanical harvesting and processing of the harvest.

The goal of the geneticists became one of obtaining a desired gene, say of resistance to a weed killer such as Roundup®, and inserting that gene into the genes of the crop plant. Now the farmer could douse the field with a herbicide and kill the weeds with no harm to the crop. Unlike plant hybrids that are done in the field with growing plants, genetically engineered plants are created in laboratories and tested in those laboratories to see if the plant grown has the desired qualities. Once the plant demonstrates success seeds can be produced for further testing. However, the seed producers will have to apply for approval to field-test the seeds. That is just the beginning.

Once field-testing is successful then that seed company is required to have regulatory approval for that seed to be sold to the farmers to grow the crops that will enter the human and/or animal food supply. That regulatory approval was established in 1986 as the Coordinated Framework for Regulation of Biotechnology. Let's see who does what. (Get ready for lots of acronyms.)

First the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) determines whether the GE crop has the possibility of becoming a weed. Then the Food and Drug Administration (FDA) may evaluate the food but it does not require premarket clearance for any food, including GE ones. If the crop is modified with pesticide properties then it must be assessed by the Environmental Protec- tion Agency (EPA). So the end product will pass through two or three regulatory agencies.

It is interesting to note that the FDA considers GE crop materials in manufactured foods as food additives. Such additives are subject to regulation and would be 'generally recognized as safe'

(GRAS) or not by the producer of that food. The producer may be required to prove the additive does not adulterate the food. An additive is not necessarily considered adulteration. Adulteration would be a substance considered harmful to people's health and the producer could be prosecuted.

The actual qualities of the various GE crops are quite varied depending on the specific crop. Let us look at some examples. One of the early GE foods, dating from 1994, is the Flavr-Savr® tomato that delays ripening so it can be shipped economically. Papaya today resists the ringspot virus that has no cure. Zucchini can resist three viruses. The Nonbrowning Arctic apple has been submitted for approval. Producers are investigating using GE techniques to increase the nutritional content of foods, such as golden rice that now offers vitamin A nourishment in countries that normally eat white rice.

At the moment the U.S. is the largest commercial grower of GE crops in the world. Let us see what these are and where they appear in our diets. Some GE foods would be eaten as such, for example papaya. Many other GE crops would be used as an ingredient in both animal and human foods. Those GE crops being grown are: corn (not the 'sweet corn' varieties) (about 90%), canola, soybeans (91%), sugar beets (95%), and cotton (88%).

Processed corn is found in so many foods it is almost impossible to list more than a few: cereals, snacks of all kinds, baked goods, baby foods, beer, sweet syrups, oil, pet foods and other animal foods. With soybeans it is different. Livestock feed uses about 98% of the soybean crop. However, the remaining 2% will be found in many of our foods (again too numerous for a complete list): salad dressings, oil, nondairy creamer, whipped topping, breads and as a meat substitute. Canola and cotton are used as oils.

Sugar beets are interesting. The U.S. produces about 90% of its own sugar supply. Half of this is from sugar beets. However in the processing of the sugar beet to pure sugar none of its DNA or protein is left. The resulting sugar is 100% pure sucrose, identical to that from sugar cane. The resulting leftover pulp is used in animal feed. So the 100% pure sucrose from sugar beets cannot be considered a GE food.

At present 64 countries require labeling of GE foods. Fifteen nations of the European Union, Japan, Australia, Brazil, Russia and China are among the list of countries. Each country has established a threshold of GE content above which the label must have GE information. In Canada the labeling is voluntary. The U.S. Food and Drug Administration (FDA) directs the labeling of our food. The only requirement for the labeling of GE foods would be for a nutritional property (fats, vitamins), allergens (peanuts), or a toxic substance over an acceptable limit.

It should be noted that the FDA considers the word 'natural' to be a marketing term and therefore has no definition of 'natural.' So that word can appear on any food product that the manufacturer wishes, but it carries no official information. The FDA has been urged to make a definition for 'natural' so that it would convey real information to the consumer.

At present a few states have labeling requirements to include GE (or GMO) information. Other states are considering adding that information to their label laws. In general, state label laws follow the FDA requirements with additions. It may become difficult to keep up with a profusion of individual state labeling laws regarding GE information.

It seems that many consumers want to know what is in the foods they consume. Therefore including GE information on the label seems to be desired. The Grocery Manufacturers Association, representing more than 300 food companies, want consistent labeling and a definition, by the FDA, of the word 'natural.' The Association wants food labels showing GE ingredients to be able to use the word 'natural' as defined by FDA.

The FDA has considered voluntary labeling of GE foods but has not taken any action on that. It is felt that mandatory label regulations will have to take into consideration future developments in GE foods.

At the moment you can find arguments for and against GE labeling, arguments about GM foods being safe or unsafe for human and/or animal consumption, and arguments about mandatory or voluntary labeling. No immediate solution is at hand.

Beekeepers will want to know about honey. Pollen is ubiquitous in a beehive. Honey, unless filtered (yes, the correct definition) will contain pollens of various kinds. Could some of those be from a GE plant? If so, would the nutritional label for honey have to state that? The amount of pollen in strained (not filtered) honey is so very low that any GE plant pollen amount would fall way below any mandated threshold for content. The REU has stated that pollen is an ingredient of honey, not an additive. Therefore it would not be on any label.

What about pollen itself? Generally the pollen collected in traps comes from a variety of plants. The beekeeper does not always know what plants all that pollen represents. Doing any sort of analysis to discover pollen from GE plants would be prohibitively expensive. Furthermore we do not have good knowledge of the action of our digestive system on all the pollens. Even today beekeepers cannot be certain of contaminants, such as pesticides or fungicides, in an assortment of pollen.

Beekeepers can keep track of any progress in the FDA label regulations. You can Google fda.gov/food/label and you will find several sites you can open. As of this writing no particular action is being taken by the FDA on GE labeling of foods. BC

Ann Harman keeps bees and reads labels at her home in Flint Hill, Virginia.

GLEANINGS

MAY, 2014 • ALL THE NEWS THAT FITS

MONITORING BEES AND HIVES

This is a Call for papers for the 2nd International Workshop on Hive and Bee Monitoring. The 2nd International Workshop on Hive and Bee Monitoring is accepting submission for Papers, Exhibits, and Demonstrations of Hive AND Bee Monitoring Methods, Equipment, and Research. Topic Areas include, but are not limited to: 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.

In the meantime, we are in the process of setting up 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).

THE BEGINNING OF THE END?

The world's first populations of glyphosate resistant wild radish – a weed that causes economic losses in 45 crop types in 65 countries – has been found in three different locations in Western Australia's far northern grainbelt.

Australian Herbicide Resistance Initiative (AHRI) researcher Mike Ashworth says the findings are important because glyphosate is the world's most important knockdown herbicide and a vital tool in the control of wild radish, which has evolved resistance to many selective herbicides.

Two of the glyphosate resistant wild radish populations were identified and tested after survivors were found in fallows treated with glyphosate.

"These populations were confirmed to have moderate levels of resistance, exhibiting high rates of survival (63% and 86%) following label rate glyphosate application on two-leaf plants," Ashworth says.

"The third population was identified following an AHRI survey in 2010 and 2011 of 239 paddocks in WA's northern and central grainbelt."

Ashworth says the glyphosate resistant wild radish plants also exhibited resistance to other important herbicides.

"The first two populations identified also had resistance to label rates of the Group B (chlorsulfuron, sulfometuron-methyl, metosulam, imazamox), Group F (diflufenican) and Group I (2,4-D amine) herbicides" he says.

Ashworth says the history of herbicide use where the three populations were discovered was likely to have been a major factor in the evolution of glyphosate resistance.

"The first two populations are believed to have been exposed to at least one and often two glyphosate applications annually over two decades," he says.

Finding the populations early means growers have the opportunity to adopt pro-active control strategies.

"Herbicides alone should not be used to control wild radish; growers and agronomists should use a range of tactics to control wild radish populations," Ashworth says.

"The aim should be to control weed survivors, eliminate weed seed set and maximise diversity of control strategies." – *Alan Harman*

HONEY AS ANTIBIOTIC

Medical professionals sometimes use honey successfully as a topical dressing, but it could play a larger role in fighting infections, the researchers predicted. Their study was part of the 247th National Meeting of the American Chemical Society (ACS), the world's largest scientific society.

"The unique property of honey lies in its ability to fight infection on multiple levels, making it more difficult for bacteria to develop resistance," said study leader Susan M. Meschwitz, Ph.D. That is, it uses a combination of weapons, including hydrogen peroxide, acidity, osmotic effect, high sugar concentration and polyphenols — all of which actively kill bacterial cells, she explained. The osmotic effect, which is the result of the high sugar concentration in honey, draws water from the bacterial cells, dehydrating and killing them.

In addition, several studies have shown that honey inhibits the formation of biofilms, or communities of slimy disease-causing bacteria, she said. "Honey may also disrupt quorum sensing, which weakens bacterial virulence, rendering the bacteria more susceptible to conventional antibiotics," Meschwitz said. Quorum sensing is the way bacteria communicate with one another, and may be involved in the formation of biofilms. In certain bacteria, this communication system also controls the release of toxins, which affects the bacteria's pathogenicity, or their ability to cause disease.

Honey is effective because it is filled with healthful polyphenols, or antioxidants, she said. These include the phenolic acids, caffeic acid, p-coumaric acid and ellagic acid, as well as many flavonoids. "Several studies have demonstrated a correlation between the non-peroxide antimicrobial and antioxidant activities of honey and the presence of honey phenolics," she added. A large number of laboratory and limited clinical studies have confirmed the broad-spectrum antibacterial, antifungal and antiviral properties of honey, according to Meschwitz.

She said that her team also is finding that honey has antioxidant properties and is an effective antibacterial. "We have run standard antioxidant tests on honey to measure the level of antioxidant activity," she explained. "We have separated and identified the various antioxidant polyphenol compounds. In our antibacterial studies, we have been testing honey's activity against E. coli, Staphylococcus aureus and Pseudomonas aeruginosa, among others."

PREPPERS ON STEROIDS

More than 20,000 crops from 100 countries arrived in Norway to seek safety in the country's doomsday seed vault.

Their arrival means there now are 820,619 samples or accessions of food crops and their wild relatives stored in the Svalbard Global Seed Vault, deep in an Arctic mountain on Norway's remote Svalbard archipelago.

The doomsday title comes from the vault's role in ensuring the crops' survival after possible global disasters natural or manmade

The latest samples include a university collection of 750 accessions of barley from earthquake-rattled Japan, crucial to everything from beer and whiskey to miso soup and summertime tea; an untamed assortment of wild relatives of rice, maize and wheat; exotic red okra from Tennessee given BY a woman who said the seed was passed down through generations of Cherokee Indians, and 514 accessions of a humble black bean from Brazil that launched a national cuisine.

Their arrival coincided with the 10th anniversary of the Global Crop Diversity Trust, which maintains the seed vault in partnership with the Norwegian government and the Nordic Genetic Resources Centre.

Crop Trust's executive director Marie Haga says the Norwegian seed vault is a backup, housing duplicates of the living crop diversity collections kept in genebanks around the world and widely and regularly shared with plant breeders.

The Japanese ultimately plan to send some 5,000 barley accessions for safe-keeping in the vault.

The International Potato Centre delivered 195 samples of wild potato and 61 of wild sweet potato. While not edible, wild potatoes are viewed as offering traits that can be used to create more nutritious, disease-resistant varieties of domestic potatoes.

Meanwhile, the International Maize and Wheat Improvement Centre's latest shipment included 1,946 samples of maize and 5,964 samples of wheat, while Australian Grains Genebank sent wild relatives of sorghum, rice and beans.

Haga says every single deposit into the vault provides an option for the future.

"At a time of unprecedented demands on our natural environment, it is critical to conserve plant genetic resources for food and agriculture," she says. "This will guarantee farmers and plant breeders continued access to the raw materials they need to improve and adapt crops."

Alan Harman

Boxes of seeds in Norway's "doomsday vault. (Svalbard Global Seed Vault photo)

WILD BEES & HONEY BEES BENEFIT

Investing in habitat that attracts and supports wild bees in farms is not only an effective approach to helping enhance crop pollination, but it can also pay for itself in four years or less, Michigan State University research finds.

Entomologist Rufus Isaacs says the work gives farmers of pollination-dependent crops tangible results to convert marginal acreage to fields of wildflowers, but doesn't mean this approach would replace honey bees.

Isaacs says other studies have demonstrated that creating flowering habitat will attract wild bees, and a few have shown that this can increase yields.

"This is the first paper that demonstrates an economic advantage," he says. "This gives us a strong argument to present to farmers that this method works, and it puts money back in their pockets."

As part of the study, marginal lands surrounding productive blueberry fields were planted with a mix of 15 native perennial wildflowers. The fields were pollinated by honey bees, but Isaacs wanted to find out if the wild bee population would improve pollination in nearby crop fields.

The results weren't immediate, Isaacs says, which implies that landowners would need to be patient.

"In the first two years as the plantings established, we found little to no increase in the number of wild bees," he says. "After that, though, the number of wild bees was twice as high as those found in our control fields that had no habitat improvements."

Once the wild bees were more abundant, more flowers turned into blueberries, and the blueberries had more seeds and were larger. Based on the results, a two-acre field planted with wildflowers adjacent to a 10-acre field of blueberries boosted yields by 10% - 20%. This translated into more revenue from the field, which can recoup the money from planting wildflowers.

Isaacs says honey bees, trucked in by beekeepers are still needed to pollinate crops valued at $14 billion nationwide,

"Honey bees do a great job of pollinating blueberries, and we're not suggesting that growers stop using them," he says. "But, our research shows that adding some wild bee habitat to the farm can increase bee abundance in the nearby crop, can be profitable and is an insurance policy to make sure there is good pollination each year.:

Establishing habitat for wild bees requires an initial investment, but there are federal and statewide programs, such as the USDA Conservation Reserve Program and Michigan's State Acres for Wildlife Enhancement, to help pay for this. In such cases, growers could see their return on investment even quicker.

Alan Harman

STANDARDIZE MANUKA HONEY LABELING

A New Zealand scientist is warning that fraudulent products threaten to destroy the international reputation of the country's honey exports.

Waikato Univ Ass. Prof. Merilyn Manley-Harris tells Radio NZ it is urgent for NZ to set up a system for standardized labelling of honey, especially the manuka variety.

NZ produced more than 16,000 tonnes of honey in 2012 and 2013. Honey exports were worth NZ$120 million in 2012, with manuka honey accounting for about 90% of this.

The Ministry of Primary Industries has formed two working groups to come up with a robust labelling guideline for manuka honey – one made up of scientists and one from the industry.

The two groups have until the end of June to come up with guidelines as to what constitutes manuka honey and what statements and claims are appropriate for the honey's labels.

Manley-Harris of Waikato University's School of Science and Engineering, who earned her PhD at the Univ of MT in 1993, is a member of the six-scientist working group.

She says one of the problems to be solves is the close similarity of manuka and kanuka honey. Researchers overseas can't tell the difference, she says, even though only manuka honey has the methylglyoxal compound seen as a key factor in its special anti-microbial powers.

Manley-Harris tells Radio NZ another issue to be solved is a chemical change manuka honey sometimes undergoes that mimics sugar being added to it.

The change can happen while it is stored and result in the honey showing a positive result when screening tests check whether the honey has been adulterated with other sugars.

Manley-Harris says the answer may be a system that allows consumers to easily track the provenance of each jar of honey. – *Alan Harman*

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Executive Publisher – John Root
Associate Publisher, Senior Editor – Kim Flottum, Kim@BeeCulture.com, Ext. 3214
Assistant Editor, Design & Layout – Kathy Summers, Kathy@BeeCulture.com, Ext. 3215
Circulation – Dawn Feagan, Dawn@BeeCulture.com, Ext. 3220
Advertising Manager – Peggy Garnes, Peggy@Beeculture.com, Ext. 3216
Publications Assistant – Amanda DeSimone, Ashaffer@RootCandles.com, Ext. 3255

Contributors

Clarence Collison • James E. Tew • Ann Harman • Kim Lehman • Phil Craft • Larry Connor • Connie Krochmal • Jessica Louque • Jeff Harris • Toni Burnham • Ross Conrad • Jennifer Berry

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V800.289.7668, Ext. 3220 • F330.725.5624
www.BeeCulture.com • info@BeeCulture.com

Advertising
800.289.7668, Ext. 3216; Peggy@BeeCulture.com

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A Redbud in Northeast Ohio. (photo by Kim Flottum)

For Christmas, I received a copy of Tom Seeley's *Honeybee Democracy*, a lyrical tome about honeybee group decision making, particularly decision making related to swarming. This hardcover book was a delight to read and to rest heavy on my lap in front of the woodstove in January. I'd just started reading it, when Pepper, my gal Marilyn's new blue heeler pound dog, ate the cover. The dear boy was bored and lonely, that's all! He'd spent two consecutive days home alone, and a dog's gotta do what he's gotta do. Chewing can be a problem with heelers, and I blame Marilyn and myself, not Pepper. The pages are all still there, but reading it now is like driving a new car you just wrecked. It's not the same.

Speaking of wrecking cars, Marilyn hit a black cow the other night, doing 60 on the way back from ski instructor certification in Crested Butte. The cow expired before her eyes in the ditch, to Marilyn's considerable dismay. Her beloved '87 Saab 900 was of course totaled, but my little darling walked away unscathed. I told her, "That Saab gave its life for you. Be grateful."

Marilyn carries liability coverage only. Now does she owe the farmer for his cow, or will the farmer buy her another car? We don't know yet. It has to be one or the other, right?

It's early March as I write, and I just got word back from Derrick in California. He's been in the almonds looking after Paul's bees, along with mine and his own, and whoever else's made the trip on Paul's eight semi-loads.

It was very nearly a disaster. The bees shipped in November from Colorado, before the weather turned. We bulked them up on pollen supplement patties before departure, so they'd be roaring to go when they got to the land of milk and honey. Feeding pollen stimulates bees to raise brood, which is what you want prior to the bees going into the almonds. But as we learned later, timing is everything.

When they arrived in California, they got set down in a holding yard, in a heat wave. All the little darlings knew to do was to fly around, and eat their food stores. When Derrick got out there in January, the pollen supplement had all been consumed. This is exactly what you don't want to do: build up your colonies with pollen supplement and then stop feeding them. When these rapidly expanding colonies suddenly run out of protein, they crash. That's what happened with the hives in Derrick's care. Some of them ran dangerously short on honey, too. Derrick fed them all more pollen supplement – lots more – and corn syrup, as needed. He said they made "an incredible turnaround!"

Now here's a curious footnote to this story: Mike Luark's bees didn't get fed pollen supplement before shipment, and they never crashed! So back in Colorado while all the other bees were getting jacked up on expensive pollen supplement, Mike's were settling down getting ready for Winter. Very interesting, no?

Derrick figures we fed those bees too soon, that's all. Next year we'll get it right.

You live and learn in this business, and if you aren't making mistakes, you have my condolences, because you aren't learning.

I shipped 40 colonies. After rolling four weak ones into two, Derrick sent 38 into the almonds. He told me the growers paid up to $180 per hive, but expenses took a big chunk out of that. Still, for me, this is a nice bump in the springtime when bee money flies out of my hands.

Those little darlings will be back in Colorado before you know it, if they don't get stolen and their truck stays on the road. I expect them to be riddled with mites. I'll deal with that. I hope these hives are ready to be split, so I can get my numbers back up after a rough year for colony survival.

The Winter wasn't so bad. Last Summer was tough! I had European foulbrood, American foulbrood, and then there were the queens. When I bought a 40-hive yard from Paul last Spring, the bees were just back from California. Paul asked if I wanted new queens or old ones. The hives with old queens had had a nuc pulled out of them. The ones with new queens were one-super splits. This should be a no-brainer, right? New queens, good; old queens, bad. Isn't that what the experts tell us?

I said I'd take half and half – 20 old and 20 new queens. All of the new queens got accepted initially, but eight of those queens failed by Labor Day. I say "failed." What I mean is, the hive either went queenless, or it wouldn't build up and fill honey supers. Meanwhile, the old-queen hives averaged 100 pounds of honey in this same apiary.

The new queens all came from the same queen producer. I remember his name. I made my mistake. I'm learning.

Ed **Colby**

Wrecks And Crashes