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The Magazine Of American Beekeeping

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The Science Of Bee Culture (Vol. 4 No. 1)

Almond Bloom Blog

ROOT PUBLICATIONS

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Water, the weather, the bloom . . . and honey bees. That's what it takes to make an almond. This just-starting-bloom orchard is near Bakersfield, CA. Read about honey bees and almonds on page 10, and page 26. (Flottum photo)

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Bee Culture

FEATURES . . .

DEPARTMENTS & COLUMNS

Science Of Bee Culture

Vol. 4 No. 1

Insurance Scam?

I have been a beekeeper for many years. I, myself, came across an insurance problem in NM. I had a neighbor that was threatened by the fact I kept bees. Despite the fact that the hives were three acres away from the fence. He fussed constantly that they would sting him.

I picked up a book called Bees and the Law at the used book store. I have found a website that also deals with this question. **www.gobeekeeping.com/LL%20lesson%20six.htm**

Yes, we can be held responsible if we are negligent at keeping our bees. But, if we are good beekeepers and take care of our girls, bees will be bees.

I firmly believe that insurance companies are going overboard on trying to capitalize on any possible way they can make money. I think these folks are on the edge of plain greed.

Its a shame that people are getting rid of their bees because of this business practice. Bees are scarce enough as it is.

I feel that perhaps our bee industry spokespeople should talk to our elected representatives before we are regulated out of beekeeping.

As for me, I moved to the middle of nowhere, so neighbors are no longer an issue for me. (In fact, the farmers welcomed my bees with open arms.) All of the small beekeepers I know consider our bees just like family. And I would never consider getting rid of them. (despite the fact that I, myself, am somewhat allergic to them.)

I learned to keep bees over 40 years ago, as a child, and I don't want to deal with the hassles of folks who just don't understand. (when I moved, my problem neighbors fruit trees quit producing.)

I wish Mr. Ewing, (see below) luck with their insurance agents.

Laura Shannon
Animas, NM

The First Time I Saw Her Die

I saw her slowly leaving by the main door. At first glance you could tell this was not a normal outing, she was moving too slowly. Many friends passed and with the briefest nod, then kept going about their business. Ever busy taking care of the chores of the day, they didn't stop, didn't pay her undue attention. It was a dignity thing as she was one of their oldest.

At a young age, she started as most in house cleaning, taking out the trash, cleaning the floors and keeping things tidy. She and her sisters spent time with mom helping with the everyday chores. As she grew older her jobs became more important. She worked hard by keeping an eye on things, helping with the youngsters and mainly working to keep everyone fed.

She got dizzy and fell. Trying to get up she knew the end was near. It was told by her older sisters such a thing would happen in due time. We all get old. She was one of the lucky ones living during prosperity and security. Others weren't, telling of times past when bitter cold and lack of food made life difficult. Others recounted the old stories of lost homes and hard times moving to new ones and rebuilding, ever building.

Moving closer she felt her life slipping away. She remembered the glory days when she joined the never ending travel to faraway places. She was strong and could go as far as anyone to supply food for the family. She became one of the few leaders that had many others depending on her sense of direction, literally the fate of the whole family rested on her shoulders.

Those adventures and responsibilities took their toll. Her body was worn out in her old age. Though never married, her family was her life. Comfort and satisfaction go with her as she leaves a legacy of honor and dedication for others to follow.

It's over now, she cannot rise. She stumbles forward with a tremendous sense of well being. It is finished as she falls to the ground below, her final flight.

I am saddened as this is my first. I had a feeling of remorse at watching the end of a life well spent. It is difficult to watch. I hope I will always have this sense of awe at the life cycle of my honey bees.

Frank Porter
Brevard, NC

Empty Lot Beekeeping

I recently visited the town of Hanover Park, IL. This may be the first town that ever set aside a piece of ground for an apiary site.

They had a storage area of about five acres that wasn't utilized very much. It has a small building and a couple of cars on it.

It is completely surrounded by a high fence with a coded gate. It is free to the residents of the town. There are not too many hives there at the present time, but more are expected this Spring.

What a wonderful concept. When you go to the site there may be other beekeepers at the site to assist you or you may find a mentor. Now all those people who want to keep bees in that area who were worried about neighbors or problems with their location can try out the great hobby of beekeeping.

Bill Bartlett
Valley Lee, MD

Insurance Update

I would have written back to you earlier but it has taken me this long to sort out my cover!

We left it before Christmas with me fuming about the greedy avaricious insurance companies acting like some kind of sleazy protection racket! I calmed down and made a few calls, mostly without success, or they were successful but still expensive! As it turns out the last person I called ended up providing the cover. Yes I know, it's *always* the last person! I called Texas Insurance and Financial Services who advertise in ABJ.

They (like most companies I called) are more used to deal-

ing with company insurance not insuring the hobbyist/backyard beekeeper. But they nevertheless looked into my predicament and were surprised by my insurance company's approach and sympathetic to my plight!

It turns out that the insurance policy they could offer me in Missouri (coverage is different across the states) is basically farm insurance! Not sure why it has to be a farm, but hey, what do I know! The cover includes for third parties (passers by, trespassers I guess) and also covers my liability with respect to the products I sell (up to a ceiling of $2,000). If I sell more I become a business, albeit a small one I guess. The documentation I have received does not however include any mention of beekeeping! The only thing I have is a note from the insurance company in an email which states:

"State Auto has not excluded coverage for beekeepers. The key is: Is it a hobby? If it is a business, it is excluded by form. If it is a hobby, coverage is automatic."

Pretty key I'd say!!!

So this leaves me asking "What have I learnt?" Well, basically that:

a) Insurance companies are still *generally* greedy and have no scruples – my early view has not changed much!
b) The risk of keeping bees is low as is borne out by the rarity of anyone ever being sued for negligence – I challenge you to find any!
c) That if your insurance company doesn't specifically exclude beekeeping you're good!
d) If you are challenged by your broker tell them to show you exactly where in the policy beekeeping is excluded.
e) If you feel you need insurance cover call Texas Insurance and Financial Services – Allison Moseley was very helpful.

Now the dust has settled I find that, overall, my insurance costs have not significantly increased from before I was "outed" as a backyard beekeeper. In fact I now have a better auto insurance policy, mainly because I was damned if I was going to keep any business with American Family Insurance! Finally, and possibly the biggest lesson, was learning you should regularly review your insurance for the best deal and don't just assume your broker is doing their best for you! All they want is easy money and there is nothing easier than sitting back waiting for your clients to renew their policy without thinking, or helping them!!!

Phil Ewing

Contamination

The more I read about imadacloprid and the neo-nicotinoid class of chemicals, the more I wonder about the possible contamination of human foods from them.

Considering the number of crops whose seeds are now treated with these products, i.e. corn, cotton, soybeans, sunflower, safflower, rapeseed, pumpkin and more, and the fact that the chemicals apparently invade every part of the plant, we would be ingesting some directly (corn, pumpkin) when we eat the fruit of the plant, and some (cotton, safflower) when the oil is pressed out and used to fry other foods (such as potato chips), and yet others (sunflower) where we both eat the seeds directly and press out the oil.

Knowing from research results that the neonicotinoids work by the insects taking the chemicals back to the nest in the nectar, pollen or leaf fragments, and the fact that the brood and workers then ingest the chemicals and end up having disorientation of their brains (e.g. termites stop preening and die from environmental poisons, and bees fly out and don't – maybe can't – get back), it is not too much of a stretch to think that maybe people's brains can be altered by eating the chemical residue in so many of our processed foods where the chemicals can be really concentrated. (Corn especially is used in so many ways, such as syrup, starch and as a direct food, and is fed in its many forms to people from infants through the elderly.)

If it is true that our brains *can* be altered in this way, then the next jump is to consider what conditions might result. Our two great scourges – autism and Alzheimers – have to be considered as possible results. I know of no research going on to study this connection and if indeed there is none, maybe it's time that some got started.

Robert Helmacy
Hop Bottom, PA

Overwintering

It could well be that plastic foundation is part of the problem in overwintering, for in the natural hive there is nothing to keep the bees from chewing right through the comb to get to the other side where more honey or bread is available. They cannot chew through plastic.

I would be interested to know from someone who has used wired frame foundation if they ever saw evidence that the bees ate through the wax foundation to survive a bad Winter. Although I have only used plastic foundation in my hives in the 10 years I have kept bees, I have seen old frames with wires where it appeared that the bees might have done just that (but it's possible some other critter made the holes).

If indeed bees *will* eat through from one side to the other, it might be even more reason to put some holes in our plastic frames so that even if the bees made wax and filled them in, they could reopen them in the late Winter.

Robert Helmacy
Hop Bottom, PA

INNER COVER

The Almond Odyssey, as all adventures must, has come to an end in terms of time on the road, people to meet, sights to see, and places to go. I had planned on this taking about 17 or 18 days, with some slack thrown in for down time due to inclement weather, but the weather Gods smiled – as far as not providing rain, so we wrapped it up after 16 days – leaving me with a couple of days to spend outside of an almond orchard.

I have been to California before for parts of this, especially the staging area time and moving into the orchards, so had a feel for what to expect, or thought I did anyway. And that's when you get in trouble – if you think you know what you're going to see, often that's exactly what you see, missing the rest of the picture. Fortunately I was traveling with a photographer who was in her second year of bees and brought to the mix a totally innocent perspective – asking questions that at first glance seemed too obvious to ask – and of course were exactly those that needed asking. This provided a needed wake-up call – a better look at what it is I should be doing here in the first place.

It would have been easy to just look at bees and beekeepers here, and we did a lot of that. But barely buried beneath the dust on the cover is the whole rest of the almond story, probably the widest and deepest picture we've looked at for some time. Without a lot of help I wouldn't have seen this picture, and couldn't have been able to share what we found. There's a lot of people who helped and I'll give you some of their background in later stories.

I'd like to think we could do this in a couple of months – bees, almonds, water, beekeepers, marketing, labor, inspections and inspectors, border crossings and fire ants and small hive beetle larvae, management and nutritional and chemical research, weather uncertainties, sub-contracting bees to fill contracts, orchard growth opportunities and limitations, fungicides, brokers, hullers, prices, bartering, CCD or whatever it is still causing colony crashes, pollen substitutes, two hours in a plane looking down on all this using google maps on an IPad, HFCS and sucrose and blends, forklifts and booms, the new self pollinating almond variety Independence, blue orchard bees, bonuses and rental prices, honey prices and colony management, Nosema, stolen hives, pollination contracts, supplemental plantings for bee food, sound pre-pollination financial planning and management and post-pollination escape routes, holding yards, Euro Fins contract research, herbicide sprays, and of course the financial multiplier of what the almond industry does for the state of California. So how much detail do you want?

Some of this of course is the almond story, offering a close look at a business model that may, or may not be sustainable in both the short and long run. And certainly some of this is a beekeeper's story, pure and simple. Some sing the praises of far sighted individuals and altruistic leaders who have the best interests of the land, the people and the future of agriculture in not only California but much of the country in mind when they make decisions. And some, of course, is about greed, crime, selfish and short sighted small people making a quick buck and damaging all who share their world. This story has a vast cast of characters and a plot that's at the same time transparent and obvious, and opaque and dense.

Let's start with the three comments heard most often, no matter who I was talking to – they had to do with water availability, labor availability, and a steady supply of healthy bees. That may sound like just almond growers talking but it's really everybody – without any one of these three the stool tips over. It's that simple. But step back and look at the thousands of things that impact the availability of water, labor and bees.

Water is nature's gift, some years. When there's lots of rain and snow and more rain everybody is happy and life is good. Some years that's the case but most years it isn't. When it isn't who gets what there is, is the result of a legal system that must decide whether California's endangered wildlife in one place have more rights than millions of people downstream and ecosystems in other places. Or they must choose whether city folks with lawns and showers have more rights than the raising-food folks with irrigation and processing demands that put food on a table somewhere – your table most days by the way. It's a complicated and top-of-the-list issue that will, in both the long and short run decide the future of California's dominance of all things agriculture and their command of all places rich and famous and comfortable.

Factors to consider are which water shed the water comes from or doesn't come from, grandfathered water rights and how much was paid for the water and by who and when. And more of course. This Solomon's decision is being made by, I'm told by what seem to be reasonable yet vested ag leaders, probably the best mind there is to decide where the water flows and where it doesn't, and which fragile ecosystem remains and which one loses.

At the same time there are other voices just as vested in the decision of business-as-usual or plow-it-under because the future is as dry as the cracked soil that remains – voices that fail to see, or choose not to see the value in preserving water-dependant ecosystems or the endangered animals that live there, who would deny people lawn-watering rights or restaurant patrons a glass of water before lunch. For them it's preserving the status quo – or improving it

Jacks Or Better

in their favor – the favor and flavor of the thousands of crop acres and millions of cattle that grow and thrive with the water they have. For many the priority should be food on the table, food on trucks heading out of state to feed you and me, food, food, food. And of course the money that food generates, the income to the state that food creates, the jobs (we'll get to those later) that food continues to feed, and the billions of dollars generated by California's agriculture. In the extreme – it's ag first, people somewhere down the line.

Where is the best choice? And how do you plan for the best choice? Do almond growers plan on expansion knowing without water all those new trees planted this year and last will be so much smoker fuel when the fields go dry? What is the return on an orchard that lives only five years? Seven years? Two years? Do you purchase land now and wait? Some say the best almond land is mostly gone so expansion is an investment in still expensive marginal land at best. Of course some say the future is bright, that water decisions will be favorable, that it will rain again and that the ever rising price of almonds will surely solve the equation – perhaps.

I certainly do not know the answer. It is decided by what price food? And the simple answer when that question arises. Water is, or isn't. Will Los Angeles use less water so growers can satisfy this growing global demand for almonds? Or does California, the Almond Board and Blue Diamond voluntarily give up the global almond market share they have so handily won in favor of Hollywood's toilets? And then there's the endangered species and habitats that need to be protected, or maybe not, anymore.

I have simplified this for brevity, but be glad you are not Solomon.

I have to add an aside here. If you are at all familiar with California – the life style, the agriculture, the geography, the industry, the population, the land, the mountains – you know that California is big – Texas and Alaska talk about being big – and they are compared to Ohio and Connecticut – but California does BIG THINGS. There are no small parts of this state. Cities and transportation. Mountains and forests. Vegetable farms and orchards dwarf their midwest and east coast cousins. Dairy farms defy description. I grew up in Wisconsin. Wisconsin is no longer the dairy capitol for a good reason – they aren't in the same league anymore. Imagine that scale when visualizing anything California.

Labor has, to some degree anyway, been discussed here before. It seems no better and no worse than many other places this season. There's plenty say some because the economy has been down and unemployment is up and there's work to be had and people to do it. Perhaps. I think this will continue to be on the ag plate, some years good, some years not. It wasn't high on anybody's agenda this Spring, so it goes.

The rest of the story though is right at the top of everybody's list – enough good bees to pollinate an expanding almond orchard market. For beekeepers the market is the orchard – more orchards mean the need for more bees. And here's the crunch. Growers know they need healthy, strong colonies to do the job of pollination and without them their yield will suffer.

And they know that the weather can muck it all up anyway, just like any other farming venture. But if there's just a few good hours of flying time during the whole four weeks or so of bloom and there's enough bees in the boxes they rent, then they'll get a good crop. But if the weather is great all during bloom even weak colonies will do an adequate job while adequate colonies will set a great crop, but boomer colonies will break records. And records are what it's all about.

This then is the poker game of almond pollination. What are the odds? Good weather and cheap weak colonies, or bad weather but strong colonies?

Across the table beekeepers, too, are playing the game.

Do they play it safe? Should they contact a broker early, get a contract for a conservative number of adequate colonies at a known price (plus the broker's cut) and do due duty to prepare them so their colonies are as ready as they said they would be? Not great, but adequate, and not too expensive to get ready. Keep three of a kind, and hope for a fourth?

Or, do they bargain hard, get a good paying contract directly with a grower, for a lot of good, strong bees, and then spend a fortune getting them up to that magic 12 frame average – that's average mind you – for not only top price, but top bonus? Stand pat on the straight flush – hoping something unforeseen doesn't come along.

Or, do they do as little as possible, knowing they'll be at the bottom of the strength pile when almonds bloom, but send them out anyway, knowing that some grower somewhere didn't find bees, or the bees he found were DOA, or had gambled on finding bees at the last minute from a desperate beekeeper and could get them for half of regular price, then couldn't and suddenly was willing to pay top shelf price for on-the-floor bees? Keep the three and hope for something from the other four.

Knowing that even weak colonies will set an adequate crop if the weather is good for an extended time, some growers look twice at those cheaper, weaker boxes, wondering if they should take the chance – should they try and fill that three to a straight, or hold with a pair?

It's not exactly dealing with the hand you are dealt, but how smart you play the hand you make in this poker game – no matter which side of the table you sit on. You can make or break your year, the weather can, the grower can or the beekeeper can – it's all in the cards, the weather and dumb luck.

But everybody wants enough good bees and it is a complicated issue at best. It starts in Midwest corn fields, Florida orange groves, on the Texas plains, Montana valleys, Washington hay fields, and California foot hills. The quality of almond pollination colonies begins at home back in April and May, June and July. It has to do with mite control all season long, productive healthy queens, and providing enough good food all season long, making sure every colony has everything it needs . . . yes, all season long.

There's lots to explore here, more hands to play, and lots of shuffling. See more in this and many issues to come. And watch *Bee Culture's* blog, MotherEarthNews.com and even a BUZZ or two. It's a grand, grand story. It's your bet.

Call.

It's Summers Time –

Bees, Chickens, Cats, Garden – Enjoy!

Spring is fast approaching, in fact the prediction is for a totally Spring-like week here in Northeast Ohio. Today was a beautiful Sunday afternoon. It was Daylight Savings day so we had an extra hour of sunshine. We unwrapped the top bar hive and to our delight and because of all the protection and planning we did, it came through Winter just fine. There's honey, unsealed and sealed brood – not a lot of each – and a fair population of bees. We checked the hive that lives on our front porch and it's small but doing well. And got the first sting on the hand.

The cats spent the afternoon following us around, exploring the yard to see what has changed since last Fall and along with the pony next door, enjoyed one of their favorite Summer activities – rolling in the dirt.

Yes, we have a pony next door, and a goat. They arrived in early Winter so we have not had a chance to get acquainted. They're both very talkative when I'm in the yard so hopefully we'll be good friends before the end of Summer.

Our new neighbors moved in about a year and a half ago, so we had last Summer to get to know them. A very nice young couple with a little boy and a very friendly, very old Golden Retriever named Frankie – and now the pony and goat. Between the weather and work we don't see much of our neighbors during the Winter months. Another good thing about Spring – everyone's out and about.

And this week Kim and I have 12 chicks coming to live at our house. Yes, we're branching out into raising chickens. You might ask why, others have – especially my son! My only answer is because we want to. I've never had chickens before. Well, that's not entirely true – when I was young we used to get the chicks that were dyed blue or green or pink. I'm not sure what happened to them. They didn't stick around very long.

My mother had chickens – long before she had me. There are photos of her and my older sister feeding the chickens. She had a lot of chickens and she used them for eggs and for butchering. This was a side of my mother I always had a hard time imagining.

We're not going to eat these chickens, I just could never do that. But we do eat a lot of eggs and I'm really looking forward to that. I've been doing a lot of reading and it seems raising chickens can be quite fun, but there's a lot of work involved. It seems that the chickens are going to take a good bit more time than the bees.

These chickens have an amazing coop waiting for them. A friend of ours built it. It's added on to the garage so when Winter arrives again I can just go through the garage to feed and care for them. The coop has pulley type doors that open into their own fenced-in area where they can be outside and still be safe from the predators that would love to get at them.

So we begin another part of the journey! If you have chickens and you have any words of wisdom please pass them on. I'll let you know how we do.

We've been talking about the garden lately. All of the seed catalogs are arriving – with all of the new tomato varieties in them. I've already succumbed to buying that first bunch of tomatoes in the grocery store and have, as always, been disappointed. Maybe you do that too. They look so good and you want one so bad – but they can't even measure up at all to the tomatoes of Summer, right off the vine, from your very own garden. Last year we had 21 tomato plants, about 10 varieties. Once they start to ripen we eat them everyday, some days for breakfast, lunch and dinner. And what we can't eat we share with neighbors and people at work. The Summers are so busy for us that I don't have the time to can or make sauce. Maybe someday. But for now we just enjoy them right out of the garden.

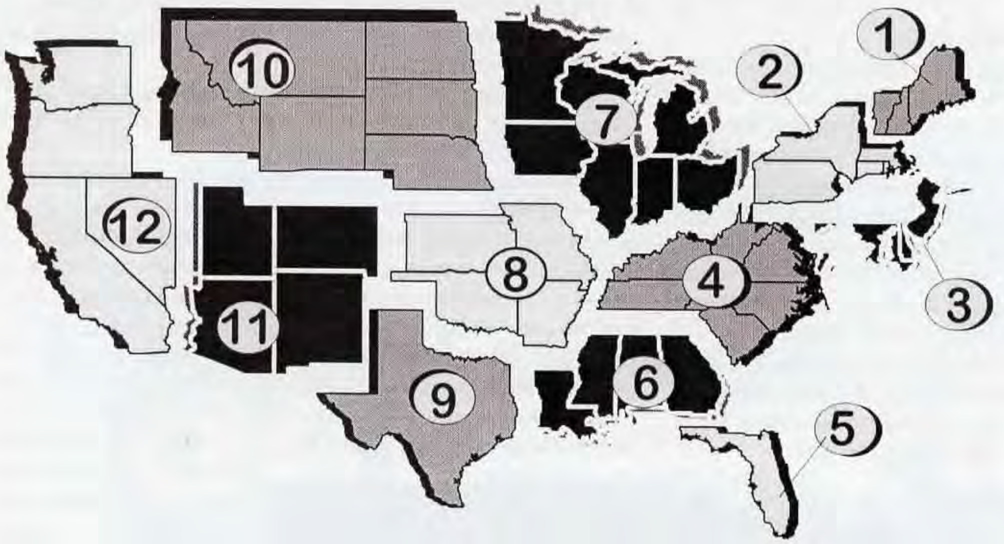
Last Summer our garden was made up of different tomatoes and different kinds of squash – another of my most favorite things to grow. We've given up on corn because the raccoons always beat me to it. Beans are time consuming to pick and deal with. We tried okra last year and it came up OK, but you need a lot of it to make it worthwhile. And we tried fennel which came up nicely but then I wasn't really quite sure what to do with it. So this year lots of tomatoes, lots of squash and we'll see what new thing we can add to the mix. And we do an excellent job on the weed crop.

We do a great job getting the garden planted, watered and fed. The first month or so we're diligent about keeping it weed free and keeping the soil nice between the rows. But then July comes and it's time to get ready for the fair, and then it rains for a week and you have to work late because you have a deadline. And then it's time to get ready to go to the EAS conference each Summer. That's an entire week that we're gone. So by the middle of August we have an amazing crop of weeds, that outshines all of the neighborhood gardens. But you know what – it doesn't matter a bit because we love the garden. And we just work our way through the weeds to get to the tomatoes and squash.

Enjoy Spring! Enjoy the garden! Enjoy the bees! Enjoy it all! Time goes by so fast. Just enjoy!

Kathy Summers

APRIL – REGIONAL HONEY PRICE REPORT



WINTER LOSSES

We polled our reporters this month asking about early season estimates of winter losses…numbers and causes.

They certainly let us know the obvious… it has been a very mild winter almost everywhere, which has contributed to lower than expected winter losses, but greater issues with the amount of food they left for the bees to winter on last fall. It's the old game of … if you play the averages you'll do OK, most times, but sometimes you'll lose big time. That's the case for some this year.

6% of our reporters have more than 1000 colonies, and a moderate loss for them would be devastating for most of us, but as a group, they reported very low losses, with some exceptions that had nothing to do with the weather.

36% or our reporters have between 100 and a 1000 colonies, while 58% have fewer than 100 colonies. This population is a bit skewed as many backyard beekeepers aren't in the honey business in a big enough way to make contributions on a regular basis to our report. That's OK.

Overall, 46% or our reporters claimed their losses were low, with 63% losing between 0 and 10 colonies lost…a good winter for most this year. On the other end, 5% of those with more than 500 colonies reported losses of 100 colonies or more…there are some reporters with significant losses this season…and we'll see where they went below.

Colony losses by reason…all over the map, and losses to several causes in any one operation, but a few patterns show up. 11% of all losses reported were do to pesticides, only 10% to Nosema, fully 28% just disappeared and they don't know why, 25% starved (mostly because the weather was warm and the bees active), 42 reported losses to Varroa, 18% to diseases and pests, 22% to queen loss and 24% to don't know, just dead. We've all had colonies go away for that reason.

REPORTING REGIONS	1	2	3	4	5	6	7	8	9	10	11	12	SUMMARY Range	SUMMARY Avg.	History Last Month	History Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS																
55 Gal. Drum, Light	1.73	1.89	1.73	1.56	1.80	1.70	1.70	1.75	1.80	1.75	1.69	1.78	1.56-1.89	1.74	1.72	1.64
55 Gal. Drum, Ambr	2.04	1.83	1.99	1.90	1.58	1.67	1.68	1.75	1.60	2.04	1.61	1.66	1.58-2.04	1.78	1.64	1.56
60# Light (retail)	162.50	163.25	149.00	154.25	160.00	151.67	138.83	150.00	125.00	150.00	164.67	166.25	125.00-166.25	152.95	155.04	144.62
60# Amber (retail)	162.50	162.67	149.00	156.00	160.00	161.67	135.00	167.50	125.00	151.51	159.50	168.33	125.00-168.33	154.89	147.96	140.47
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																
1/2# 24/case	68.18	74.89	48.00	64.24	70.26	60.00	49.84	80.00	70.26	49.92	58.50	85.80	48.00-85.80	64.99	68.87	61.81
1# 24/case	94.92	89.00	98.00	79.65	84.00	91.00	84.17	91.60	72.00	73.60	92.34	93.00	72.00-98.00	86.94	98.01	87.50
2# 12/case	92.50	87.29	75.90	73.67	78.00	81.76	68.07	92.00	67.50	86.16	58.33	89.80	58.33-92.50	79.25	84.38	80.05
12.oz. Plas. 24/cs	87.12	91.00	64.20	74.93	67.20	85.33	65.47	86.87	66.00	64.08	77.60	77.44	64.08-91.00	75.60	79.00	71.43
5# 6/case	101.00	97.26	89.25	80.93	96.00	120.00	82.85	99.00	72.00	88.98	82.29	100.00	72.00-120.00	92.46	93.68	84.21
Quarts 12/case	106.00	102.44	102.80	113.00	102.00	110.19	108.90	97.25	132.46	137.48	102.90	122.50	97.25-137.48	111.49	118.30	109.07
Pints 12/case	121.00	89.48	84.30	70.70	68.00	64.80	130.40	66.35	70.00	111.00	65.25	74.75	64.80-130.40	84.67	70.87	75.36
RETAIL SHELF PRICES																
1/2#	4.13	3.79	3.03	3.70	3.96	3,00	3.26	3.23	3.96	3.25	3.68	4.45	3.00-4.45	3.62	3.46	3.55
12 oz. Plastic	5.50	4.81	4.51	4.01	4.29	4.50	3.66	4.94	4.00	3.76	4.64	4.83	3.66-5.50	4.45	4.26	4.14
1# Glass/Plastic	6.23	5.77	5.78	5.23	6.50	5.95	4.78	5.67	5.00	5.25	5.53	6.19	4.78-6.50	5.66	5.67	5.26
2# Glass/Plastic	10.58	9.12	10.76	9.20	9.75	9.13	8.37	9.32	7.00	9.73	8.68	10.33	7.00-10.76	9.33	9.04	8.65
Pint	7.50	8.91	8.50	7.42	7.75	7.13	9.59	8.24	5.00	8.27	7.25	9.05	5.00-9.59	7.88	8.33	7.84
Quart	14.00	13.54	14.25	11.81	11.00	11.94	12.63	14.20	10.00	13.68	11.41	14.88	10.00-14.88	12.78	13.24	13.20
5# Glass/Plastic	24.50	20.33	21.96	20.21	23.00	25.00	18.74	20.70	18.00	21.09	19.17	25.00	18.00-25.00	21.47	21.67	19.52
1# Cream	8.58	7.12	8.02	6.32	6.93	5.75	5.93	6.50	6.93	5.93	7.34	7.00	5.75-8.58	6.86	7.29	6.41
1# Cut Comb	8.00	7.19	13.90	6.83	10.81	8.75	8.03	7.25	10.81	8.50	8.50	11.75	6.83-13.90	9.19	7.70	7.25
Ross Round	9.25	5.48	7.80	5.73	8.90	6.50	5.50	8.00	8.90	8.90	9.00	7.73	5.48-9.25	7.64	7.69	6.75
Wholesale Wax (Lt)	3.25	4.55	3.88	3.70	3.15	5.20	4.00	5.00	5.03	5.00	4.05	4.90	3.15-5.20	4.31	4.68	4.34
Wholesale Wax (Dk)	3.25	4.50	2.75	3.49	2.40	4.00	3.44	4.88	4.95	4.75	3.13	3.45	2.40-4.95	3.75	3.91	3.54
Pollination Fee/Col.	62.50	94.83	87.50	57.60	52.50	72.50	54.17	75.00	91.18	50.00	62.00	113.75	50.00-113.75	72.79	80.72	78.18

A Closer Look

Circadian Rhythm

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Audrey **Sheridan**

Several studies have shown that newly emerged workers are arrhythmic, whether individually isolated under constant conditions or housed in observation colonies under natural conditions.

A circadian rhythm, popularly referred to as a biological clock, is an endogenously driven (non-reliant on environmental cues), roughly a 24 hour cycle in biochemical, physiological or behavioral processes. Although circadian rhythms are endogenous ("built-in", self-sustained), they are adjusted (entrained) to the environment by external cues called zeitgebers, the primary one is daylight. To be called circadian, a biological rhythm must meet four general criteria: 1) the rhythms repeat once a day (have a 24 hour period); 2) the rhythms persist in the absence of external clues (endogenous); 3) the rhythms can be adjusted to match the local time (entrainable); and 4) the rhythms maintain circadian periodicity over a range of physiological temperatures.

One of the more remarkable features of the circadian system controlling behavior in honey bees is its plasticity. Typically, honey bee workers perform an age-related sequence of in-hive tasks (an integral component of the division of labor) from emergence until they assume foraging duties at about 21 days of age (Seeley 1982; Robinson 1992). Several studies have shown that newly emerged workers are arrhythmic, whether individually isolated under constant conditions (Spangler 1972; Toma et al. 2000) or housed in observation colonies under natural conditions (Moore et al. 1998).

Spangler (1972) examined the locomotor (walking) activity of individually isolated, newly emerged worker and drone honey bees under constant dark at 27°C and found no evidence for circadian rhythmicity. However, older bees showed clear free-running rhythms when placed under the same conditions. An absence of rhythmicity also has been observed for oxygen consumption and temperature regulation in young adult bees (Moore 2001). These studies occurred during the worker bee's life cycle between recent emergence and the onset of foraging behavior, a span of approximately 20 days, during which the bee switches from an arrhythmic to a rhythmic lifestyle. Since circadian rhythms are absent in younger worker bees (in the cell-cleaning and nursing phases) but present in forager bees, then when during behavioral development does rhythmicity occur? Spangler (1972) suggested that arrhythmic, newly emerged bees become "conditioned by entrainment" in the colony, presumably through social interactions with rhythmic individuals. However, an equally plausible hypothesis is that a progression from arrhythmic to rhythmic activity is a normal component of behavioral development, as is the well described age-related division of labor.

Moore et al. (1998) monitored newly emerged, individually marked worker bees over virtually their entire duration of behavioral development. Detailed observations were made every three hours throughout the 24 hour day in a large, glass-walled observation colony. Contrary to expectations based on social synchronization studies, no evidence was found for rhythmicity in the performance

"Since individual worker bees exhibit no rhythmicity in the performance of in-hive tasks, then one might predict that rhythmicity occurs abruptyly with the onset of foraging behavior."

of any behavioral task (brood care; capping honey cells; grooming self; inspecting empty cells, honey cells, pollen cells; mandibulating capped brood cells; motionless in cell; social interactions; smoothing substrate; standing; ventilating; walking). All in-hive tasks were performed at all hours of the day and night. Even those pre-foraging workers that have become rhythmic, based on their assay for rhythmicity, continue to perform their tasks around the clock. It is interesting to note that the intense diurnal activity associated with foraging apparently did not impose rhythmicity upon the performance of in-hive tasks, even those related to foraging. Food storage tasks (inspecting pollen cells, inspecting honey cells, and capping honey cells) did not occur in synchrony with foraging behavior. The situation is even more complex because there is an additional temporal diversity within the foraging subpopulation. On any given day, there may be several different foraging groups in the colony (Visscher and Seeley 1982; Moore et al. 1989), each with a high degree of fidelity to one species of flower. Each foraging group may be active only during a limited portion of the available daytime, as individuals within the group match their flight activity times with the maximal availability of food.

Since individual worker bees exhibit no rhythmicity in the performance of in-hive tasks, then one might predict that rhythmicity occurs abruptly with the onset of foraging behavior. However, other measures of behavior indicate that rhythmicity occurs before this behavioral transition (Moore et al. 1998). When two common behaviors, standing and motionless-in-cell, are considered equivalent to 'rest' and all other behaviors (brood care, capping honey cells, social interactions, etc.) equivalent to 'activity,' a progressive increase in the frequency of resting behavior at night is seen throughout behavioral development.

Genotypic differences in the development of rhythmicity were also observed. Because it is typical for honey bee queens to mate with 10-15 different drones, there exist multiple subfamilies (patrilines or genotypes) of worker bees within the colony. Using worker bees from genotype groups that differed significantly in the number of days required to make the progression from adult emergence until the onset of foraging behavior (Giray and Robinson 1994), it was found that fast-genotype bees achieved significant rhythmicity at an earlier age than did the slow-genotype bees. Most fast-genotype bees became rhythmic in the nurse phase of behavioral development whereas most slow-genotype bees did not become rhythmic until late in the food storage phase (Moore et al. 1998). Crailsheim et al. (1996) examined nurse bees and foragers during noon and midnight observation periods, and found no day-night differences in the behavior of nurse bees but a significant diel activity pattern in the foragers.

In the field of insect circadian rhythms, the honey bee is best known for its foraging time-sense, or Zeitgedächtnis, which permits the forager bee to make precise associations between the presence of food and time of day. It is well established that adult worker honey bees have circadian rhythms of behavioral activity associated with foraging (Moore and Rankin 1983; Moore et al. 1989). Foragers require a working circadian clock in order to navigate using the time-compensated sun compass, to express and interpret directional information contained in the recruitment waggle dance (based on the angular displacement of the resource with respect to the ever changing sun's azimuth) (von Frisch 1967). Experiments have demonstrated that honey bee foragers trained to collect food at virtually any time of day will return to that food source on subsequent days with a remarkable degree of temporal accuracy. This versatile time-memory, based on an endogenous circadian clock, presumably enables foragers to schedule their flights to best take advantage of the daily rhythms of nectar and pollen availability in different species of flowers. Foraging behavior is strictly diurnal. Periodicity in foragers is evident from a diurnal elevation in trophallacitc contacts and a pronounced nocturnal inactivity. Such night-time inactivity in foragers has been described as a form of sleep, having the attributes of reduced muscle tone, lowered body temperature and higher behavioral reaction thresholds relative to daytime levels (Kaiser 1988).

It is commonly believed that the time-memory rapidly extinguishes if not reinforced daily, thus enabling foragers to switch quickly from relatively poor food sources to more productive ones. On the other hand, it is also commonly thought that extinction of the time-memory is slow enough to permit foragers to 'remember' the food source over a day or two of bad weather. What exactly is the time-course of time-memory extinction? To gain insights into the extinction process, Moore et al. (2011) began by examining the performance of food-anticipatory activity (FAA) in forager honey bees that had been trained to collect sucrose solution from artificial feeding stations at certain fixed times of day. In particular, they explored the pattern of abandonment of the food source over a span of several days by foragers with different degrees of experience (i.e., days of training) at that source. Previous work (Moore and Doherty 2009) examined reconnaissance flights of time-trained foragers to a previously rewarded feeding station on the first day in which no food was provided: the probability of a forager expressing FAA was dependent on the amount of experience accumulated at that source. In a series of field experiments, Moore et al. (2011) determined that the level of FAA directed at a food source is not rapidly extinguished and, furthermore, the time-course of extinction is dependent upon the amount of experience accumulated by the forager at that source. They also found that FAA is prolonged in response to inclement weather, indicating that time-memory extinction is not a simple decay function but is responsive to environmental changes.

This would seem to be selectively adaptive in light of the ephemeral (lasting for a short period) nature of natural food sources. Accordingly, a previous spatiotemporal memory of a food source should be rapidly extinguished, so that forages may join the ranks of the unemployed and then be recruited to different, productive food sources. On the other hand, in cases of inclement weather, it would seem to benefit the colony if its foragers retained a 'memory,' for at least a few days, of the nectar secretion times of productive flower patches. Presumably, such a memory also contributes to the efficiency of food gathering by the colony during good weather, in that valuable food resources do not need to be rediscovered each day by scouts (Moore 2001).

The time-memory of forager bees must also be somewhat unstable, as the colony is constantly recruiting and abandoning different nectar sources according to their profitabilities (Butler 1945; Visscher and Seeley 1982). The 'decision' to continue with or to abandon a food source is apparently not based on direct comparisons among nectar loads brought back to the colony. Instead, individual foragers independently assess the profitability of their current nectar source by integrating information such as sugar concentration and distance from the hive (Seeley et al. 1991). The internal thresholds for discriminating between better and poorer sources may be adjusted according to the nutritional status of the colony. This information is communicated to the returning nectar forager by the waiting time required before it can unload its nectar to a food-storer bee, a direct reflection of the colony's available empty comb and nectar intake rate (Seeley 1986, 1989). Similarly, foragers are thought to assess the colony's requirements for pollen from the availability of protein-rich hypopharyngeal gland secretions delivered via trophallaxis from nurse bees (Camazine 1993). Foragers returning from a profitable nectar source have a greater probability of performing the waggle dance, dance more strongly, and return to the food source at a higher frequency than do bees attending a poor food source. The colony-level decision to recruit to a quality source or abandon an inferior source, therefore, is an emergent property regulated at the level of the individual forager (Seeley et al. 1991). 'Unemployed' foragers do not survey multiple dances being performed on the dance floor in an effort to find the one corresponding to the best food source, but rather they sample just one dance before leaving the hive in search of the advertised food (Seeley and Towne 1992). What happens to the time-memory when a forager switches from one flower species at a particular time of day to another species at a different time of day? Is the first time-memory extinguished immediately or does it undergo a process of extinction over a span of time? Exactly what stimulus is required to cause the timing switch? Additional research is needed to answer these questions.

Free et al. (1992) found no diel rhythmicity in the behavior of the queen or in worker bees attending to her. Relatively little is known about the temporal control of behavior of honey bee queens under natural conditions. To determine if mated honey bee queens possess diel rhythmicity in behavior, Johnson et al. (2010) observed them in glass-sided observation hives, employing two focal studies involving continuous observations of individual queens as well as a scan-sampling study of multiple queens. In all cases, all behaviors were observed at all times of the day and night. In four of the five queens examined in focal studies, there were no consistent occurrences of diel periodicity for any of the individual behaviors. A more encompassing measure for periodicity, in which the behaviors were characterized as active (walking, inspecting cells, egg-laying, begging for food, feeding and grooming self) or inactive (standing), also failed to reveal consistent diel rhythmicity. Furthermore, there were no consistent diel differences in the number of workers in the queen's retinue. Behavioral arrhythmicity persisted across seasons despite daily changes in both light and temperature levels. Both day and night levels of behavioral activity were correlated with daytime, but not with nighttime ambient temperatures. The behavior of the one exceptional queen was not consistent: diurnal activity patterns were present during two 24-hour observation sessions but arrhythmicity during another. Based on the behavior observed by all but one of the queens examined in this work, the arrhythmic behavior by the mated honey bee queen inside the colony appears to be similar to that exhibited by worker bees before they approach the age of onset of foraging behavior. BC

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Managed Pollinator CAP
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First Two Years Of The Stationary Hive Project

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Abiotic Site Effects

A stationary hive project was initiated in the Spring of 2009 (Spivak 2010a,b). This research project will run through 2013 and consists of two replicate two-year trials (2009-2011 and 2011–2013). The objective of the study was to conduct a longitudinal study of colonies through a two-year period. In this article we review observations that were recorded in the First Trial of this study (2009-2011), specifically the effects that relate to abiotic factors that characterized each apiary site.

The experimental design of the project involves stationary apiaries of 30 colonies in each of seven states (see Spivak 2010a,b for more detail). In the Spring of 2009 seven stationary apiaries consisting of ca. 30 colonies per site were initiated from three-lb packages obtained from various commercial honey bee producers across the southern and western U.S. New hive hardware was used in all apiaries. A single assigned manufacturers batch of Pierco black plastic waxed foundation was used exclusively at all apiaries and a pre-installment wax sample was collected for pesticide analysis. At all sites colonies were re-queened either at colony establishment or shortly after establishment with Italian race queens from a similar genetic background obtained from Koehnen & Sons, Inc. All colonies were fed sugar syrup and pollen substitute (MegaBee®) when necessary and were managed typical for the region, except there were NO efforts to manage pests, parasites, or pathogens. Sampling of colony strength, disease incidence, pest and parasite loads, and select environmental factors was carried out at each apiary through the duration of the honey bee foraging season.

The following measures were taken at each of the apiaries in 2009, 2010, and are now being collected for the 2011 Trial. Monthly pollen sampling for estimating pesticide exposure was conducted by deploying traps on five colonies in each apiary for one to two days two times a month. Dr. Eitzer, an analytical chemist at the Connecticut Agricultural Experiment Station, analyzed the pollen for many of the common pesticides using a modified QuEChERS procedure. Wax comb samples were taken from colonies when they were first noticed to have died out. Colony strength and condition was sampled in all colonies monthly by assessing presence of queen, presence of eggs and young larvae, egg laying pattern, supersedure rates based upon marking of queens, and brood and adult population size was sampled by estimating percentage of total frame area occupied per colony.

Pest occurrence such as small hive beetle (*Aethina tumida*) and wax moth (*Galleria mellonella*) were recorded monthly and parasite loads were estimated by dissection of bees for tracheal mites (*Acarapis woodi*) and sampling approximately 300 bees per colony for *Varroa* mite (*Varroa destructor*) levels via sugar rolls in 2009 and 2010. Disease agent sampling was also conducted monthly. One hundred forager honey bees were collected per colony for dissection to quantify *Nosema* spore levels and determination of *Nosema* species (*apis* or *ceranae*). Symptoms of European (*Melissococcus plutonius*) and American foulbrood (*Paenibacillus larvae ssp. larvae*) and Chalkbrood (*Ascosphaera apis*) were recorded in each colony per monthly sample. A honey bee sample of at least 100 bees per colony were collected and molecular markers were used for qualitative and quantitative PCR to obtain disease presence and/or incidence of *Nosema ceranae* and the following viruses: deformed wing virus (DWV), Kashmir bee virus (KBV), Israeli acute paralysis virus (IAPV), and black queen cell virus (BQCV).

Landscape and climate features relevant to honey bee foraging were assessed for each apiary site in all

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Minnesota apiary in Summer 2009 and Main apiary in Winter 2009.

trials. This involved spatial analysis of landscape coverages in a two-mile radius from each apiary. The geographic area of land-use/habitat types was calculated using Google Earth® or other suitable digital spatial coverages. A database was constructed for each apiary so that the percentage of surface waters, riparian habitat, urban, suburban/residential, forest, wetland, meadow, agricultural pasture, orchard, or vegetable/field crops could be estimated via spatial analysis software such as "freemaptools." Climate zones were recorded for each apiary and weather experienced at each site was represented by summaries of local weather conditions during the year (monthly mean, max, and min air temperatures and precipitation) measured at or near each apiary.

The initial design for this longitudinal study was to initiate a trial consisting of seven apiaries in 2009, follow the colonies through at least two years and then initiate a Second Trial in 2011 that would be followed for two years. However, in 2009, California had to drop out of the study, but was able to setup a trial in 2010. In order to provide a basis of comparison, a Second Trial was also set up in 2010 in Maine with a 15-colony apiary located in a different site than the 2009 Maine apiary. The reduced 2010 Trial was again initiated with packages from commercial bee production operations on brand new equipment and foundation, exactly as was done in 2009. All colonies at these two sites were re-queened with Italian race queens obtained from Koehnen & Sons, Inc.

The FOCUS of this article is a review of the preliminary findings with colony losses, hive strength, and queen status that were associated with the abiotic factors characterizing each apiary site.

Summary of Our Results

Colony loss rate. Colony losses, measured as percent cumulative colony mortality, were different among apiaries at the end of each of the first two years for the 2009 Trial (ranging from 3 (MN) – 40 (PA)% in 2009 and 31 (MN) to 100 (PA)% in 2010), but not for the 2010 Trial where the apiaries in ME and CA at the end of 2010 had loss rates of 20 and 25%, respectively, and by the spring of 2011 both apiaries had loss rates of 100%.

Our observations suggest that colony loss is quite variable and not necessarily similar in effect across the U.S. and across different types of beekeeping operations. Apiaries in the northern tier states of MN, ME, and WA were characterized by colony loss rates which were highest during overwintering, while a more continuous rate of colony losses occurred over the entire year for the southern tier states of PA, TX, and FL. In the 2010 Trial the apiary in ME (a new apiary setup in 2010 in a different location) is characterized by primarily overwintering mortality, while colony loss in CA is similar to the southern tier apiaries in exhibiting a more continuous loss during the year.

Another pattern in colony losses that was observed for the initial 2009 Trial was that the proportion of colony loss that occurred during the first growing season was highly related to the level of mortality over the subsequent winter. This is consistent with a causal effect that is characterized by "carryover," such as parasites, pathogens, pesticide contamination of the hive, or cumulative stress. This carryover effect could not be detected in 2010/2011 since all apiaries setup in 2009, except FL, experienced 100% loss.

Supersedure rates. High supersedure rates are often an indication of colony stress, poor egg laying by the queen, or poor colony health and ultimately a subsequent high likelihood of colony loss. Supersedure rates, averaged over all colonies in each apiary, ranged from 0.14 to 0.31 supersedures/colony during the first year of the 2009 Trial, 0.18 to 0.61 during the second year of the 2009 Trial, and 0.08 to 0.38 in the first year of the 2010 Trial). Conducting an analysis at the colony level within apiaries we found that in the 2009 Trial there were strong effects of apiary location on both supersedure rate and colony loss rates during the study. There was no interaction between apiary site and supersedure rate affecting colony loss rates. This suggests that these effects of supersedure on colony loss showed a similar trend across all sites. The colony loss rate being statistically explained supersedure might be due to reduced colony populations in those colonies that have high supersedure rates. We found that this was the case in PA and ME, the higher the supersedure rate in a colony the lower the colony brood population size. However, this was not the case for the other states where there appeared to be no relationship between colony-level supersedure rate and colony brood population size.

A similar relationship appears to be the case for colony losses and supersedure rates in the 2010 Trial. Differences in supersedure rates between ME and CA existed, with the ME apiary having a low average supersedure rate of 0.08 and CA having a high rate of 0.38. Yet the colony loss rates in these apiaries were quite similar as mentioned above. An apiary site effect was apparent in colony population levels of brood and workers (CA being much lower than ME), but there was no relationship between the supersedure level for each colony and its colony brood population level as was the case for PA and ME in the 2009 Trial.

Climate and Weather effects. The stationary hive project has apiaries assigned to five broad climate zones of the continental U.S. These are: 1) semi-arid steppe climate (WA), 2) Mediterranean climate (CA), 3) humid sub-tropical climate (FL, TX), 4) humid continental warm summer climate (PA), and 5) humid continental cool summer climate (MN, ME). Weather data was collected at or near all apiaries in 2009 - 2011. The reason for this was to assess abiotic conditions during the conduct of the study. Weather parameters that were assessed were maximum and minimum air temperatures, mean precipitation, a derived index of stress (maximum air temperature relative to the seasonal precipitation), and a composite new variable explaining most of the variation among all of the weather variables collected (first eigenvalue of a principal components analysis (PCA)). These weather parameters were used to determine if weather/climate effects were correlated with colony loss and supersedure rates over the first foraging season, over the Winter, over the second foraging season, and over the entire duration of the study for each trial. Of the more than 40 analyses conducted (many combinations of weather factors crossed with different lengths of monitoring times), there was only one marginally significant relationship that was observed between weather factors and apiary site-level colony loss rates and one relationship between weather factors and supersedure rates. Maximum mean air temperatures in the second year (2010) of the 2009 Trial, were positively correlated with colony loss rates. When both the 2009 and 2010 Trials were combined into one analysis, supersedure rates were correlated with maximum temperature during foraging. These relationships are only weak, but they suggest that hotter climates might, in a given year, might result in higher colony losses or poorer colony population levels via supersedure, than cooler climates. Hot Summer daily temperatures may be an index of heat stress. Such heat stress may not only be directly operating on colony health, but may have an indirect effect of colony losses and colony health due to effects on the quality of bee pasture. It will be interesting if these same relationships are borne out in the 2011 Trial (we will have a much greater sample size of apiaries to test this than what currently exists (apiaries = 8) in the 2009 and 2010 Trials).

Landscape effects. The characteristics of the apiary landscape for an area of a two-mile radius from the apiary (Fig. 2) did show an interesting relationship with colony loss rates. The landscape was characterized by land use as seen in Table 1, an example of the Florida apiary. The classification was aggregated to six categories in order to have relevant common categories across all apiary sites. These categories were: 1) forest, 2) old field /scrub shrub, 3) pasture, 4) wetlands, 5) urban / suburban, and 6) intensive agriculture. We found a strong positive correlation between the proportion of landscape in intensive agricultural production and the proportion of colony losses for the 2009 Trial through the spring of 2010. When both Trials (2009 (n=5) and 2010 (n=2)) are examined over a twelve-month period in relation to percent of foraging area in agricultural production, we found a significant year effect and a significant proportion agricultural land effect, but no year by agricultural land interaction. Therefore, this relationship appears consistent for both years for different apiaries with the result of proportion of land area in intensive agriculture explaining a meaningful amount of the variation in colony losses. It is unknown why the proportion of landscape in agriculture is related to colony losses. There are several factors that might be associated with intensive agricultural production, pesticides being the most obvious, but others could be quantity and quality of bee pasture, water availability, and intra-colony competition.

Pesticide exposure. Pollen trapping was conducted 2009-2011. The chemical analyses were conducted by Dr. Brian Eitzer at the Connecticut Agricultural Experiment Station. Five colonies per apiary were fitted with pollen traps and trapped twice monthly for a three-day period. Overall, the results show variation in both time and apiary location. This is not unexpected as different pesticides are used at different times of the year at a single location, and, different pesticides are used for different crops grown at different locations. Over the First and Second Trials

Landscape within a two-mile foraging radius of the Texas apiary, 2009-2011.

Table 1. Land use classification patterns in a two-mile radius of the Florida apiary.

Land Cover Description	Acres	Percent
Coniferous Pine	14.6	0.47%
Emergent Aquatic Veg	8.9	0.29%
Field Crops	543.3	17.62%
Forest Regeneration	83.9	2.72%
Freshwater Marshes	201	6.52%
Horse Farm	99	3.21%
Improved Pastures	1166.6	37.83%
Institutional	6.1	0.20%
Lakes	9.4	0.30%
Mixed Crops	216.5	7.02%
Mixed Scrub-shrub Wetland	25.3	0.82%
Mixed Upland Nonforested	1.4	0.05%
Mixed Wetland Hardwoods	15.6	0.51%
Reservoirs	0.4	0.01%
Residentual. Low desity	18.4	0.60%
Residentual. Med. desity	51.5	1.67%
Streams and Waterways	3.3	0.11%
Unimproved Pastures	2.7	0.09%
Upland hardwood Forest	9.3	0.30%
Upland Mixed Coniferous/Hardwood	457	14.82%
Wet Prairies	12.8	0.42%
Wetland Forested Mixed	15.3	0.50%
Woodland Pastures	121.9	3.95%

⇨

(2009-2011) 44 different pesticide or pesticide metabolites have been observed (18 insecticides, 14 fungicides, 10 herbicides, two metabolites). Over the two-year period of the First Trial, the numbers of different pesticide residues in pollen was 10 and that was found in a single composite sample (composited over apiary and season). Residue concentrations also had great variation. Most residues observed are less than 10 PPB, a fair number are in the 10-100 PPB range, and a few are greater than 100 PPB. It should be noted that the compositing process does affect the data; high concentration individual samples are averaged with lower concentration samples, and a low concentration individual sample could drop below the detection limits. However, compositing is necessary given the number of samples and cost of analysis. Wax samples from the apiaries have also been collected from recent dead-out colonies throughout the season and all surviving colonies at the end of the Fall of each year. These wax samples are currently undergoing analysis.

We have investigated the relationship between residues in trapped pollen and colony loss rate and supersedure events. In order to do this we used several measures of pollen contamination: 1) total number of pesticides over the season in each apiary, 2) concentration (ppb) of all pesticides over the season, 3) concentration (ppb) of all insecticides, 4) concentration (ppb) of all miticides, and 5) concentration (ppb) of all neonicotinoid insecticides. We did not find any relationship with any of our measures of pesticide contamination and colony loss rate at the apiary level for either 2009 or 2010 in the 2009 Trial (the sample size for the 2010 Trial is only two apiaries and the CA and ME apiaries had almost identical mean pesticide residues. We did see a marginal relationship with the number of total pesticides (diversity) in trapped pollen at an apiary and the integral of supersedure rates (area under the plotted curve of supersedure events) for 2009. We did not see a similar trend for the same apiaries in 2010, although colony loss had deleted PA from the analysis and TX had very few colonies surviving in 2010. It is surprising that we do see a trend in 2009, since most of the residues are at extremely low levels. Another question that can be asked with the trapped contaminated pollen is whether the proportion of foraging area in agriculture is related to the contamination of pollen trapped at a give apiary. We conducted this analysis for 2009 and 2010 using the pollen collected over two years in the 2009 Trial. We found no relationship for 2009 and 2010 between proportion of foraging area in agriculture and total number of pesticides, concentration of all pesticides, concentration of all miticides, concentration of all insecticides, and concentration of neonicotinoid insecticides. There were also no relationships between any of the measures of pollen-pesticide contamination and the proportion of land in urban/suburban land use. The 2011 Trial will provide a larger sample size when included with the 2009 Trial to further investigate these trends since these analyses have very low power with only five to six apiaries per analysis.

Summary and conclusions.

We have reported on just the abiotic apiary site effects for the First Trial of the CAPS Stationary Hive Project. Perhaps we have stimulated more new questions than we answered. What we have found is that geography of the apiary affects colony losses. Now many readers may suggest that this is an obvious finding, but what is not obvious . . . is why? Yes, honey bee colony stress levels may increase as one moves from the southern U.S. to the northern U.S., but we argue that not all stressors are expected to be higher in the South. For instance, overwintering stress would be hypothesized to be much greater in the North.

We have also conducted analyses on the effects of *Varroa* and tracheal mites, *Nosema ceranae,* and viruses on colony losses in this study. We are not reporting on this part of the study, but we not only found strong support in some preliminary analyses for the role of *Varroa, Nosema,* and IAPV in colony losses, BUT some of these biotic causes of colony loss were also moderated by apiary-site. This suggests that the factors discussed in this article may be key in determining the relative risk of colonies dying out due to pathogens and parasites.

So, in summary, what are these apiary-site factors that might influence colony losses? First we found that our apiaries experiencing the hotter daily maximum temperatures tended to have higher colony losses and supersedure rates over the two-year period, although this was a weak trend at best. However, as far back as 1869, high levels of colony losses have been attributed to extreme high temperatures during the Summer (anon. 1869). Also, associated with an apiary site is the habitat surrounding the apiary. Our First Trial, along with the Second Trial setup in 2010, suggest that intensive agricultural landscapes may affect colony losses. As the percent of intensive agricultural land area increased within a two-mile radius of an apiary, colony losses within an apiary also increased. On the one hand, agricultural landscapes can be very beneficial to foraging honey bees, but more and more evidence suggests that this is not the case for native bees (Kremen et al. 2004) and we suggest that this also might not be the case for honey bees. Now, an obvious hypothesis regarding the deleterious effects of increasing land area of agricultural landscapes might be increased pesticide exposure. Although, it is the case that as the proportion of agricultural land increases in an area, the proportion of non-agricultural, less disturbed habitats decreases and so what is the mechanism? We did, however, find that pesticide contamination of pollen brought back to the hive in our apiaries did correlate weakly with increased mean supersedure rates. Now the measure that we found to correlate with supersedure rate was the number of total pesticides (and metabolites) found in the contaminated pollen. There is a high degree of attention currently on interactive lethal and sub-lethal effects of pesticide exposure to honey bees, much of it supported by the CAPS project. Our findings with supersedure provide evidence that subtle effects such as queen failure found in more controlled field and laboratory studies (Ellis 2010) can be detected in large-scale typical bee yard-level studies.

In CONCLUSION, what can we say about abiotic conditions associated with an apiary-site that might affect colony loss. We CAN say that we have strong evidence to suggest that apiary-site effects do exist. However, with our study many of the site-effects appear to be correlated with one another. Thus we have identified several potential abiotic effects that might increase colony losses, but teasing out which factors are the key factors may have to be the focus of a study specifically designed to test independent hypotheses while controlling for other factors, if this is possible at the scale of foraging honey bees. We think that the power of the CAPS Stationary Hive Project will be to identify factors that consistently result in colony losses over two large-scale trials (2009 and 2011) and then to identify which factors might interact with one another to produce synergistic colony losses. These will be the dangerous combinations of potential causative factors that need to be studied more intensively in the future. BC

Acknowledgements

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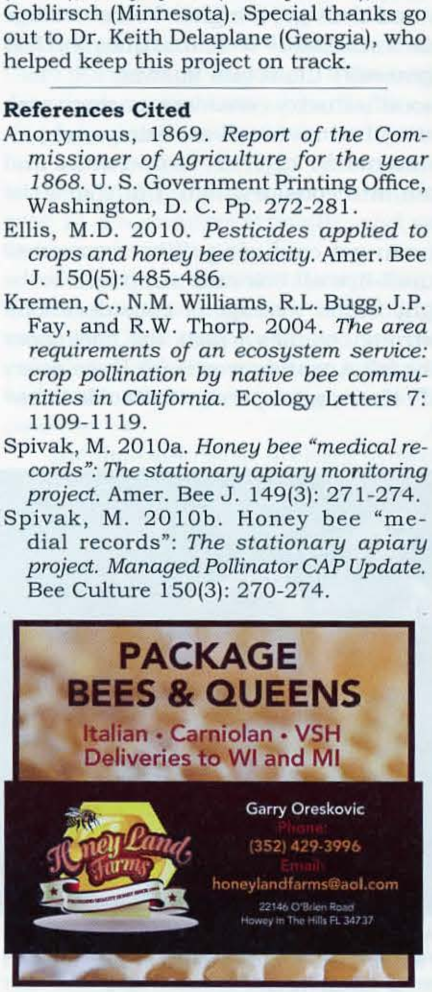
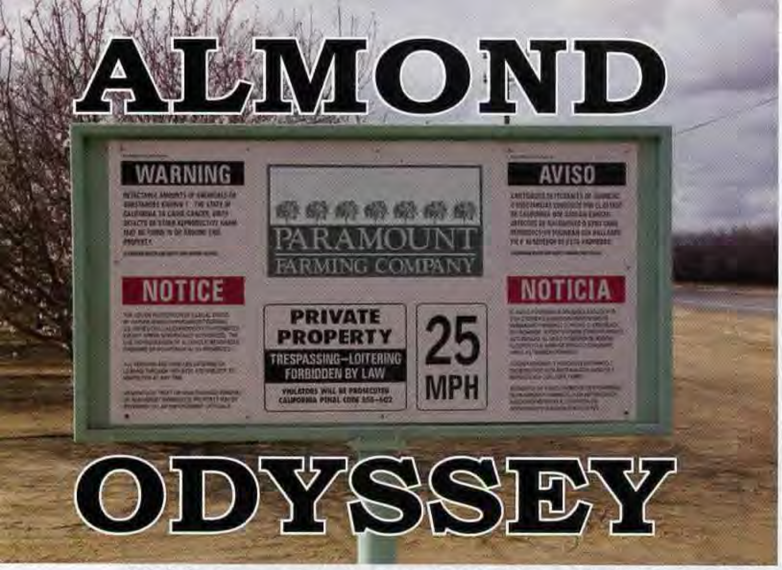


ALMOND ODYSSEY



INSPECTION INNOVATION

Kim **Flottum**

There's a million stories in California's almond orchards, hulling factories, processing plants and industry board rooms. This is one.

Paramount Farming is a part of Paramount Farms, one branch of Roll International, the holding company of Stewart and Lynda Resnick. This includes FIJI Water, Telefloral, Pom Wonderful, Cutie mandarins, Paramount Citrus, and industrial sized pomegranate, pistachio and almond growing operations. They are unquestionably the almond giant in California's southern San Joaquin valley, producing about six percent of the state's almonds on over 45,000 acres of orchards with more on the way.

To pollinate all those trees (figure 125 trees/acre, each producing something like 7500 nuts/tree for a total of about 3000 pounds/acre, with a farmgate value of about $2.00/pound) requires two healthy right-sized colonies per acre for a total of about 92,000 colonies.

Organizing 92,000 colonies, owned by 32 beekeepers is a logistical challenge that increases in complexity every year. And although Paramount/beekeeper relations were seldom negative, in its wisdom Paramount saw the need to focus on this absolutely critical aspect of production by bringing on board a full time bee specialist. Gordy Wardell, who created the pollen supplement Mega Bee while working at the Tucson Bee Lab facility as an independent researcher, now manages Paramount's pollination needs. He organizes holding yards before bees arrive, provides water, access and protection after they arrive, has smoothed and standardized the inspection process, and looks to the future for even better ways to make bees, almonds and Paramount work better together.

Paramount has adopted the attitude that they want to be a resource to their beekeepers. They've issued protocols for beekeepers to use before leaving home to reduce or eliminate fire ant problems, and have set up specialized holding yards to deal with ants for out-of-state beekeepers that are safe and have easy access with available water, somewhat of a luxury in southern California.

Paramount Farming is the production arm of Paramount Farms, and Joe MacIlvaine, President of the group stresses the bigger picture when discussing almonds and bees.

"Of course we need strong, healthy colonies to get a maximum return on our pollination investment," he said, "but remember our additional inputs, too, starting with getting Gordy on staff. And last year we matched somewhere between $20,000 and $30,000 for honey bee research with our beekeepers (Paramount matches dollar for dollar every dollar their beekeepers donate to this), plus all the preparation work and post season work Gordy does and Paramount pays on time, a distinct advantage for the beekeepers, and not practiced by all almond growers.

"And because of where we are – the driest part of the state – we don't have to apply fungicides during bloom, a practice that's becoming a real issue with honey bee health," he added.

Water is always in any discussion about the almond industry. It is a major factor in any expansion plans because of its uncertain year to year availability. Too, the cost of establishing an orchard has grown, now to about $10,000 to $12,000 an acre to prepare and plant, figuring leveling, irrigation, installation of roads, trees and the labor to do it all.

"So we've quite an investment in the orchard, and an investment in getting good bees," he said. "We do a lot to help beekeepers, but we expect something in return."

That's where Gordy's inspection process enters the picture. It works like this.

Paramount's policy is that bees from holding yards, or bees just entering the state that are going directly to the orchards have a week after placement to get examined by the beekeeper so they can remove and replace colonies not up to standard, and thus get a higher frame average when examined. What's standard? Well, that question has an expensive, and generally uncertain answer.

Overall, the almond industry considers a colony with eight frames of bees and some brood an 'adequate' pollination unit. Adjustments for external temperature and time of day are taken into consideration, but that's the 'normal' equation.

Here's where it can get confusing. Who measures? How do they measure? Are all colonies supposed to be adequate? Is an eight frame 'average' a consideration? What about really strong colonies – does the beekeeper get paid more for those? Are they worth it? Does every colony get measured? If not, what percent? Who decides? Well, it all depends.

One inspector operates the bar code reader, one removes covers and tips the top super up and one counts frames in both top and bottom. A new inspector is being trained to count here.

Some growers take the word of the beekeeper that some predetermined level of colony strength exists and the contract – number of colonies and average strength – has been met. This is usually the result of a long standing relationship between the grower and beekeeper.

Others hire independent inspectors to look (we visit with one of those businesses later to see how that works) and evaluate the colonies, and pay the beekeeper based on the results of that evaluation. Usually this includes some level of penalty for under-strength colonies, and a bonus for super-sized colonies, or payment is based on an average overall colony strength. The downside to all of this of course is grower assumptions, inspector bias, or a beekeeper's imagination. The bias issue, though not common, can arise when the inspector considers who he or she is being paid by...whose interests are best served by looking for the best, or the worst of the colonies to inspect. It happens. And sometimes, if a grower or beekeeper suspects a problem, an additional inspector will be brought in and paid for by the party suspecting a problem, to see if two inspections can agree. Here the issue is time – a group of colonies that were weak a week ago can rebound given good weather and a good queen, or can collapse in a heartbeat if there are serious health problems.

For colonies that are brokered, that is, a Pollination Brokering business, and there are several that handle many thousands of colonies, deals with many beekeepers who do not have enough colonies to deal directly with a grower, or who do not come to California and arrange to have their bees shipped there, or are picked up by the broker and delivered. The broker 'assembles' these in holding yards until needed, may help feed and care for them during their stay there if the beekeeper doesn't, then gets them moved into orchards he contracts with.

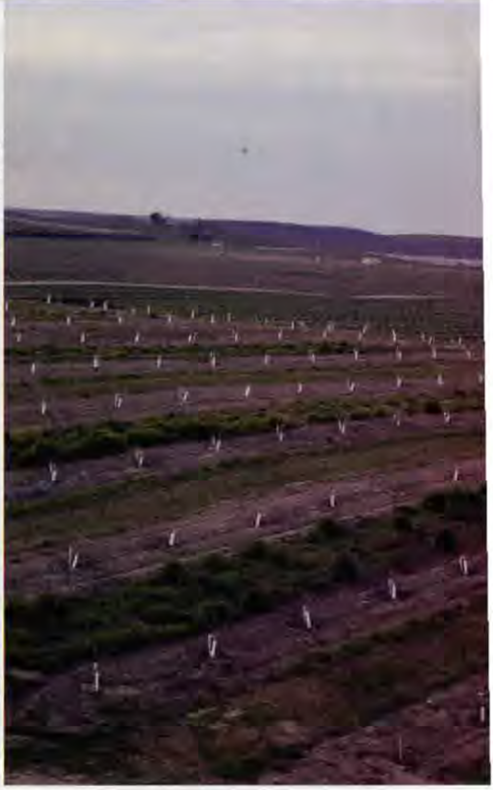
A broker usually deals with many orchard owners, too, so not all of the eggs are in one basket. Generally, brokers and growers agree on a price per colony delivered at a minimum strength, and sometimes a penalty or bonus is arranged.

Often the broker is the inspector, but almost as often an independent inspector is brought in to evaluate the colonies. Good brokers know their beekeepers, know the colonies they keep, and have good working relationships with both beekeepers and growers. That's what they are paid for.

Incidentally, most orchard growers deal with several beekeepers or brokers to make sure they have several sources of bees if one beekeeper crashes and burns. It happens. And, most larger beekeepers often deal with more than one orchard because sometimes payment is late, short or non-existent. That happens too.

But, because the inspection process has been less than transparent sometimes, Paramount has taken most of the guess work and bias out of the equation and the resulting consistency and accuracy seem pretty good. They have their own inspectors, and will inspect 15% of the 92,000 colonies they rent. When they contract with a beekeeper he is given a unique number, replicated on sheets of bar codes. Every four-colony pallet gets a bar code sticker. Every drop, that is every location in an orchard where colonies are placed – usually on the edge of the regular roads running throughout the orchard – contains six pallets of four colonies each. Each location has a permanent sign on an almond tree trunk that indicates these locations – white sign, black letters are easy to see at night.

In three years every one of these acres is going to need even more water, and at least two colonies of bees.



An inspection team consists of four individuals. One operates a hand-held code reader that records the bar code and thus the owner of the hives, but there's more. When activated it records the exact gps location of the drop. At the same time it assigns a number to each colony in the drop (1 – 24) then picks two or four of them to be inspected – picked randomly by the code reader. The total is 15% when all is said and done.

The operator tells two inspectors which colonies to inspect. One inspector removes the cover and tips the top super so it sits on end on the colony behind it, while the second inspector looks at that upturned super from the bottom and visually measures the daylight he can see on the two sides (outside frames), and top and bottom. He shouts out a number. By this time bees in the bottom super have risen to the top bars and outline the size of the cluster below. Another number. These two numbers are totaled in the device – next colony.

The fourth inspector? He's behind the wheel and doesn't really stop at a drop – he just edges forward, all the time moving. Slow, yes. Stop, no. When done the two inspectors hop on the back of the truck, the device operator hops inside and they're off to the next drop. At the end of the day a beekeeper's hives can be rated by average number of frames, or by the number with 12, 11 or 10 or fewer frames. Gordy likes a 10 frame colony because it has room to expand a bit before pollination is over. Paramount pays for basic eight frames – some beekeepers say they pay a bit low for an eight framer especially when compared to other growers, but they pay a bonus for eight to 10 frames, and an additional for 10 - 12 frames, encouraging a strong colony – but remember, giving a week to get to that strength after they arrive. Interest in a bonus varies from beekeeper to beekeeper because it costs more to get colonies from eight to 10 frames, and from 10 – 12 frames, and the bonus should more than cover that additional cost.

Joe Traynor, a well known pollination broker – we'll

Uneven bloom causes pollination problems, bees or no bees.

Fungicide sprays during bloom are drawing more and more attention. The fungicide, it seems, may not be the culprit when it comes to the break in the brood cycle, but rather the spreader/ stickers applied with it. Too, the stuff smells so bad it drives the bees out of the orchard for a couple of days...growers need to rethink this management process.

visit with several of these businesses before we're done – is a strong advocate of early season communication between grower and beekeeper on rental prices and bonuses so beekeepers can budget for extra feed if warranted, or not if cost prohibitive. Fees? They are all over the map, but as a working figure, $150/eight frame colony is a good start. But weak colonies rented late in the game might make far less, and strong colonies working with a good broker might make a good deal more. Penalties and bonuses change the figure of course. But for budget purposes almond growers use the $150 fee, at least this year.

Agreements

Most grower/beekeeper agreements are pretty straight forward single page documents common to most pollination contracts. Delivery time, minimum number of colonies delivered, strength, bonuses if any, inspection by who, re-inspection if a problem, theft compensation (many are that the grower pays the contract price, but the beekeeper has the insurance to cover equipment and bees lost), pesticide issues, removal and other regular items.

Because of the holding yard provisions, inspection bar code requirements and other somewhat uncommon practices, Paramount's contract is longer, but it does offer additional protection for both beekeepers and grower.

Though inspection isn't the first encounter between growers and beekeepers in the almonds, it can be either one of the most contentious or one of the most rewarding. Beekeepers have a lot on the line – it costs this year roughly $25/colony to get a Midwest colony to, and from California. If using a broker there are additional costs there, and if storing colonies in California for any amount of time before the bloom there are medication, food and labor costs that come right off the top. Moving into the orchards is labor intensive, and, though most growers are seeing the light, some still require drop locations set up by puzzle masters, rather than beekeepers with trucks and forklifts. If the weather cooperates colonies can build quite fast on almond honey and pollen and swarming can be a serious problem, but if there's nothing but rain for two weeks – it happens – colonies that went in healthy can come out essentially starving. Fungicide sprays during bloom are coming under increasing pressure from beekeepers because of breaks in the brood cycle several weeks later, and tank mixes of fungicides and insecticides . . . a free ride for the grower who can save a trip through the orchard – are occasionally made which are even worse for the bees. And then there are the just-finding-out problems of the synergistic effects of chemicals already in the hives – basically miticides – and these other grower applied chemicals that aren't even figured out yet.

There may be a token pollination contract after almonds out west somewhere – apples in Washington for instance, taking up time and finding a space until the bees can get back home, but those contracts are a pittance and mostly don't even break even, though there might be some buildup going on. Joe Traynor has said for years that the almond growers are subsidizing the pollination costs of many other west coast growers because of this timing issue. He's right.

But growers, too, have a lot on the line...their entire crop depends on getting as many blossoms pollinated as possible in what can be horrendous weather, or perfect flight time. This year the cool weather caused the different varieties to bloom at different times in some orchards . . . almonds need cross pollination to set fruit and growers plant different rows with different varieties to make sure there's a mix of pollen going on. But if the bloom doesn't coincide – there's a problem, no matter how many bees there are. So their pollination rental costs are increased because they must rent pollen inserts on the hives so the bees can take a different pollen to the trees they are visiting.

But still, it all comes down to colony strength, and the inspection process – transparent and benign or flawed and biased, is the connection between beekeeper and almond grower. The bees and the flowers? They know what's going on. The growers – they kind of know the market. Beekeepers – they have the bees almost figured out. There's lots more here – stay tuned. BC

Photos by Kodua Photography.

ABF Meets In Vegas

Malcolm **Sanford**

Some 700 eager beaver attendees showed up at the Rio All-Suite Hotel in Las Vegas January 10 through 14, 2012. They made the obligatory long walk daily from the hotel through the casino to the convention area and were treated to the newest information about bees and beekeeping at the annual convention of the American Beekeeping Federation (ABF). These conventions are continually improving in both the political and scientific content each year; the Las Vegas meeting was no exception.

Although the political climate is changing and evolving, it is fortunate that many of the "old hands" who have engaged in this activity continue to be there to provide historical context and continuity. The message from the ABF's leadership revealed this in spades. George Hanson, who was elected ABF President in Las Vegas, a stalwart of the Legislative Committee for many years, introduced Mr. Fran Boyd, who has been the official bee lobbyist for the Federation now going on 30 years. He reported that last year started with extreme optimism, and negotiations for the 2012 Farm Bill were going along smoothly. The Farm Bill is the long-range (generally five years) policy that governs agricultural endeavors and is looked to by everyone in the field for guidance. It not only includes the production portion of agriculture (subsidies, emergency and disaster relief), but also how food is distributed (food stamps and related programs).

Mr. Boyd said that the Senate and House Agriculture committees were the only ones in congress to have done their duty in hitting their goal of about $2.7 billion in cost reduction as part of the Farm Bill negotiations. But these were driven off the rails by the results of the 2010 election, followed by the "debt ceiling" crisis of last Summer. The failure of the "unprecedented" charge to the so-called "super committee," of $1.7 trillion in budget reductions effectively means that most of these efforts have been compromised.

In short, Mr. Boyd concluded that most of the previous efforts, which literally have taken years to negotiate in order to develop an effective five-year Farm Bill going forward, were rendered obsolete in less than a month and a half. It now appears that there will be no new bill and Congress will probably simply extend the current one. With 2012 being an election year, nothing is certain, except that there will be another change in the "body politic." And that will result in a whole new crop of legislators and aids to educate about agriculture in general and beekeeping in particular. Two hot things on the ABF agenda at the moment include the closing of the Weslaco, Texas bee laboratory and the Food and Drug Administration's official denial, yet again, for a standard of identity for honey. It appears the latter decision means that some legislative solution is now needed. Fortunately for the industry Mr. Boyd will continue his efforts as an advocate for the beekeeping industry, but it will take patience and money.

George Hanson took the stage to deliver an address concerning the state of the Federation's lobbying activities and possible future. Entitled: "Beekeeping Beyond the Basics," he presented a video, "Honey Bee Song," that revealed a good many reasons why humans take up beekeeping. It purported to answer his own question of why beekeepers were present at the meeting, "because we love bees." This segued into a discussion that beekeeping and honey bees need help. Assistance has been possible in the past, he concluded, because of research and education that incorporated the use of public money for these goals, funding efforts by the Agricultural Research Service (ARS), National Science Foundation (NSF), and other agencies.

However, Mr. Hanson said, there is a continued debate about the use of public funds in all kinds of efforts. The only way to ensure they continue for beekeepers is through constant lobbying efforts. Every one is needed in the fight to save the resources supporting beekeeping, whether they have one or twenty thousand hives of bees. The best way was to support the ABF's legislative fund, which has the following priorities:

1) Funding for CCD Research. Many beekeepers are again having large losses due to Colony Collapse Disorder (CCD). The Farm Bill authorized additional funds for CCD research, but only a portion of that was actually appropriated. We are encouraging Congress to appropriate the authorized funds.

2) Maintaining ARS Lab Funding. USDA-ARS conducts honey bee research at four locations: Beltsville, Md.; Baton Rouge, La.; Weslaco, Texas; and Tucson, Ariz. Each of these has a different mission that correlates to its location. It is important that adequate funding be available for them.

George Hanson is the new ABF President.


Laurie Davies Adams, Executive Director of The Pollinator Partnership gave the keynote address.

3) Protecting our Honey Market. We have two priorities here: a) establishing a national standard of identity for honey; and b) stopping illegal imports, particularly transshipment of Chinese honey through intermediary countries. Our honey market is in precarious shape. Strong steps are needed to shore it up.

FDA has promised Congress that it will get to work on the honey standard of identity that the industry, led by ABF, submitted nearly five years ago. Despite those promises, FDA continues to ignore our need. The national standard of identity would give state and federal enforcement officials a better tool to use to stop those who are adding cheaper sweeteners to our honey.

4) Disaster Programs and Crop Insurance and H2A Labor Programs. We are continuing to work for USDA disaster programs to be more "user friendly" to beekeepers. While immigration and farm subsidies are sure to create headlines, our industry's need for legal laborers requires an H2A labor program that works, and programs that allow for the management of risk without opening the door to fraud.

One thing to keep in mind is relatively small size of the ABF membership. A profile reveals that growth in numbers has been relatively flat over the last two years, although slowly increasing from 1,049 in January 2010 to 1,140 in December 2011. All categories of membership (Sideliner, Commercial, President's Club, President's Club Silver and President's Club Gold) more or less mirror this with exception of Small Scale (previously called Hobbyist). The latter has grown from 675 in January of 2010 to 745 in December of 2011. An update report released after the convention showed that 101 new members had signed up, along with 55 renewals. The majority of that was small-scale, topping out at 840, resulting in a total of 1233 members. Given the growth in small-scale beekeeping around the United States, it is dismaying that the national organization has so few beekeeper members. In contrast, the Florida State Beekeepers Association has grown substantially in the last few years, tripling its membership to about 900.

Both Fran Booth and George Hanson were unanimous in their opinion that beekeepers get the most "bang for their buck" out of legislative activities at the national level, which is remarkable considering the size of the membership. As an example, it didn't take long for the National Agricultural Statistics Service (NASS) to reinstate the Annual Bee/Honey Production Report, once beekeepers began calling their congressional representatives.

Membership growth continues to be on the minds of the leadership and there have and will be changes in ABF policy to recruit more, especially in the small-scale arena. The Federation publishes a printed and electronic newsletter that has been well received, and will also be producing training via webinars, as well as an online beekeeping course being developed at a well-recognized university. In addition, the success of the "Serious Sideliner Symposium" under the direction of Dr. Larry Connor is attracting attention. One disconnect is the lack of relationship that exists between the Federation and the many state and local beekeeping associations found in the U.S. This was easily seen in the State Delegates Assembly, responsible for electing four (4) members of the Board of Directors, which had limited attendance. Meeting at 6:00 a.m. probably did not help, but more problematic is that this aspect of ABF governance has not been promoted. Last year a state delegates' position description/information kit was developed to help close this gap, but there was no report on any follow up to this initiative. There is a new member orientation held during each convention. The one in Las Vegas was attended by less than a dozen new members.

The Federation also has set up the Foundation for the Preservation of Honey Bees http://honeybeepreservation.org/. This is a 501(C)3 nonprofit organization, which has several ongoing projects, including: providing $2000 scholarships to selected students studying various aspects of honey bees and bee culture; administering the 4-H Essay Contest, which provides various awards to young writers; awarding grants to young beekeepers via state beekeepers associations, and the Kids & Bees and Bee Buddies Program that reaches out to grade school children. The convention prominently featured two of these programs. There was a Foundation luncheon honoring the four selected scholars, and the Kids & Bees Program hosted 400 students from local schools, exposing them to all aspects of honey bees and beekeeping.

The Ladies Auxillary each year also sponsors the honey queen and princess program. This year six contestants vied to be named queen and princess. These will be the official ambassadors for honey sent around the nation to promote the sweet. Many activities of each convention financially supports the honey queen program, including sweepstakes ticket promotions, an annual auction at the banquet, and selling winning entries in the honey and gadget show.

Another strategy to increase political clout is to partner with like-minded organizations. Thus, the keynote address in Las Vegas was not specifically related to beekeeping, but referred to all organisms that might play a role in plant pollination. Ms. Laurie Davies Adams, Executive Director of the the Pollinator Partnership http://www.pollinator.org/, in her presentation, entitled "The 21st Century Hive: People, Partners, Pollinators" provided a window into what other initiatives are ongoing to protect and encourage organisms that pollinate, including honey bees. These include The North American Pollinator Protection Campaign (140 cooperators) which held a meeting at the Smithsonian last Fall, and promotes other initiatives such as distributing the Bee

Smart Pollinator Gardener phone APP application, and d istributing a group letter supporting the Highways Bee Act. This would require the U.S. Department of Transportation to help the states implement integrated vegetation management (IVM), including reducing mowing and increasing plantings of native forbs and grasses, on the 17 million acres of highway rights-of-way (ROWs) that will benefit pollinators. Finally, a Bee Smart School Garden Kit targeted for grades three to six is being distributed containing seeds and information on planting both garden and ornamental plants.

The Pollinator Partnership is heavily involved in pesticide issues. It was part of the international Pellston Pesticide Risk Assessment for Pollinators workshop held in Pensacola, FL last January concerning pesticide labeling; and collaborates with OPERA, a young, growing think tank and a research center at the Università Cattolica del Sacro Cuore, a major European private university. OPERA is an independent, non-profit scientific organization, committed in supporting the successful implementation of the agri-environmental measures within the European legislation. The Pollination Partnership also is involved in looking at North American Free Trade (NAFTA) initiatives and works closely with a Canada specific group, CANPOL.

Ms. Adams concluded with thoughts going back to Rachel Carson's book, Silent Spring. At the time of its writing some 765 pesticides were in use. The present day number is about 16,000. Her advice is to take the emotions out of the issue and rely on science to lower the volume so all interested parties can work together solving many of the pesticide issues facing human society today.

The ABF is also reaching out to the international beekeeping community, something that has not been prominently on its agenda in the past. Thus, Mr. Gilles Ratia, current president of Apimonida, was invited to provide a description of efforts by this group to its member constituents. Apimondia is properly termed a federation of beekeepers associations. The ABF became affiliated again after a hiatus. It was a member in the past, working with other organizations to host Apimondia in 1967. One of the possibilities suggested by Mr. Ratia was that the United States via the ABF solicit to host the world congress in 2017. Planning should begin fairly soon to develop a bid by the 2015 Congress in South Korea. The next Apimondia Congress will take place in Ukraine in 2013, which, according to Mr. Ratia has almost 400,000 beekeepers.

Apimondia has been around since 1897. Mr. Ratia was elected president at the 2009 meeting in Montpellier, France. He outlined his vision for the future, most of it now concisely delivered on an updated web page http://apimondia.org. At the moment there are 111 members representing 75 countries. Traditionally seven standing commissions made up the federation: flora and pollination, bee health, bee biology, economy, technology, apitherapy and rural development. Mr. Ratia has incorporated five new commissions based on geography: the Americas, Africa, Asia, Europe, Oceania.

Apimondia is currently soliciting ideas for working groups. Thirteen have been identified so far, including organic beekeeping, honey bees as endangered species, rules for international contests, bee product quality, good

Liz Vaenoski, from Wisconsin again produced beautiful beeswax art.

beekeeping practices in apitherapy, an ethical charter for the international honey trade, queen rearing's impact on genetic variability, accreditation for apicultural ecotours, and bees and pesticides. The hottest one at the moment is genetically modified organisms (GMOs) and bees. There is a huge debate at present concerning the effect of GMO pollen on honey quality. Europeans in general are much more skeptical of GMOs in their food supply than some other countries like the U.S. Recently, GMO pollen found in honey has resulted in imports being denied entry into Europe, an "unintended consequence" of the GMO revolution not on anyone's radar. Each working group will be implementing research, roundtables and training. The latter will include so-called "digital kits," which seek to put recent, relevant information in the hands of appropriate individuals.

Mr. Ratia closed with a call to action. Now that a template has been designed for a more streamlined and efficient way to attack issues, the "ball is in the court" of the beekeepers of the world to engage in discussion and provide support for research in areas they consider most critical. He urged beekeepers to become affiliated with both Apimonida and the American Beekeeping Federation. For only through these organizations, can beekeepers find the political clout necessary to effectively deal with issues critical to the apicultural industry's survival in the 21st Century. BC

MOVE THOSE BEES!

Don **Jackson,** with Scott **Lucas**

At dandelion time our colonies began to dwindle. Why?

In the last article I described a severe and disheartening loss of my bee operation in the Fall of 2009 through the Spring of 2010. Many hobbyists in our area have depended on us to provide nuclei for their own operations each Spring. Our losses forced us to look to another supplier to satisfy the local beekeepers. This is problematic as it may bring in new diseases, pests, and problems for everyone, and some of that apparently is just what happened. Nevertheless, we hoped that the demonstration yard of our local bee club (the North Central Beekeepers Association, or NCBA) would be up to the task of helping everyone willing to learn how to keep their bees healthy and produce some great honey in our group.

History

NCBA has maintained a demonstration yard of bees for some years now. First, the location was on a local farm. That successful effort was a valuable educational tool, with "hands-on" training of such activities as installing packages, medicating, preparing equipment, raising queens (Dolittle method), harvesting, and wintering. We tried several breeds, and found a bounty of tracheal mites even in the supposedly "resistant" stock!

A change in meeting locations gave us a different location for the demo yard which was also a good one, producing a honey crop every year, though it was a bad spot for deer ticks which can carry Lyme's disease. We all picked them up as we waded through the tall grass and became tick prey.

Then came the third location, and our eight colonies produced a bumper crop of honey – 1200 pounds in 2009, with three deep supers full of honey for wintering left for the bees. In 2009-2010 they did not Winter well, in spite of all the years of our vast membership's expertise, "proper" medication in the Fall, plenty of feed, etc. We had to replace losses by making splits out of the remaining two strong colonies, which were moved to another location 30 miles away for a few weeks. Everything then was looking healthy and starting out well in the Spring. Then the splits with the new queens were moved back to the demo yard.

Problems Develop

About the time of the dandelion bloom in 2010 the bees began to dwindle and the brood patterns deteriorated. Some entire hives were dying, and we speculated that perhaps the new neonicotinoids (which were replacing organophosphates) were being used in the area, especially since we found them available in the box stores. We also wondered if there was a problem with *Nosema ceranae*; we knew it was in the area as I had personally arranged for the export of the 10 colonies of one of our members to Canada in 2006 for research and testing (positive for *Nosema ceranae*). My suggestion was that the group try spraying the bees with a sugar syrup medicated with Fumidil-B and Nozevit, which we did. This had reversed the failure of my own operation.

Very shortly, full-blown collapse was setting in on all except one colony. We could only call it "Colony Collapse Disorder" because we did not know what was killing the bees. What was going on? There was a scramble to determine if someone was using toxic insecticides in the area, but no one came forth with any specific information. We all knew something was radically wrong.

The Summer of 2010 had one hive (out of eight) that produced about 100 pounds of honey, while the others were failures. That one hive made it through the next Winter but also began to fall apart in the early Summer of 2011. Packages were purchased to replace the losses, and began to build up normally . . . until the dandelion bloom; and then deterioration, disappearing bees, and poor, spotty brood patterns became the norm. No honey was produced in 2011, and the beeyard had to again be moved to another farm in an attempt to save what was left. NCBA is now trying to Winter the two remaining survivors.

Where To Find Help?

Our bee club was losing a pile of dollars fast. We were purchasing bees and queens, then losing them. There was no honey crop to sell to pay for the losses. And our "demo" yard was no longer a learning "hands-on" course in good beekeeping for any of us. We couldn't find out if someone was using poisons and we didn't know if the equipment was now hopelessly contaminated.

NCBA finally decided to send in wax samples to be tested by the National Science Lab in Gastonia, North Carolina. It would be costly – $283.50 – to spend this much on bees and equipment which were now largely worthless, but NCBA thought it might be worth the effort. Most individual hobby beekeepers will not go to this expense and effort – they just accept their losses and purchase new bees the next Spring. This had happened to the group after the Winter of 2009-2010, when nearly 400 new packages and nuclei were needed to replace the losses. Most of the 100-plus membership had lost their bees, and . . . what a gold mine for the suppliers but those losses really hurt us and stung our pocketbooks. So, NCBA decided to spend the bucks to test our stuff from the demo yard. Maybe NCBA's membership could all benefit from what we learned.

What The Lab Found

With all the hoopla in the bee literature on CCD and neonicotinoids, we decided to have the lab test for that. The lab scientists were generous with us and gave us more than our money's worth – they were also wondering what was wrong with those bees. We expected the results to indicate extensive mortality from insecticides (especially from the systemic neonicotinoid family). We thought that, since we are a non-profit organization, we could then use that information to try to "educate" the applicators who were killing off these beneficial pollinators.

The demo yard was located in an urban area. Some of the surrounding residents do not like to see their lawns turn brown from fungi killing the grass after the snow pack has melted. They also do not like to see their lawns turn yellow with dandelion bloom during the month of May, much less see gazillions of bees working this favorite flower for pollen and nectar: was someone doing some harmful spraying? The urban area also has a low tolerance for mosquitoes, which we were told were sprayed for; and what kills them will also kill bees if poison is used. Fruit trees in the backyards of city homeowners, four major box stores selling Spring plantings, and at least one greenhouse supplier with many flowers in bloom were all within flight of NCBA's bees – could there be spray damage on some of that stuff – this Fall (2011) honey bees were observed working blooming asters at one box store, so that cannot be ruled out as a source of pesticide

The mortality of NCBA's demo yard of bees was on our minds. We just didn't have all the answers, but one thing we learned was certain; nobody wanted to confess to killing someone else's livestock! Not only that, but some poisons have a very, very short effective kill life and may not leave a detectable residue. Consequently, the lab testing could not possibly give us the complete picture of why NCBA's bees died. We would have to settle for just what they could find out.

Nevertheless, the lab's work gave us the surprise of the year! Those darned miticides could have been part of the problem! What has the NCBA been using on *Varroa* mites – the same thing everyone else is using – whatever is legally available. First Apistan (fluvalinate), then Coumaphos, then the "environmentally friendly" thymol were discovered in residue. It was all there in the wax. We have all heard of beeswax sequestering miticide residues, and now the evidence came in: Coumaphos at 2560 parts per billion; Coumaphos oxon at 151 parts per billion; Fluvalinate at 24.5 PPB; Thymol at 7260 PPB.

The literature is clear, and scientists have discovered, that multiple kinds of miticides residual in beehives have a much-increased mortal affect on the bees (called "synergy," and may increase the mortality many times greater than the use of a single miticide). Still, the colonies have been building up well in the early Spring, in spite of whatever was found in the wax. So the bees were able to handle it. Besides, beekeepers have few options – they must control the *Varroa* populations or they will be out of business.

However, the lab also found two other substances in the wax – Chlorothalonil at 202 PPB and Chlorpyrifos at 2.3 PPB. Now the picture gets more complicated. How did that stuff get into the beehives? We don't know, neither do we know when. If it took place during miticide treatment, then it could be quite serious.

The Chlorothalonil is a fungicide. A recent report on miticide and fungicide interactions was published in the October 2011 issue of *American Bee Journal*, and some interactions with the two apparently could increase the toxicity by more than 20 fold, even almost up to 1000 fold! I'm sure we'll be reading more on this in the future as findings are published. The article indicates that there is miticide toxicity interaction between fluvalinate and chlorothalonil and also between thymol and chlorothalonil; toxicity to the bees themselves is not yet established.

Part of the crew of the NCBA getting the demo yard ready for the Winter ahead.

The Internet also has information on Chlorothalonil (Wikipedia, the free encyclopedia). A few of the comments are:

Environmental: "Chlorothalonil has been suggested as a partial cause of colony Collapse Disorder, among many other factors."

Chlorothalonil: ". . . is a polychlorinated aromatic mainly used as a broad spectrum, non-systemic fungicide, with other uses as a wood protectant, pesticide, acaricide, and to control mold, mildew, bacteria, algae. Chlorothalonil-containing products are sold under the names Bravo, Echo, and Daconil . . . the EPA estimates that on average almost 15 million pounds were used annually from 1990-1996."

Uses: "In the U.S., chlorothalonil is used predominantly on peanuts (about 34% of U.S. usage), potatoes (about 12%), and tomatoes (about 7%), though the EPA recognizes its use on many other crops. It is also used on golf courses and lawns (about 10%) and as a preservative additive in some paints (about 13%), resins, emulsions, and coatings. It may be applied by hand, by ground sprayer, or by aircraft."

The other potentially dangerous substance found in the wax was Chlorpyrifos. NCBA was filled with consternation – how did this organophosphate pesticide get into our beehives? This insecticide, also known as Dursban and Lorsban, is described on the Internet as having many potential health effects, including:

From Food: "Children may also be exposed to chlorpyrifos by eating foods with pesticide residues. The U.S. Department of Agriculture's Pesticide Data program has found chlorpyrifos residues on apples, tomatoes, grapes, and soybeans . . ."

Significant Statistics

"About 10 million pounds of chlorpyrifos are applied annually in agricultural areas. The majority of it, 5.5 million pounds, is on corn."

"Chlorpyrifos is highly toxic to birds, fish and aquatic life and bees."

Few bees are left in this collapsing hive.

Lost brood is the result of a collapsing colony not able to provide proper care.

"Scientific studies have found that as the chemical breaks down naturally in the environment, it releases chlorpyrifos oxon, which has been found to be even more toxic than the original form of the chemical."

What We Do Not Know

So, what killed the NCBA yard of bees? Frankly, none of us can be sure at this time. Was it the interaction between beekeeper-applied miticides and chlorothalonil and/or chlorpyrifos? We cannot be sure, though this points to danger. Was it fast-deteriorating mosquito spray? Who can say? Was it another substance not yet tested for in the environment? Was it a cumulative effect of too much build-up of miticides in the wax combs? At this point, nothing is certain.

Lab testing was done for these substances. There is a synergistic affect from the use of multiple varroacides used on the bees, though we doubt that to be enough to kill the insects because they started off so well in the Spring. However, we have no way to know how much of a kill resulted from the interaction of the two chemicals, or between the chemicals and the miticides. These questions are so very serious for the bee industry, and we hope the scientific community will be able to answer them in the future.

One thing is certain – what a disappointment for a no-profit organization of beekeepers trying to help its members learn how to practice successful beekeeping and produce good honey!

Move Those Bees!

So what do we do? NCBA finally moved the apiary off the location and onto a farm a few miles away. The colonies missed the honey flow, and the weak hives finished dying off. But two have survived, though a great deal of food was needed to prepare them for Winter. Minnesota Winters are long and cold – it'll be interesting to see if the bees survive and what condition they'll be in the Spring.

Maybe this saga of NCBA can help some of the readers figure out what is wrong with their own bees and how to handle the problem. Diagnosis is not easy in our modern chemical-saturated environment, but over and over again it has helped to move apiary locations to less chemically-stressful sites.

We also learned of possible multiple causes of the collapse of bee colonies. "Colony Collapse Disorder" is not a cause, it's just an observation that something has happened to the bees. The work on causes is not yet done, and perhaps never will be, but we have to keep looking at each and every situation. I lost my own apiaries in 2009-2010, but cleared up the problem with one of the new "health" medications. That did not work on the NCBA apiary, so we have to keep an open mind as to possibilities. BC

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BOOTS ON THE GROUND

A Radical Shift In The Interface Between Research And Real World

M.E.A. **McNeil**

Booooos from the back of the audience were directed to the young woman on the stage at the California Beekeepers Association Conference. Without the context, the message could easily have been misconstrued. After all, Katie Lee was part of a national data-collection project, the Bee Informed Partnership (BIP), and the Northern California bee breeders were known for being less than open to outsiders. In the conference hallway, a breeder had just fumed over one hapless suitor to the role of mentor: "That guy comes up here to show us how to keep bees." With a sweep of an arm toward a nearby group he said, "Right there you have 600 years of beekeeping experience. We don't need anyone to tell us how to do things."

Lee had announced to the audience that she is leaving BIP's California Tech Transfer Team to start another team in her native Minnesota. She had been working closely with those bee breeders, and their catcall was saying: "Don't go, don't go, we love you so."

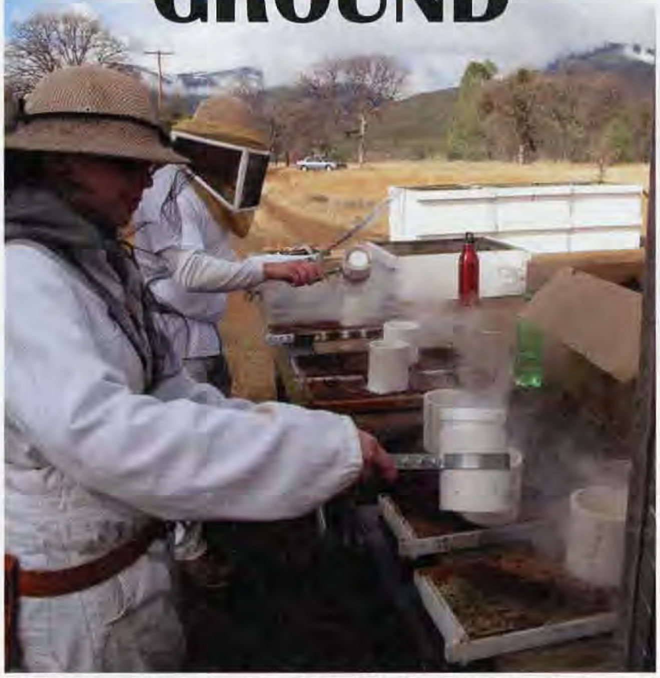
What was happening was no less than a seismic shift in the relationship between research and beekeepers. "Researchers used to inform us about what they were doing, and now they are saying, 'What can we do for you?'" said Jackie Park-Burris who runs one of the large queen breeding operations. At this point it would be fair to say that neither is the tech team strictly researchers nor are the breeders strangers to scientific process: For example, Park-Burris dissected bees for tracheal mites for over ten years, and said, "We have zero now." But testing for the accumulation of insults on the bees has become too much for beekeepers to keep up with.

Dennis vanEngelsdorp describes the broader mission of BIP, "It is not a research project to collect data. We are doing what the beekeepers want – to learn what other beekeepers are doing but don't want to reveal their own. It is anonymous. We gather the information and we provide it. It's what they want rather than what researchers decide, but the two are not exclusive."

But how is it that three "kids", as some beekeepers call the tech team, have access – not only to apiaries but to guarded information? "Because of who they are and how they have conducted themselves, they have gotten access to some of the best bee breeders in the world. Before this, the beekeepers have kept things close to the vest; it's proprietary information," said Pat Heitkam, who is one of the participating breeders. The 16 were not chosen; they were simply those who stepped forward to participate.

Lee said, "We don't tell the beekeepers how to keep their bees. That's not what we are interested in doing. We are trying to make their process easier. They are total experts at what they do. We provide them with a pool of data on their own colonies and let them do what they want with it." The other ingredient is strict anonymity. Try and tease some information out of any one of the team and you will be convinced that they each keeps a cyanide capsule in their bee hat.

How did this team come about? The idea that genetics were key to strengthening the health of honey bees drove Marla Spivak's development of the Minnesota Hygienic line at the University of Minnesota. She knew that



Katie Lee and Rob Snyder of the BIP Tech Transfer Team pour liquid nitrogen to test for hygienic behavior for Northern California bee breeders. (Mike Andree photo)

Northern California queen breeders produce most of the genetics disseminated across the country. Her proposal to them was to provide testing for *Varroa*, Nosema and hygienic behavior to support their breeder queen selection, starting in 2008. "In the beginning, we had already selected our breeders when we got Marla's results," said Park-Burris. "Marla came here with a goal, 'I have to get results to you before you select your breeders'. She did accomplish that goal. You can't give enough kudos to Marla for accomplishing this."

Meanwhile, researcher Dennis vanEngelsdorp came up with a sweeping vision: to bring diverse troves of bee data together with national surveys and assays to create an interactive online resource – all information for

The Bee Informed Partnership Tech Transfer Team, from left, Rob Snyder, Mike Andree and Katie Lee gratefully accept the gift of a truck, donated by Dan Cummings, an almond grower. Cummings will take care of major repairs as well. (BIP Tech Transfer Team)

the Tech Transfer Team doing hygienic testing at an apiary of Jackie park-Burris, right. Team member Mike Andree says: "this picture epitomizes the quality of beekeeping that is synonymous with the high quality of beekeeping in Northern CA. (Mike Andree photo)

the Tech Transfer team works with nucs at Heitkam's mating yard. Lee is in foreground and Pat Heitkam is in plaid shirt. (BIP Tech Transfer Team photo)

all beekeepers. He has funded his brainchild, the Bee Informed Partnership, with the largest extension grant ever given by the USDA, $5 million. Nine universities and the USDA are coordinating the gathering and analyzing of material – including the yearly APHIS National Honey Bee Disease Survey, the national Winter Loss Survey and the deep historical archives of the USDA. The philosophy of the project, to empower beekeepers to make their own informed decisions, fit what Spivak was already doing in Northern California.

Spivak had formally handed over the queen breeder project to Katie Lee, who, as her grad student, had created the 300-bee mite test that is now a standard. Lee had accompanied Spivak for the California work, which they did together for several years. When referred to as the head of the project, Lee laughed, "I was the only one here, so I was in charge of myself." Take charge she did, waking early, meeting a queen breeder every day somewhere in the region at his yard by 8:00 am or so, testing, taking samples among his apiaries and recording data for five to eight hours – one day for each beekeeper. Then, after the drive home, she'd work several hours more in her kitchen lab, the additional hour round trip to the UC Davis Extension lab eschewed in favor of sleep. "That was a little bit rough. It was a lot of work, and it was worth it," she said.

When the Tech Transfer Team became part of BIP, two new young teammates joined Lee – Rob Snyder and Mike Andree. Snyder had worked on a North Dakota longitudinal monitoring project and had been an apiary inspector. He and Andree had worked as field researchers with vanEngelsdorp in Pennsylvania. Andree likens his new experience to driving a vehicle built by those who created the grant: "It's been fun for the three of us to drive it around."

But it took some time to get up to speed: "Learning the dynamics of each of those operations was a challenge at first," said Andree. "A lot of them are family-run businesses, and these guys all know each other. So when you meet beekeepers there are also wives and children and sometimes their children's girlfriends – a whole big community of beekeepers rather than the 16 beekeepers that we are working with. You want to be scientific, you want to be consistent, and that goes for the way you process the samples to the way you deal with beekeepers in the field. Consistency is big in science.

Instead of analyzing all of the samples themselves, the team now does about 10% – to allow for quick preliminary results. "You find yourself on a weekend looking through the microscope counting Nosema or washing *Varroa*," said Snyder. "It's just something that you have to do to get this information back to them quickly."

Most testing for Nosema and *Varroa* is done at the USDA Beltsville lab. Andree blogged: "The BRL [bee research lab] Team has done an excellent job turning around samples, generating reports to the beekeepers, and getting them back to us to report." Timing, he said, is crucial for the information to be useful. Virus testing is done at Dave Tarpey's lab at the University of North Carolina to establish a base line. "It's still more than 40 hours a week, but it's a lot better. And I like being dedicated," said Lee.

Before they could begin to work together, the three realized that each had a separate idea of what was important for hive assessment, which they needed to do for every colony. Snyder described their consensus: on a one to five scale they rate frames of bees, weight of a colony, brood pattern, disease or pests, whether it is queenright. Fall, he acknowledges, is not the best time to judge temperament, so they assess that at other times. Color is also noted because it is important to some breeders. More qualities are added to later assessments. "What we are looking for are the outliers, colonies that are extreme – really heavy or light, black or yellow. When you pick breeders you want an exceptional hive," he said.

"We test four times the number of breeders they want. If it's 40 breeders, we will test 160 colonies that they have already selected," said Andree. In addition to *Varroa* and Nosema testing, they also do hygienic testing, returning to the apiary after 24 hours to read results. They are also doing separate studies of Pristine, a commonly used agricultural fungicide, and fumagillin, an antimicrobial treatment used by beekeepers.

A surprising finding has been similar levels of Nosema in some fumagillin-treated and some untreated hives. Lee emphasized that they had just a snapshot from which they could not draw a conclusion. "This story is that there are other factors going on affecting Nosema levels in the colony that we don't know about yet. This is something that we really want to investigate, what the difference is with these beekeepers."

"We have tested a lot of colonies that we would call hygienic. We are finding a lot of potential here. This has been really exciting for us. Keep in mind that we have not been at this that long, and a lot of what I am talking about is preliminary," Lee said. "We don't want them to sacrifice any of their other traits. Some of these breeders have been selecting their line of bees for decades. The point is to help them breed that trait into their gene pool so that the daughter queens will be more hygienic and reduce the overall level of disease in the U.S."

The work has made a difference for breeder Brad Prancratz. He said at the CBA conference, "This project has really given me peace of mind. Now I have professionals coming in, giving me accurate results, telling me where I don't have Nosema and I don't have to treat, and it is saving me $80,000. Then they are telling me where I don't have *Varroa* and I don't have to treat. I used to come to these conferences and I would be thinking about what's going on, and I'm not there, and I can't do anything about it. Now I am here and I have peace of mind."

The goal of BIP, Andree said, "is to increase colony survivorship. If we can cut the top 25% of losses by half, we can save roughly 86,000 beehives. That would mean losses would drop from 34% to 19%." The project pursues that goal with national management surveys, field work to assay samples and longitudinal monitoring. You, the beekeeping reader, are asked to participate in the online management survey, providing data to be made anonymously accessible. More shareholders, as vanEngelsdorp refers to contributors, are needed to broaden the base of information. The website **www.beeinformed.org** gives simple instructions as well as the tech team's blogs and a wealth of information.

Apart from the many other samples that come into the USDA and become part of the data pool, the tech team is, at present, adding tests from only the 16 California bee breeders. "Lots of other beekeepers want to join. This is a model and we plan to get it in other parts of the country," said vanEngelsdorp, who was just coming out of the BIP national advisory board meeting that included researchers from five countries. "To do it stretches our budget so we need help."

Among the subjects discussed at the yearly meeting was the University of Illinois project to create a business plan to allow BIP to continue after its initial grant. The Tech Transfer Team in California is funded for five years, after which it will need to survive through fee for service.

Heitkam agrees: "It needs to be privatized." The process has already begun: When Lee leaves to start the new team to test migratory beekeepers in the Midwest, the Northern California beekeepers stepped forward to replace her. "Everyone at the meeting agreed that we are ready to put money out of our pockets to see this continue. That's how well accepted it is. It's amazing."

Geographic expansion of the program is needed, said Lee: "Just recently, Dennis vanEngelsdorp got a phone call from a beekeeper in North Dakota who desperately wanted someone to come out, but nobody could go. I would be there to see what was going on." She will be working with beekeepers who move bees in and out of the Midwest. "I still will be traveling quite a bit. Summer in the Dakotas looks like California in almonds sometimes, so many beekeepers are there."

Frank Pendell, center with yellow cap, and his crew afte a day in the bees with the Tech Transfer Team, the three to the right. (BIP Tech Transfer Team photo)

Another potential location for a team is Hawaii, where Snyder and Andree's Penn State colleague Lauren Rusert is now an apiarist. Rusert and apiary specialist Danielle Downey visited the California tech team "to follow us around," according to Andree, to see if such a team could be created in Hawaii, where the *Varroa* mite has more recently been introduced. BIP is sending Lee to Hawaii to discuss the project with the predictable toss line "someone has to do it".

The California team will spread regionally as well. Andree said, "It's going to start here in the north state, and eventually we will be working with migratory beekeepers as well. The big thing is the breeder selection, that's the big thing."

Just as the project is expanding geographically, Snyder said that the protocol is evolving: "We are always looking for ideas from the beekeepers. One idea they gave us is to look at protein levels – natural pollen versus pollen patties going into and coming out of Winter."

The current longitudinal study in California involves 12 beekeepers of the 16, monitored three or four times a year. From that, a smaller group next year of about three beekeepers will have sampling and assessing from 200-300 beekeeper-chosen colonies after they requeen and before they treat. Summer reassessment will reduce them to the 100 best for more detailed evaluation. According to Andree, they will crunch numbers in December and winnow the group down to 50, which will be examined yet again with additional criteria.

These results will be available online at the Bee Informed Partnership website – anonymously, of course – with management practices and outcomes linked. A unified way of tracking, indexing and diagnosing field samples has already been completed in the database. The goal of going live with the interactive aspect of the site is about 70% finished, according to the BIP yearly progress

Rob Snyder and Katie lee sample bees at Strachan Apiaries, one of the 16 participants in the first phase of the tech team work. Lee is shaking bees into a simple device designed by Gary Reuter at the University of Minnesota called The Honey Bee Sample Thing – a piece of metal flashing the length of a frame and twice the width, folded to a 90° angle so that a frame of bees can be shaken into it and poured into a container. (Mike Andree photo)

report. Citing that the project has been funded for only a year, Jeff Pettis, who heads the USDA Beltsville lab, said, "I am amazed that they are as far along as they are."

BIP proposes to "Promote model best-management practices that are evidence-based" as well as "the training and inauguration of specialist apicultural crop-protection agent teams."

Heitkam sees the Tech Transfer Team as the start: "I have said that it could be industry changing. These people are incredibly talented and dedicated. They have so much enthusiasm. I see this as moving toward something like what they have in agriculture – crop advisors, technical advisors. It's about the bee industry maturing like other facets of agriculture have."

The team's old truck has been replaced by an almond grower. The jump seat in back was too small for any of them. "It was comical because none of us could sit back there, and we switched off cramming ourselves in," said Lee. "Dan Cummings donated a truck to the tech team. It is a personal gift from him. He also said that he would pay for any major work that needs to be done. It's super generous of him. It's a great truck."

When reminded that she was booed at the conference, Lee laughed. "I consider these beekeepers all to be friends of mine at this point. They have all been so supportive. I love working with them. These people are really interested in what they are doing. We are working to help them out, and I think they appreciate that. They lament the loss of any one who works out. For one, I remember it was the loss of a UPS driver who was reliable and took good care of the queens."

Park-Burris said of the team on the ground, "It's great having the kids here. It's stuff we can do, but we are so busy it is hard for us to follow through. They are better at tagging and following the hives and keeping the records. We get the results right away, so we can implement what we learn. I have considerably improved queen selection from the information. This is a vision Marla had, and now it is coming true for her with this project."

Pancratz said, "The tech team is a great asset for the industry. They come out to your outfit and do the work, and they work around my schedule. We've needed them for a long time."

"I'm real impressed with these young people," said Heitkam. "We have had a lot of stodgy old farts out here." BC

M.E.A. McNeil is a journalist and longtime beekeeper living in Northern California on a small organic farm with her husband, son and a very, very old dog. She can be reached at **mea@onthefarm.com**.

Beekeeping Instructor's Guide

Drone Bees
Fourth In A Series

Larry **Connor**

Introduction

In this session (or series of sessions, as you are able) examine with your class the role of the drone bee in the beehive. In your lecture/textbook section review the biology of drone production, reproduction and removal. When age-appropriate, discuss the mating behavior of drones, drone congregation areas and what happens during mating.

Then, if possible, go to the apiary to examine the stages of drone development. Find newly emerged drones and compare them with drones that are flying in and out of the hive. In the laboratory examine the large eyes and reproductive structure of the drones' body. If possible, collect semen and examine some under a high powered compound microscope.

A. Lecture-Textbook
Drone Metamorphosis

The male bees in a hive are called drones. They have few duties in the hive other than to mate with new queens that area hives produce. Drones have a 24 day development time, the longest of the bees. Drone brood is produced only when the colony is in a growth period, or if the queen has depleted her supply sperm stored in her body.

Drones past emergence feed themselves, first on pollen, and then on honey. This drone is on a honey frame and refueling on honey between mating flight attempts.

Drones are genetic envoys available to nearby virgin queens necessary to supply the diversity of sperm healthy colonies need for survival against diseases. Drones die when they mate. It is unusual for them to mate with queens from the same location – both queens and drones have behaviors that insure out-crossing and minimize inbreeding. This makes the small-scale beekeeper dependant on the drones produced in colonies within a mile or more radius. Drone saturation requires multiple nearby locations for success.

Healthy drone populations are necessary for genetically robust, disease resistant colonies. When maintaining a special line of bees it is necessary to have large colony numbers adequate to supply drones needed for the successful production of queens.

When the nectar flow is over, or when a colony is in stress, workers expel drones from the hive as a means of saving resources (pollen and nectar). Anytime there is stress in the hive, the workers will remove or 'trim' young drones and consume the protein and other foods in their body for colony survival.

Brood

The term brood (the immature stages of the colony) usually describes the worker brood, but there is usually drone brood included in the total population of brood during the Spring and Summer. These eggs, larvae and pupae are kept in a compact region of the hive called the brood nest or brood chamber. The bees keep his area at 95°F. to ensure rapid and healthy development of the young bees.

Drone Comb

Worker bees produce the beeswax honey comb during a nectar flow or when fed thin (1:1) sugar: water mixture. The bees are stimulated to secrete wax scale on the underside of their abdomens on eight wax plates. These wax scales are moved to the mouthparts and chewed with saliva and formed into beeswax comb. It takes eight to 12 pounds of honey to produce one pound of beeswax.

The bees use the comb to house brood (new bees) and for honey and pollen storage. There is a formal organization to these various components that every new beekeeper must learn and respect.

The Life of the Drone Bee

Drone bees in the hive develop from unfertilized eggs. They are essential for the mating of new queen bees, and are produced during the Spring and Summer of the year when the weather and food supplies support large bee populations. Healthy colonies of bees seldom have drones in the hive during the Winter since they consume food and cannot mate inside the hive. Large healthy hives will, sometimes, have many drones overwinter however, a sign of a strong colony.

Drones are a natural part of the hive, but they are produced by the colony only during natural mating weather. We do not find many drones in cold climates during the Winter or when there is no food coming into the hive. Drone populations peak when worker bee populations peak, about the same time as swarming. In strong colonies with abundant food reserves, drones are present for most of the Summer, but their production slowly declines as Summer begins. While Florida hives start drone production in January or early February, it is March or April for Michigan to produce drones. Usually drone rearing starts about six weeks before the first swarming activity.

Vigorous, healthy colonies produce about five percent of the colony population in drones at the peak of the queen replacement (swarming and supersedure) season that comes with the rapid growth and development of colonies in your local area. Swarming season moves North as Spring moves North, stimulated by growing day length, but primarily the abundance of food. By the Summer equinox the key stimulation of increasing day length slowly reverses, but drone rearing continues until September to November (depending on latitude). A strong incoming food supply will prolong drone production, or it may be done by early June if the pollen and nectar supply has already dried up. This happens in parts of Florida and Texas, as well as other areas of North America. There may be a second cycle of drone production in the late Summer and early Fall to coincide with local nectar flows, if they happen. When the incoming food is reduced or stops, worker bees become selective about the number (and age) of the drones they keep, even if they are their brothers. The colony rules!

Normal drone production is an indication of a healthy colony. It indicates that virgin queens in the area will be well served by your healthy and well-fed drones.

Using drones for mite control

Drones have been used extensively by beekeepers as a means of Integrated Pest Management (IPM) against *Varroa* mites. Instead of using miticides to kill *Varroa*, beekeepers remove sealed drone combs to reduce the reproductive upswing of *Varroa* populations. *Varroa* mites have a relatively low rate of increase on worker brood, perhaps a 10 to 20% increase with each brood cycle, so it takes several brood cycles to double the *Varroa* mite population without drone brood in the colony.

Bees instinctively build drone brood and if you add drone cells, *Varroa* mites will skyrocket in numbers. Drones have a three-day longer developmental time than workers. This gives more time for more mites to develop in each cell. In one cycle of *Varroa* growth, there may be two to five times more mites coming out of the cells than went into them as foundress mites. Doing the math: each 'foundress' mite will develop two to five daughter mites inside the sealed drone cell. No wonder *Varroa* mite population explodes so quickly.

As part of IPM, beekeepers remove and kill sealed drone brood by freezing it. After several days in the deep freezer the comb is thawed out and returned to the hive and the workers suck out the juices from the dead brood. Or you might scrape the sealed drone brood into a bucket and feed the slurry to the chickens or bury it as fertilizer on the garden.

For a large percentage of small-scale beekeepers, the integration of the drone comb with screened bottom boards offers two chemical-free opportunities to reduce mite populations, and all you had to do is kill a few thousand drones to do it!

Removing and killing drones goes against the colony's instinct. They NEED drones to mate with virgin queens. As a result colonies go out of their way to REPLACE removed drones. Each new queen requires 12 to 20 drones to mate with, and for every drone that successfully mates, there are probably five to 10 that never mate. There must be

Due to the three-day longer developmental time than worker brood, drone brood is the favorite food of varroa mites that sneak into the cell just before sealing. One mite might produce two to five daughter mites!

a very large number of drones in the air to mate with a queen during any mating flight. If you use drone comb removal or destruction and seriously reduce the number of suitors for area queens this suddenly takes on a sinister tone: A successfully mated queen must carry the sperm from the 12 to 20 drones for the remainder of her years and will NOT go back to mate again once she starts egg laying.

Sex Determination

Honey bees share a sex determination mechanism with ants, wasps, hornets and other bees. Female individuals are created from a fertilized egg or ova, where the female releases stored sperm so the ova are fertilized. When the female does not release sperm, or for some reason fertilization does not take place, the unfertilized individual becomes a male, or drone.

The Genetics: The fertilized females have two sets of chromosomes, one from each parent, and are thus diploid. The unfertilized males only have one set of chromosomes and are haploid. Humans are diploid and have two sets of chromosomes.

Diploid - two set of chromosomes = female (worker or queen)

Haploid - one set of chromosomes = male (drone)

1. The queen controls the sex of each bee. She may not 'know' this, as evidence suggests that she acts only in response to stimuli. It has been shown that the queen measures the size of cells before she lays into them and this regulates her release of sperm. If she inspects a smaller worker cell she will release sperm, but when she inspects a drone-sized cell, she does not release sperm. The queen stores four to eight million sperm in her body after mating with 12 to 20 drones early in her adult life, before she starts egg laying.
2. When a queen does not have sperm in her body (or if she is sterile), she will only produce drone bees.
3. Drones do not have fathers, and carry only the genetic information of their mothers. This has important consequences in bee breeding programs. See *Bee Sex Essentials* for a thorough discussion of this subject.

One method beekeepers remove varroa mites is to place a medium frame into a deep hive body, and let the bees build drone comb at the bottom. The beekeeper then cuts off the sealed drone brood, and all the mites inside. This delays the need for chemical treatment in many colonies.

B. Apiary

Apiary Activities

Drones are suitable to give to small children and adults who want to handle a bee. They are often warm from the heat of the hive, and fuzzy to touch. They do not sting, but often defecate when picked up. We can have several activities with drones:

1. a. **Marking drones and measuring drone drifting.** Use a permanent art paint marker to put a dot of paint on the top (dorsal) surface of the drone's thorax, the section where the four wings and side legs are attached. To do this, remove drones from the honey supers of a hive, being careful not to pickup a worker! Drones have large eyes that touch at the middle of the head. Since the sting structure is a modified egg-laying device, no drones have a stinger, and are safe to handle.

   b. Return the marked drones to the hive. On the following visit, put a queen excluder in front of this hive and the other hives in the apiary. During afternoon flight (calm, warm days from noon to 4 p.m.), watch for marked drones at the entrances of all the hives in the apiary. This shows how drones fly to different hives after they return from a mating attempt.

2. **How old is this drone?** Find a frame of drone brood where young drones are emerging from the cells. Look for drones that are still soft and downy. These are newly emerged drones. Be careful if you pick them up, as they defecate some really nasty stuff.

Next, go to a frame on the outside of the brood nest (usually the frame next to the outside frame of brood). There should be pollen-filled cells, where drones feed upon the pollen. Yes, drones can feed themselves! Carefully pick up some of these drones, they should be firm to the touch, and if they defecate, the material will not be quite so nasty.

Finally, go to frames of honey and look for drones there. If they are sexually mature they will fly away from you when you try to pick them up. Their bodies will be hard and any fecal material will be clear from all the honey they are eating for energy for mating flights.

C. Microscope Lab

In the lab take some of the sexually mature drones and learn how to ejaculate them to harvest semen. Put the tan or brown material on a microscope slide and examine it under a high powered compound microscope. The spermatazoa will be clumped but will be actively moving for several minutes until they die under the light and heat of the scope. Use you cell phone camera and take some photographs! BC

D. Discussion

What would happen to a colony that did not produce drones, and all the area colonies failed to produce drones? What would happen to area colonies. Can your students think of anything that would kill all the drones in all the hives?

New book is on its way: Bee-sentials: A Field Guide. *Check* **www.wicwas.com** *for details.*

Ross **Conrad**

Working With Various Queen Conditions

Some Ideas For Working With Hives With Various Queen Conditions

Last month we explored ways of determining the condition of a queen within a colony through an evaluation of the brood nest of the hive. This month, I would like to look at some of the available management options beekeepers may use in response to the various queen conditions that may be encountered.

The Ideal Colony

The ideal colony is what we call "queen-right", and has a fertile laying queen. The biggest challenge with a queen-right hive is to provide space for expansion during the busy seasons of Spring, Summer, and Autumn when foragers are bringing in nectar and pollen. It is during Spring and Summer especially that the colony can expand its population and fill up space within the hive very quickly.

Beekeepers who do not realize how rapidly a hive can build up can easily get behind and allow hives to become so crowded that worker bees begin to store nectar in the cells vacated by young adult bees that recently emerged. This condition, where the queen becomes crowded by workers backfilling the brood area with nectar, is often referred to as "honey bound" and is known to prompt a colony to swarm. The fact that a hive in the Champlain Valley of Vermont was once observed to draw out 10 frames of foundation in a deep honey super, fill the combs with honey and cap about half of the comb all within a period of one week, gives you an idea of how fast a strong, healthy colony can fill up a hive when conditions are ideal.

In addition to the importance of not supering a hive too late, it is also not good to super too early. One should strive to provide additional expansion room for the colony in a way that does not expand the hive cavity too much, too fast. The goal is to match the size of the hive cavity to the population of the bees. It may help to imagine the hive like a suit of clothing; you don't want it to be so large that you're swimming in the outfit, and you don't want it so small that it is too tight for you to move around comfortably. I try to add an additional honey super onto a Langstroth hive (or move the follower board back and add several empty top bars in a top bar hive) when all the comb is drawn and there are at least half of the frames empty. This is why regular hive inspections during Spring and Summer are so important if a beekeeper hopes to super a hive at just the right time, making sure there is ample room for nectar *and* honey storage.

Fight the temptation to cut corners and super the hive for the season all at once since it can be detrimental to the colonies development. In the old days when colonies were generally very strong and healthy, beekeepers could super up the hives in Spring, ignore the bees all Summer and harvest a bountiful crop in Autumn. Unfortunately, if our modern-day hives don't have a large enough population of workers to be able to adequately patrol and maintain the additional space, problems can arise from wax moths and small hive beetles that are easily avoided by adding more space just before the colony actually needs it rather than way ahead of time. While ideally the beekeeper will keep just a little ahead of the hive's growth, weather and foraging conditions along with colony population, play a large role in determining how fast a colony will fill up the space within the hive and therefore how often the hive should be inspected and supered.

I should address here the fact that there are fellow beekeepers who teach other beekeepers to leave the bees alone and not bother the hive with inspections. To inspect colonies regularly disturbs the bees too much and is unnecessary they say. I believe that such advice, while well meaning, is misguided and ignores our current real-world situation. Today's bees are up against a host of threats and stresses from: the industrialized agricultural system we've created based upon monocultures and toxic pesticides, herbicides, fungicides, insecticides; diseases and pests we export and import with help from the corporate globalized economy; and the human induced rapid increase of greenhouse gases that are helping to destabilize the world's climate patterns, just to name a few. Since we are collectively responsible for many of the challenges that the bees of the world face today, we have a responsibility to help the bees deal with these threats to their survival. Once we have gotten our act together and cleaned up the messes we have made, then we can leave the bees alone and let them 'do their thing' without constant intrusions into their homes. In these modern times, it is unfortunately the rare hive that will survive and thrive without some kind of human assistance.

The Drone Layer

Once a hive has established one or more active laying workers and becomes a drone layer, correcting the situation is difficult if not impossible. Trying to identify the laying workers and remove them from the hive is extremely difficult since they don't look that much different from the regular workers in the colony. A frame of brood and un-hatched eggs taken from a queen-right colony rarely works in prompting a drone layer colony to begin to raise a new queen from the newly supplied fertile eggs. Alternatively, a queen cell, or a newly mated fertile queen may be introduced to a drone layer. The addition of a frame of brood and eggs, a queen cell, or a new fertile mated queen works best when introduced to a colony that recently became queenless, before the workers develop their ovaries to the point where they begin to lay eggs in earnest. Once the workers start laying, pheromones that are produced fool the rest of the colony into thinking that they have a proper queen. This suppresses their desire to readily accept a newly introduced queen or to raise a new queen from eggs or young larva that are supplied by the beekeeper. The addition of a ripe queen cell that is days from hatching is also likely to fail even though of all the options it may have the best chance of successfully transitioning the drone laying hive into a normally functioning colony. This tends to be true for hives in all states and conditions . . . they will accept a queen cell and the queen that hatches from the cell much more readily than they will accept a mated queen that the beekeeper tries to introduce into the hive.

Once the laying workers are firmly established in a queenless hive, or the number of workers in the hive is too small for the colony to have a good chance of caring for a queen on their own, the most effective and efficient way to deal with the hive is to combine it with one or more queen-right hives that are in need of more room or more bees or both. This is because, as noted above, the chances of successfully getting the hive to accept a queen or raise a new queen from eggs is very slim, and the same is true for queen cells that are days from hatching, even when they are readily available. It is especially helpful to give the full supers, or frames of bees, brood, honey, and pollen from a drone-layer, to colonies that could use a boost either in food stores or their worker population. The workers in the queen-right colony will protect their queen from the worker bees that came from the drone-laying colony. This will allow the workers from the drone-laying hive time to get used to the queen's pheromones and to become integrated into the queen-right hive. Of course this option is only available if you have more than one hive.

The Failing Queen

When a queen is reaching the end of her useful lifespan and is running out of sperm to fertilize eggs, the workers within the colony will often raise a new queen to replace her through the process called supercedure. The easiest thing is to allow this natural process to unfold on its own. Unfortuantely, not all hives will develop queen cells in an effort to raise a replacement queen. Beekeepers who wish to help the process along may choose to introduce a ripe queen cell. A close eye needs to be kept on the hive however, because the raising of a new queen either from a supercedure cell or an introduced queen cell is not always successful. Even through the workers may build queen cells, or allow an introduced cell to hatch, there is no guarantee that the queens that hatch from those cells will successfully mate and make it back to the hive. The process of mating is the most dangerous time in the queen's life. She could get eaten by a bird, get caught in stormy weather, or succumb to a host of other disasters that would prevent her from successfully mating and returning to the hive. If the colony is unsuccessful in raising a new fertile queen, a ripe queen cell can be placed in the brood nest if there is time in the season to give the hive another chance to succeed.

For those who don't want to risk the natural process of letting the hive replace the queen on their own, or when there is not enough time left in the season for such a slow process, the introduction of a fully mated queen will often resolve the situation. To help ensure the successful introduction of a fertile queen, the failing queen must be removed from the hive first. For best results, remove the old queen one to two days before introducing a new queen to the hive.

The Swarming Queen

Once a colony has decided to swarm it is not easy to change their mind. Swarm cells can be cut out in an attempt to stop the behavior but if you miss a cell, you're out of luck. Even worse, you can cut all the swarm cells out of a hive and the colony may still swarm, leaving behind a hopelessly queenless hive. These facts combined with the brutal nature of cutting queen cells is an indication to me that this method of swarm control is not a good one.

Clearly the easiest way to deal with a swarm is the path of least resistance...let nature take its course. Unfortunately, if you are an urban beekeeper with hundreds of neighbors that don't appreciate seeing a huge cloud of bees fly past them on the street, or if it is late in the season and the swarm will have little chance of building up enough honey stores for Winter and the mother hive is unlikely to encounter weather favorable for a virgin queen to mate, then letting nature take its course is not a very good option. An alternative approach that respects the hives desire, recognizes the beekeepers needs, and often stops the swarm in its tracks, is to manipulate the hive in a way that simulates the act of swarming without having the bees actually fly off in a cloud.

To accomplish this, remove the queen along with about half the number of frames of brood, honey, pollen, and bees from the hive and place them into a new hive and move this new hive to a new location. All frames containing queen cells must be left in the original hive, which is left in its original location. When timed correctly, this maneuver greatly decreases the desire and potential for swarming on the part of the workers and the queen.

This is most effective when the queen's new location is close to the original location of the hive. This will allow all the older foraging bees to return to the original hive that is now queenless. With the loss of all the older foraging-age workers in the hive and a significant amount of brood combined with the addition of a number of new combs with space to lay eggs, the new colony tends to lose interest in swarming. Meanwhile, the workers in the original hive are without a queen to swarm with, and so continue to raise the newly forming queens in the queen cells until one of them takes over the hive.

The Queenless Colony

The challenge with finding a queenless colony is accurately determining whether or not the hive is really without a queen. When caught early enough there is no drone brood to reveal the presence of laying workers. When observed late in the process, the supercedure or emergency queen cells have all hatched out and the worker bees have torn down the remains destroying the evidence that would let you know that a new queen has been raised but has yet to start laying eggs. A new queen introduced to such a colony can be a waste of time since she is liable to be either rejected by the workers, or end up fighting the hive's natural queen to the death. On the other hand, if it is impossible to determine the exact state of the hive, the safest route to restoring the hive to normalcy may be to introduce a queen just in case the hive has not been able to raise a new one. Sometimes despite all our science, intense observation, and experience in beekeeping, decisions need to be based upon simple intuition and what feels right at the time. BC

Bear Beware

Jeff **Greenwood**

"Oh yes, I'm rumbly in my tumbly. Time for something sweet."
– *Winnie The Pooh*

For nearly 35 years I've worked in various educational capacities at White Memorial Conservation Center in Litchfield, Connecticut. The Center was established in 1964 as the educational and research arm of the larger and older White Memorial Foundation. The Foundation was the brainchild of brother and sister, Alain and May White, who used their considerable wealth to acquire lands around Bantam Lake and preserve them in perpetuity. In 1913 they established the Foundation in memory of their parents who had moved to Litchfield in 1863. To insure that their project would live on after they were gone, the Whites left a substantial endowment. Their legacy was ahead of its time, created when land conservation was not widespread. Today the Foundation boasts a land trust of nearly 4,000 acres including more than half of the shoreline of Bantam Lake, Connecticut's largest natural lake. Complimenting this are 35 miles of woods roads and trails which are open all year providing ample opportunity for multiple forms of passive outdoor recreation such as hiking, bicycle riding, cross-country skiing, canoeing, picnicking, and camping.

Situated within this extensive outdoor resource is the Conservation Center's natural history museum which is housed in the former Summer home of the Whites. The museum features exhibits that showcase the preserve. There are plentiful year-round educational programs for people of all ages as well.

One exhibit, which was created before I came, offers visitors the unique opportunity to view honey bees while safely buffered by a sheet of plexiglass. Having gone through several iterations over the years, the hive currently resides inside an artificial tree which can be opened using the "shelf fungus" handle. For years the colony over-wintered on its own. Then we went through a period where a beekeeper installed a new colony each Spring. The last several Winters, however, have seen the colony once again survive. The hive volume comprises seven standard frames arranged vertically with the front-most four for viewing.

While all this was going on inside, the outdoor environment was also changing.

Wild Turkeys and Moose reintroduced themselves to the Connecticut landscape, and Black Bears have made a frequent and sometimes unwelcome appearance. Our staff has been dealing with the consequences of *that* wherever and whenever we have bird feeders established.

The stage is now set for an unusual event. On the morning of May 24th last year we discovered that there were bees flying around INSIDE the museum! That seemed odd. Further inspection revealed that the hive entrance on the outside of the building had been torn apart. More confused bees were flying around there. Something had tried to get at the sweet-smelling honeycomb inside the hive. The staff concluded that the culprit was a bear! Last Fall, the bird feeders on the deck had been victimized by a bear. Earlier in the Spring, the feeders at the bird blind were hit. Now, several days later, a bear had attempted to rob the bee hive in the museum. This was in addition to breaking two wooden bird feeder poles and trashing the feeders. The clapboards, insulation, and the hive entrance tube had been literally torn from the building! Our sense is that the bear was initially intent on snitching seed from the feeders until it caught the scent of honey. That's when the side of the building was drawn into the foray.

During the past Winter, the staff had talked of just

such a possibility. We were not *really* surprised, more shocked. To now have this catastrophe staring us in the face was pretty significant . . . almost scary. Wow, it had really happened! It is amazing what a bear can do with teeth, claws, and brute strength. The bear actually returned the next night and tore into the clapboards above our temporary patch and destroyed the nearby window screens.

So now what? Do we discontinue the exhibit or bear-proof the building? We selected the latter. A week later not only was the outside wall repaired but a five-strand electric fence system was installed to protect our investment. The resulting arrangement features horizontal strands of wire and a wire grid on top of a black insulating pad on the deck. So, if the bear (or a non-observant staff member!) steps on the grid and then touches one of the strands, the results will be shocking. Initially the system was powered with standard house current. We have since gone to a solar panel which provides the necessary juice to charge the battery and thereby energize the bear deterring fence.

So, back to the bees. When disaster struck, our beekeeper, Mark Moorman, took the observation hive home to his facility (Sprain Brook Apiary, Woodbury, CT) for TLC while repairs were completed here. The bees were returned several weeks later after things had quieted down and the repairs finished.

I think the various disruptions resulted in the colony being somewhat behind its usual routine. Generally speaking, observation hives are designed for viewing, not management. In a museum setting once the colony is installed the hive is usually left alone and enjoyed. The Center has elected from time to time to take the hive out of its hiding place in the tree and do some manipulations during the active bee season. Therefore, early last Fall in response to incredible crowding and lots of capped brood in the hive, Mark took the hive outside, removed some of the brood, and replaced those frames with new foundation. Hopefully this would avoid a very late season swarm. As of last October it has worked. It seems likely with the population size and the amount of capped honey that we will have clustered bees to observe all Winter – a real treat for our visitors.

Honey bees sure are fascinating creatures. Now since bears go into dormancy in the Winter, dare we disconnect the electric fence? BC

New York Honey Festival

Chase **Emmons**

OK, I seriously still don't believe how successful this was. It's like I'm going to wake up and it's still Friday night before, subways to Rockaway are down, and a sudden storm front is about to roll in.

THREE MONTHS EARLIER

I was hanging around with my beekeeping mentor, Dan Conlon of Warm Colors Apiary in Deerfield MA. He holds a Honey Festival every year in Sept and we were talking about it. All of a sudden it hit me, why not have an NYC Honey Festival now that beekeeping has been legal for a year? Dan said that if someone hadn't already thought of it, somebody would soon, so it might as well be me. I picked his brain for a bit and then set off on this kooky mission. It seemed like the perfect event for Brooklyn Grange to actually put on, and the partners all agreed. That was easy. Now I had to figure out a venue. I remembered that my friend, David Selig, had mentioned to me that it would be cool to find events to hold at the Rockaway Beach Boardwalk, especially events that could extend the season a bit. The Rockaway Beach Club Concessions is a new venture by a group of really cool restaurateurs who brought really good food and drink out to the Rockaway boardwalk. David had opened Rockaway Taco four years ago and it has since become a huge success, so this was a logical extension of that. Oh yeah, David is a beekeeper himself and actually got a bunch of attention for the maraschino cherry juice tainted red honey his hives produced in Brooklyn last year. So perfect time of year, perfect connection to food/drink, and a perfect site. Sure, there were some who claimed it was too far away, or too much of a hassle to get to. But hey, doing it in Union Square or Central Park would have taken no creativity whatsoever, involved no risk/reward, and would have relegated the Fest to being just another "thing" going on in Manhattan that day. There was also a very personal aspect to choosing the boardwalk. I grew up in the Meat Packing District. Back when I was a kid, it actually was a meat packing district, with dumpsters full of cow heads, friendly transvestite hookers, an abandoned elevated West Side Highway and Highline where me and my little friends could have urban Stand By Me adventures. The time between that and what my neighborhood is now was an amazing time. Such creativity, such open thought, such idealistic nonsense that was so totally fun while it was happening. That's the same feeling I get in Rockaway today. I never went out there once in my life until this past winter. Selig gave me the tour at the most dreary and depressing time of year, and I totally felt it. Rockaway is having it's time of dreams now, and I'm gonna enjoy a portion of my second childhood out there. So the choice was clear as there was no choice. It had to be the boardwalk. Selig said great, make it happen!

OK, now the hard part: making it actually happen.

I knew I had to get a group/team/gaggle together in order to pull this off. Had to be beekeepers or even wanabees. Had to be cool and open minded people, not saddled with entrenched and hobbling beliefs, but also intelligent and pragmatic. Ability to be social, laugh, and adventurous a must. Shared vision a must too. Tall order! Well, turned out not so much. Timing is almost everything, network/connections makes up the rest. Within a week I had a core group of like minded individuals, and two weeks after that I had the rest. Some were serendipitous finds, some found us, and some felt the disturbance in the force and had to investigate. I openly referred to myself as Tom Sawyer and the group as my fence painters, so from now on I will use "we" instead of "I" almost exclusively. Without further ado, the usual suspects were:

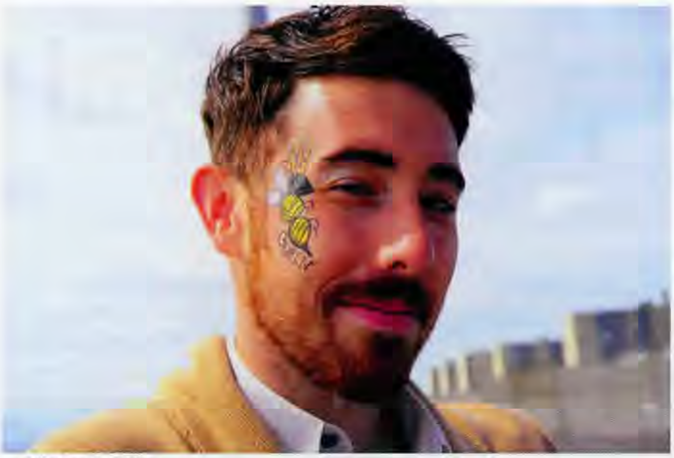
Megan Paska: The Brooklyn Homesteader. Megan has been a huge force in the NYC urban agriculture sphere, including rooftop beekeeping, to a well-read blog, backyard chickens, writing a book, slaughtering her first chicken and writing about it on HuffPo, founding the NYC chapter of Backwards Beekeepers. And a huge amount in between. If the group has a Queen, Megan is it.

Molly Byrnes: Responsible for our digital identity. What's an event like this without an amazing web page, amazing Facebook page, Twitter, etc? Molly was definitely the subtle binding agent, or propolis as it were.

Amanda Rodriguez and Andrew Povolny: AmandaRodriguez.com and yoitsandrew.com Actual architects of the web site, securer of server space, and always available to make last minute changes just as fast as we could bombard them.

Tim O'Neal: Boroughbees. Tim knows a load about keeping bees both in the country and in the city. He actually has groupies that hound him for dates after they see one of his bee talks or demos. Kelly York: Yellow Queen Honey Kelly was our muse and had some amazing contacts. Hooked us with several great participants and sponsors. She's the one who hooked up 6 Point Brewery with the honey they turned into 5 special brews just for the fest! So wait, she was responsible for the BEER, maybe she needs to be listed first?

The mural art project.


Michael Meier.

Emily Vaughn: Emily had the knack for writing copy, tweaking the web site, utilizing her contacts through Slow Food. With all the work she did, she was unable to actually attend the Fest. Talk about dedication!

Michael Meier, from Brooklyn. From the get go he was cycling all over the city getting our flyers to every farmers market possible. Networking, spreading the word, he was our Paul Revere.

Ross Brown: First year beekeeper, super gung ho, amazing pad in BK with a garden, grills an amazing spread upon request.

Michael Leung: HK Honey. Came to NYC from Hong Kong for two months just to get the low down on the urban AG and beekeeping scene, created the amazing signs we had at the Fest. Designer, brander, artist, and HK urban beekeeper.

Karen Russo: ABC News, then to NBC, somehow decided she liked hanging with this eclectic bunch, helped us get some good press going.

Then the lunacy began. First meeting was in the yard at Roberta's in Bushwick. Chris and Brandon, owners, were super cool and hooked us with a private table, on movie night. All sorts of crazy ideas, the more the better. Bee costume break dance competition, sure! Bee costume parade with marching band on the boardwalk, of course! And it went on like that.

Over the next few weeks we got a bit more rational. Nixing lots of stuff, but coming up with new and more reasonable stuff. Getting sponsors and participants. It was a coup to get 6 Point involved from the start. Ian saw the opportunity to do some local honey brews, and really was the anchor sponsor. Pickles, Hot Honey, Honeydrop, shirt screening, they all started signing up. Then the press started noticing. Started small but was steady. I had a feeling that everyone was hedging their bets to get close enough to see the weather report. Understandable, it being at the beach and all. Then, the week before, the flood gates opened. Weather report was super solid, participants were signing up, big press was interested, it all came together. Since this wasn't about any one person, the press time was spread amongst several of us. Emily gets to write a piece for Grist which was her dream. And looks like some of the other cast members will do some post-game press, too.

Friday, Sept 16, 2011. Got all the loaner chairs and tables from Build It Green (what I call the Post Apocalyptic Home Depot) out there in advance, the PA system too. Everyone is psyched, weather is gonna be perfect, it's wonderful when a plan comes together. Or not... that afternoon we find out that both subways that most people would take to get to Rockaway were shut down for Saturday. Shuttle bus from one point, but added a good hour to travel time. Yippee! Looks like we'll be sitting around with a small crew, drinking 6 Point from about noon on.

Saturday, Sept 17, 2011. Got there at 8:00 a.m. just because. Told everyone to get there at 9:00 a.m. for setup, and a start time of 10am. Had a schedule of speakers and a few demos. A couple participants got there at 9am. Set stuff up. A few more by 9:30. 10:00 a.m., an ok showing and some actual visitors starting to take notice. Feeling ever so slightly better. Clearly the schedule of speakers was not going to happen as planned, but we figured we'd play it by ear. Seemed like the speakers were having a good time talking to the visitors directly, more like schmoozing and networking, not so bad. Then it was like all of a sudden there were a bunch more participants, vendors, and visitors! The Rockaway Arts Alliance and Sophia Skeans got the kids art mural project kicking, George Schramm from the Long Island Beekeeper Club had a big crowd around his observation hive, Horman's Best Pickles had a line, and everything was clicking! Then, basically everyone selling honey had sold out. Yeah, two hours, no more honey. At around 4:00 someone brought some more supers to extract and was selling it as fast as they could fill jars, then they ran out of jars. They ran down to the Dollar Store and bought every last jar. Came back, sold them all in literally five minutes. Would have sold quicker if they could have taken the money quicker. If that's not a direct sign of how many people and how successful this was, I don't know what is.

Now I'll start using "I" again since everyone else was doing their thing and I was running around making sure everything was under control. I knew I wasn't going to get to enjoy the Fest itself, kind of like a movie director doesn't get to enjoy seeing the film for the first time. But that's what I signed up for, and making sure things were happening and people were happy was my sole concern. No beer for me, gotta stay frosty. Press people? Here let me introduce you to one of my team . . . OK, I spent a few minutes with the woman from the Japanese paper, it was the least I could do. But otherwise I knew it had a life of its own and all I had to do was make sure there were no actual fires. But then there was something that I, and apparently a few others, did notice . . .

We set up the honey extractor in a back room because we knew that open honey would end up attracting the local bee population. Giving out soda, you get people. Giving out honey, you get people and bees. But still, even with the extractor indoors, we knew that vendors would have stuff out for tasting and sooner or later a scout was gonna report back the bounty she had discovered. By mid day there were a lot of bees around. Lots of bees, lots of people, you'd think this was going to end badly. But something totally unexpected and wonderful happened. Nobody cared. Well, the kids seemed to care since they started petting the bees that would land on their honey coated finger. But otherwise, we had human and bee attendees, all enjoying the fest and totally accepting of each other. The coolest thing was watching the honey tasting contest. We set it up to be crowd source judged. People would come up, take a stick, dip/taste, and go down the line of submissions. Then they would put a mark on the sign for the sample they liked the best. But when they would dip the stick, many times a bee would land on the stick and start sampling too, and people had no problem putting the stick in their mouth, carefully not to disturb the fellow sampler. It was something out of a Disney movie, totally unbelievable. Not one attendee got stung. This will be the big takeaway memory for me of this entire event.

OK, from the sublime to the absurd. When it came time to announce and MC the raffle, we had no megaphone. So Tim stood up on a table and began to holler. It was fantastic. He was brilliant, couldn't have scripted something like this. People won nice gift certificates to various eateries around the city and books on beekeeping. Afterwards I took half the proceeds and gave it to the Rockaway Arts Alliance crew. With all the work they put in making the kids mural come to life, they deserved it. The other half will go towards a thank you dinner for the team. I think Roberta's again. After the raffle it was time to announce the winners from the honey tasting contest.

First prize was a fully assembled English Garden eight-Frame hive with copper top from Brushy Mountain Bee Supply.

Second prize was an Ultimate Hive Stand from Bee Smart Designs.

After that, things began to wind down. I asked a few of the eateries in the concessions how the day was, they said it was one of the best days of the season. 6-Point sold out completely and Honeydrop almost emptied their truck. Later, I got a pretty reliable estimate from a guy who knows how to do it, that we easily saw 1000 active visitors roll through. In retrospect, the subway issue was a blessing in disguise. If they had been running, it might have been a bit unmanageable. BC

Long Island's observation hive.

Small To Mid-Size Commercial Queen Production

The Fourth In This Series Covers The Important Tasks Of Grafting and Working Finishers

Dann **Purvis**

This is the fourth article so far on small to mid-size commercial queen production. Our example is based upon a 100 hive/500 mating nucleus example which can easily be used to design a larger of smaller queen rearing operation, with the goal being to produce the highest quality queens that you would use for yourself or for sales. Again, this set of articles is not all-inclusive concerning commercial queen production. There are many ways or techniques on how to produce queens. However, there are a few less known methods of doing things that will produce the highest quality of queens considering the added pressure of the 21st century state of beekeeping. Survival is important but it should also be profitable. The Goldline queen was bred and developed using this guideline as the standard. This article will briefly cover the very important tasks of ***Grafting*** and ***Working Finishers***.

Here is a list of supplies that you will need for successful ***grafting***:

- Cell cups. We like to use JZ/BZ smoke colored cups with the pins.
- Cell bars
- Cell bar frames
- 30+ gallon tote boxes to hold cell bars
- Chinese grafting tool. Order many of these. They are not consistent and sometimes you will have to go through several to get one that works well. Although not necessary, scraping with a sharp razor blade will thin the reed enough for a more usable tool also.
- Black sharpie markers and duct tape. Good for marking grafting date onto duct tape which is placed on the top bar of the grafting frame.
- Optics-Reading glasses, magnifying headset (Dentist tool), or Binocular dissecting microscope.
- Damp towels to keep the brood from drying out.
- Lighting: cooler and brighter is better. Direct sunlight and incandescent spotlighting are not good because they dry out the larva.

Where and How - *Grafting*

Keep the following foundation points in mind as you read along:

- The highest quality queen is one that is produced which most closely mimics natural swarm queens *in most cases.*
- The best grafted queens come from the youngest larvae.
- Anytime you are handling grafting larvae, high humidity is much more important than high temperature.

Well, let's get started!

There are two recognized methods of grafting: wet or dry. *Wet grafting* refers to the use of priming cell cups with Royal jelly, Coconut juice or some other concoction that can be, and often is, the source of contamination problems. *Dry grafting* is a method of grafting without these concoctions. *It is not* grafting a larva minus the bed of royal jelly into a dry cup as largely believed. Dry grafting, if done properly, is the lifting out of the larva *with* most of the bed of royal jelly that it floats upon. Wet grafting involves priming the cell cups with unrelated royal jelly from a different hive, time, or in the case of coconuts-substance. Perceived advantages, in time savings or management, by using foreign substances to prime the cups is not worth the risk of contamination (especially since the Chinese grafting tool is now on the scene and capable of doing everything in one step). It is however, a means to make more money at the cost of producing lower quality queens. It is not the best way to produce quality queens and since you are not trying to pump out 100,000 queens per season, you will not have to use wet grafting. Unfortunately, it is a method often taught in courses or books today.

Compare a chicken egg (minus the shell) lying in a bowl to a larva lying in the bottom of a cell about to be grafted. With wet grafting, you are removing the yolk from the white with a spoon and placing it into another bowl

Close up of the frames in a grafting box right after the grafting larva was removed, grafted from and relaced with new grafts. notice the grafting date of May 14 on the new grafts and May 7 on the older capped grafts. Also note the number of cells grafted - 30. Older capped cells can be removed from the finisher when the starter/finisher is worked the day before. The take percentage will go up if you do this but does involve more risk by placing all your grafts in fewer hives (eggs in a basket thing).

Break down of a queenright starter/finsiher. Spare deep boxes for extra capped brood, honey or pollen that will not fit into the other boxes. The bottom spare also provides a place for overnight sleeping arrangements of returning field force. If your mating yard is close to your starter/finishers (virgins looking for a nice home), you can place a queen excluder above the grafting box as well.

in which you placed some older, unrelated, and possibly contaminated, egg whites or even coconut juice instead. With dry grafting you simply are scooping all the egg, yolk and white and putting it into a new clean bowl. This method of dry grafting will save you time and produce a better quality queen.

To dry graft effectively you must use a reed type-grafting tool known as the Chinese grafting tool. If done properly, with fully conditioned grafting larva, nothing except royal jelly will come in direct contact with the larva. Alternatively, the commonly accepted grafting needle, sometimes called a German grafting needle, actually touches the larva to lift it out. If you have ever noticed a black spot on a queen's abdomen, it is likely caused from damage during grafting in which the metal or plastic needle bumps up against the fragile larva and causes the spots.

Cell Cups

The cell cups we use are plastic smoke colored JZ/BZ cups, with pins for attaching them to the framer bar. The reasons for choosing these over wax cups are numerous but the big one is time. You will not see any differences in yield versus wax cell cups. I am also increasingly concerned today with environmental contaminants that wax so easily absorbs, and if you are buying ready-made wax cell cups the possibility of contamination is higher. Also, the plastic cups are easier to handle and offer a measure of protection for the cell from the time of harvest to placement into the mating nuc.

Conditions

Optimal grafting environment is a well lit room, 70°F, draft-free, and 70% relative humidity. A wet floor and humidifier can be invaluable at achieving these conditions. There is no reason to graft in uncomfortable conditions. In fact, results are usually lower when the operator is not comfortable and is constantly wiping sweat from the brow.

It is best to use the brood as soon as possible (not because of temperature maintenance) because larva can dry out. I save time by collecting all my grafting larva frames at one time. I place the grafting larva frames in my large converted poultry incubator and rotate through them evenly as I graft to ensure diversity. I keep the humidity high and the temp at about 90°F inside the incubator. The best scenario is to have your starter/finishers close to your grafting room, so that you can do one frame at a time and place them into the starter/finishers as soon as they are grafted. I found it is best to place the grafts into the starter/finisher as soon as possible. I place each frame of grafts into the starter/finisher as I finish them. You can graft several frames at a time but I believe it is best for the larva to be "nursed" as much as possible. Humidity extends the time that the grafting larvae can be away from the hive and nurse bees. Even though a humid incubator is a big time saver it is not absolutely necessary. A wet towel wrapped around the grafting larva frames and lying in a plastic tub out of direct light can work as well.

You will need to have a comfortable place to sit, or stand while grafting. I like to have the grafting frame resting at an angle so that I am looking directly down into the cells that I harvest the larva from, to lessen neck strain. If you are going to be grafting for several hours at a time, consider building a head rest that you can lean your forehead against to alleviate neck and upper back strain. It is a tedious operation, which requires a steady hand, so I suggest that you keep your caffeine level down as low as possible before grafting. But by all means, make yourself comfortable, have a cool drink and maybe have some music to listen to. The secret to longevity in quality queen production is joy not money. Don't make it burdensome.

Lighting

Many debates can be started on what is the best lighting to use. I have used them all and strongly recommend a 150-watt Halogen lamp fiber optic light. I bought several for less than $100/ea., from ebay. I consider it mission essential equipment and would never go back to fluorescent lighting.

Seeing to Graft

The best optic is your natural vision providing it is strong enough to see the larvae well and without causing eyestrain. In my case, I switched over to working with 1.5 power reading glasses. Anything stronger (higher power) shortens the distance (focal length) between your eyes and the larva to the point that it is hard to get my hands, grafting needle and light in the working area. In the past, I have altered grafting tools to make them shorter but that is not a good fix. I think a larger field of view is better. Other options I have used in the past are dental magnifying glasses or a binocular dissecting microscope on low enough power to have adequate field of view. I use the same scope for artificial insemination work and disease identification. However, a scope is expensive and not necessary for queen rearing.

The Queenright Cell Starter and Finisher

When I produce cells, I am trying to mimic the natural swarming or reproduction of the honey bee. I believe that the bees are much better at producing queens if we get out of their way. With queen-right starter/finishers, the bees are more finicky and are much better at identifying problems and removing them instead of being forced to accept what may be a substandard graft, larva or situation in the "emergency" condition of a queen-less swarm box. At this point, I am not trying to find out what works. I know what works. What I am doing is trying to find the balance between doing what is best (naturally) and still do it profitably. What we want to produce is a Queen honey bee that is in the absolute top physical condition. This will remove any obstacles other than genetics, which is a completely different subject. Breeding is not producing. A poorly produced queen, grafted from and mated to "Super Bee" genetics, is still a poor queen. You can remove a lot of roadblocks to your queen problems by simply applying these techniques or even developing them into better ones.

What makes this technique superior to others? The answer is, it most closely mimics the natural reproductive behavior of the honey bee and is still manageable. Barring genetic factors and environmental anomalies, the gold standard for a superior queen is a swarm queen. We want to try to get as close to that and still keep the queen economically feasible. The following points should be observed with queen-right starter/finishers:

- The starter/finishers are on the verge of swarming.
- New *clipped* queens should be heading them.
- They are worked once per week, no more.
- A heavy pollen and nectar flow is mandatory.
- Have plenty of room below the queen chamber (empty medium or deep with frames of foundation) for the returning field force during hours of darkness and inclement weather.
- Provide plenty of ventilation and preferably shade from afternoon sun.

We work the starter/finishers one day before the planned graft day. We do several things:

- Check to see if the queen is still performing well. If she is laying well is the main concern. If not, then re-queen her with a new clipped and marked queen.
- Manipulate the starter/finisher so that all the uncapped brood (wet or milk brood) is in the box in which the grafts will be going, and the capped brood is in the box where the queen is located. Any extra capped brood that cannot fit into the queen's box can go in a temporary deep on top of the grafts, or into another weaker starter/finisher.
- Add additional brood or bulk bees whenever the population drops to anything less than swarm conditions.
- Ensure there is room for the queen to lay.
- Arrange the wet brood so that the youngest is in the center.
- Collect and place the grafting larva (for grafting the next day) in the center of the graft box next to the frame of youngest milk brood. The ideal grafting larva frame is one that is full of eggs but has a patch of larva just starting to hatch out. Mark it with an X on top for easing identification when you pull it for grafting. By the time you graft from this frame the next day, most of the eggs will have hatched out and will be floating in an abundant bed of royal jelly. NOTE: The next day when you pull the larva frame to graft, DO NOT shake the bees off. Brush them from bottom bar to top bar. This way you will not dislodge the larva off of the top center of the royal jelly bed nor get debris into the larva.
- Place a frame of pollen on the other side of the grafting larva. I like to have plenty of pollen in the starter/finisher and the best place for extra is in a spare box on top of and/or on the outer locations of the graft chamber box.
- Extra honey frames can be placed in a spare box underneath the queen chamber box or in the spare box on top.
- Syrup feeding starts on the day we "work" the finishers and is stopped 4 days after grafting by simply turning the bucket right side up.
- Protein supplement is offered continuously via barrel feeders.
- When moving the brood, the frames coming from the queen box have to be shaken free of all bees as the frames are removed and checked closely to make sure the queen is not attached. It is not necessary to find the queen. However, make sure she remains in the queen box and that she is laying. Do not use a bee

For sake of illustration, frames are different color. Note that the new grafts are replacing the grafting larva frame that was in the starter/finisher overnight. Also, the older capped cells (seven days old and capped) are moved out of this position to the left or right away from the new grafts when the starter/finisher was worked the day before. It is IMPORTANT to have the youngest wet brood or uncapped larva right next to the new grafts to attract the majority of the nurse bees. Honey frames can be capped or uncapped. They provide more insulation or thermal mass than anything else.

Our field incubator (chicken type with a fan) that plugs into a small cigarette plug voltage inverter (>50 watt) for getting cells and sometimes queens to and from the mating/out yards. We use a wet heavy paper towel to provide humidity. Note the white duct tape over the clear plastic windows on top. KEEP QUEENS OUT OF THE SUN!

brush, it is hard on the queen and takes too much time.

- Use a high quality queen excluder that has no dents or gaps in the wires and place it between the queen box and the graft box. The queen will try to get up into the grafting box. She will destroy all cells she can get to. To decrease this risk, you can carefully transfer capped cells to an incubator or queen-less bank colony until they are ready to use.
- If done properly, removing cells from the starter/finishers after they are capped will improve your grafting take percentage with no observable loss in quality, so it is profitable if you have the extra hives or incubator.

Scheduling

In queen rearing operations, schedules are adhered to come-what-may, rain or shine (back ache or no back ache). Schedules are non-negotiable once set in place. Consistent work produces consistent results. Cutting some corners lowers your standards and lessens your quality. Having said all that, prepare to make your schedule!

Conclusion

Once you have completed your first set of grafts, you may feel elated and seriously proud of yourself, or you may feel like tearing out your hair and throwing in the towel! As with anything requiring a skilled technique, it demands practice. One of the challenges of grafting is simply learning to use the new tools you've been given. The grafting tool will become friendlier in your hand the more that you use it. Patience is of the essence here. If you are serious about grafting after reading the above, then hang in there and keep practicing. BC

Thank you for following along with us in this series on queen production. Please visit us at ***www.purvisbees.com*** *Dann Purvis of Purvis Bees, Inc.*

Swarm Stories

James D. **Ray**

It was a weekend afternoon during my very first year of beekeeping. I was making one of my routine circuits around my lot, observing my beehives and various bee and hummingbird plants. I was walking past my kids' make-shift, and unfinished, fort and just happened to notice a softball-sized ball of bees hanging onto the eastern lip of the structure's roof. My first swarm!

My first reaction was to panic; probably not unlike how most new beekeepers would react. Would the bees fly away before I could walk or run to my garage, get suited up, and carry their new hive box out to them? Would the queen slip away during or before capture, drawing her faithful servants with her? What exactly am I going to do with them? Would they stay in there during the next few hours or days? Of course, the boxing went smoothly, as it does *most of the time.*

What a rush! And the bigger the swarm, or the less smoothly the operation goes, the bigger the rush. As a relatively new beekeeper my adrenalin shoots sky-high, and I get caught up in a state of child-like amazement.

MY HOME SWARMS

I find it hard to subscribe to the rationalization of many beekeepers that swarms are a positive, "a means for free bees." Yes, I know. Swarming is natural, a means of perpetuating the species. However, in my experience a swarming incident kills any chance of me getting honey from that hive, thus I personally try to do everything in my power to practice swarm prevention. I've only been "so-so" effective at it. In comparing my swarming frequency to a friend that does not practice swarm prevention, it seems that I only delay it by a few weeks.

Another reason I try to prevent swarming is that I have hives in a subdivision and wouldn't want swarms to impact neighbor relations. I have one neighbor that would absolutely freak out if she or her husband discovered a swarm on their property.

I keep four to six hives at my home place, and seem to have four to five swarms per year. I set out bait hives with brood comb and lemongrass oil but have yet to have a swarm settle into one. However, that first one – the swarm on the boys' fort – settled right underneath one that I had placed on its roof. I wondered if that had something to do where the bees were hanging. I have only found a total of one swarm at any other location that I have placed hives, but some could have easily slipped away between my infrequent visits.

At the home place I have found swarms hanging on fence posts, some with vines (Lemonade honeysuckle [*Lonicera x heckrottii* 'Pink Lemonade'] and Crossvine [*Bignonia capreolata*]), and some without. Also, they have settled on my northern catalpa (*Catalpa speciosa*), desert willow (*Chilopsis linearis*), and Mimosa (*Albizia julibrissin*) trees, as well as a Rose-of-Sharon (*Hibiscus syriacus*). The single swarm that I have found at another of my beeyards was on a juniper (*Juniperous spp.).* I have never observed or been notified by a neighbor that a swarm had settled on their property.

I have observed swarms in the air on several occasions. Once, one of my sons and I were pulling into our driveway around noontime, and there was a swarm that was swirling out over our front sideyard. We parked and got out, and then followed the swarm to our backyard. The swarm landed on the front of the box and, within minutes, all had entered the hive. This was a healthy hive, so I assume that the swarm returned to its original box. A week or so later there was a similar-sized swarm hanging a short distance from this hive.

SWARM CALLS

I respond to swarm calls whenever possible, and am listed on several "swarm response" internet sites. Sometimes, I refer calls to another beekeeper if I can't respond or don't have room for the bees. When I can respond, I grab a hive box or a cardboard nuc, my bee jacket and gloves, and such equipment as duct tape, steel wool, a ratchet strap, a spray bottle with sugar water, and a brush. The steel wool comes in handy to close off a hive box's entrance while allowing airflow into and out of the hive.

I tend to use each capture as a teaching tool if the landowner or other people are observing. I either let the box set until after dark, or take home what I can after most have entered. On occasion I will leave the box a few days until I can move it to its new location.

Because, I have had swarms not stay in capture boxes at times, I have learned to keep the queen contained by placing an entrance queen encloser in front of the entrance or I set a queen excluder on top of the bottom board. I'll leave that in place for a few days to lock them in. A frame or two of brood does a good job of that, too.

Like at my home place, I have found other swarms

in a variety of situations. This includes 15-feet up in trees, on a young sapling, on wooden fences, and on the upper frame of a garage door. Swarms have ranged in size from softballs to watermelons.

One swarm was particularly interesting, to say the least. In fact, I am not so sure that some of the bees weren't in a cavity and that the rest couldn't get inside. As soon as I started to try to brush them off the side of a house into a box, they got aggressive. I am glad this was at a farmhouse and not in a residential neighborhood. First, I had to send the residents inside. Then, I retreated a hundred feet or so before only a few were bombarding me. I went back. Here they came, and this time I retreated another 200 feet where my wife was waiting in the truck. Eventually, I had to climb in to the bed of my pickup and have the wife drive me a quarter of a mile down the road before the bees were no longer bothering me. I now have a bee-vac that would take care of that situation, had I returned after the bees had time to settle down.

SWARM USES

I use swarms in several ways. I have started new hives, and I have merged the workforce into weak hives. I also have given swarms to other beekeepers on occasion.

IN CLOSING

Retrieving swarms is one of the most exiting aspects of beekeeping for me. Not only are you helping people, but you also can use retrievals as an educational outreach opportunity. The "this is how bee colonies reproduce," and "workers actually control all of this" messages captivates those watching you box them. I like to lay an inner cover or a piece of cardboard down in front of the entrance and watch the bees race into the entrance after gently dumping them there. That, right there, will captivate the audience, as will the fact that bystanders can usually stand unprotected a few feet away and watch the whole process. Talk about a rush! Truly, the adrenalin rush of collecting swarms is one of the great things about being a beekeeper. BC

The Waxing And Waning Of Beekeeping

James E. **Tew**

We all go through it – some more than others!

Sneaking out of church

When I was a little guy (but not real little), I would quietly leave the church service and take the back stairway to the dark, warm boiler room in basement of the church. There the church custodian would be sitting near a large dark, boiler that hissed and clanked. As I remember, the coal door was always open and the hot, yellow and blue fire could be seen inside the boiler belly. I can't say that the custodian was particularly glad to see me. No doubt, I interrupted his nap, but he was always congenial. We never discussed anything of note. The air was quiet and warm. Faintly, I could hear the passing of the various church service elements in the upstairs distance. In a strange way, the scene was placid, dignified, and suitable for church.

A prominent feature of boiler was a water-filled sight-glass that was attached to the boiler above the fire door. As the hot unit hissed and huffed, the water in the glass would dance up and down. So far as I could tell, the water moving in the sight-glass was about the only moving part on the boiler. Oddly, all these years later, I see beekeeping interest and commitment to be a lot like the dancing water in the sight-glass. The hot boiler represents the beekeeping industry. At times our industry is very hot, but at other times it can be cooler. Beekeepers, beekeeping, and beekeeping interest are represented by the bouncing water in the now long gone boiler sight-glass. Sometimes interest and activity is up and then it sometimes goes down. Sometimes the players and the programs change and what was once important wanes and something new waxes. It's the natural scheme of things.

It seems that was just a few years ago

It seems that it was just a few years ago, that my Dad, my two brothers, and I were all hot for beekeeping. Years earlier during the late 1960s, Dad's brother – our uncle – got into beekeeping. The story goes that another beekeeper in Micanopy, Florida gave my uncle a hive. He got the fever. After hearing his stories and seeing his love and commitment, we all followed along. Then we all became infected with beekeeping passion. Our furnace was hot and our water was high.

Each of the four of us had a beekeeping component that was our thing. Dad had a bit of an equipment business ongoing, but he particularly had a brisk local honey market ongoing. Honey-starved customers would respond to the "honey for sale" sign in the front yard, ring the doorbell and want to know if the honey was raw. One of my brothers got into the pollination rental business and provided colonies for commercial watermelons. Another brother moved to Tennessee and became a beekeeper there. For a long while he was an officer in clubs and was and heavily involved in the Nashville beekeeping scene. I pursued beekeeping academically and committed my life's energy to the craft. All of the men in my immediate family oozed beekeeping. The women in our family just tolerated us. One way or the other, most of whatever we did, related to beekeeping. That period was a classic period in my beekeeping life.

Things peaked

I don't know where or when it happened, but somewhere along the way, things peaked in my bee family. It happens. The upward path can't last forever.

These Alabama bees are weeks ahead of my Ohio bees.

Beehives in the pines. Nothing beats a nice day.

Dad aged and processing the honey became too much for him. Piece by piece and bit by bit, he sold out. My brothers aged. Loading beehives and working at night lost whatever glamor it ever may have had. Being an officer in bee clubs can be a pathway to burnout for some. My Tennessee brother tired of the responsibility. After all, it was a labor-of-love and loving to labor can wear thin. Now, I am the last man standing. I am still immersed in beekeeping, but my family's interest seems to have run its course.

Doing again what I have done before

So what now? I am planning to do what I have done before – I never seem to tire of it. In fact, several months ago I wrote about starting over in beekeeping. While it is gloomy to see the empty hive stands and wax-moth eaten combs, I am as eager about beekeeping as I have ever been. And I am totally at ease telling you that modern-day beekeeping is as exciting as it ever has been. True, bees seem to have issues and, true, imported honey is rampant, but the interest in bees for local honey and local pollination has never been greater. So while some in my family have moved to a different place in life, many, many new people – and their families – have recently become beekeepers. The water in the sight-glass bounces up and down. For now, beekeeping is hot.

The primary thing that I have done before that I am planning to do this Spring is buy packages. *Wow – that's novel!* I have bought some packages every Spring for probably the last 15 Springs. I realize that buying packages is absolutely routine, but I still enjoy getting my packages each Spring. For me, it's a lot like buying tomato plants or various garden seeds in preparation for my annual gardening project. Getting my packages each Spring helps me relive all the past Springs when the bees arrived. While I no longer buy the number of packages I bought in years past, I still want five to 10 packages this season.

The installation procedure that I am planning to use is one I used a few years ago when I had to release packages in the rain. I posted the procedure on YouTube at onetewbee. The short video is entitled "*Hiving Packages in the Rain.*" I had good luck with this procedure as I showed it. The rain event will not preclude using the procedure when the weather is clear.

The seasons are the same but different

All those years ago, when I began a cooperative relationship with the Alabama Cooperative Extension System, I didn't see the rise in beekeeping interest on the horizon. Our concern then was about the arrival of Africanized honey bees (AHB) and how to prepare for them. At the time, the AHB was not even in Florida. In short order, nearly 20 years will have soon passed. Now, I realize that being at Auburn University in the early Spring is a part of my seasonal ritual that developed while I was unawares.

No doubt, many times I have submitted *Bee Culture* articles on subjects that were already passed in some parts of the U.S. To really cover such topics as, Swarm Control or making early splits, the author would very nearly have to write the article in November. This would make sense for North Florida, but would feel a bit goofy for central Michigan or somewhere in Minnesota.

So here I am – ready to go but with no place to go. The early nectar and pollen flow has started at my home in the southeast, but at my northern home location in Ohio, it's only just beginning. The packages that I am ordering will go in my small home yard in Ohio. If I had to install them right now, I would locate them back with the compost pile and the pile of extra paver bricks and the extra fencing. All of these piles are components of my future perfect beeyard. At this moment, the place is a wreck, but I fully plan for this location to become an integral part of my home place and beekeeping project. I will have an out yard away from my home property, but I have not selected the site or begun to develop it. I have been down this *location development* path many times before.

Repeating procedures of very, very long ago

Approximately 25 years ago, I wintered about 50 Ohio State colonies in the panhandle of North Florida. I wrote several articles about the event at the time. We stuck trucks in muddy bogs and made an incredible number of strong splits. (This was all pre-*Varroa* days.) All in all, the grand experiment worked very well. University funding became much tighter, so the trip died. Now, all this time later, I am once again considering starting packages in the southeastern U.S. and then moving them to Ohio. Essentially, the packages will experience two Springs. Of course, I will be running up and down the interstate as though fuel costs were inconsequential. From all those years ago, I learned that that the colonies built up amazingly well; however, the drive was bruising. We didn't stop other than to buy fuel and food. At my present ever-advancing age, I will not be able to be that dedicated this time around.

Just exactly how daft am I?

Well, in many areas I am pretty far gone, but in the beekeeping area I am simply recently rejuvenated. Several months ago I retired from one position and began a different path with a different university. I now have a sense of freedom that is still enjoyable and fresh. I don't know how long it will last but while the opportunity feels right I would love to revisit some of my beekeeping adventures that I experienced many years ago – but on a smaller scale. And this time I will have much better video and camera equipment and I can do a more thorough job of reporting on the various exploits of the bee caper.

Time and again, I have asked

Time and again, I have asked you as I wrote earlier articles for *Bee Culture* when is it proper to refer to beekeeping past and when am I simply dwelling too much on the bygone?

Presently I am on a trip to Alabama. This past Winter was extraordinarily mild and colonies here built up well ahead of schedule. While Ohio and points northward were still in Winter conditions, this area was enjoying a climate that already supported flying drones and an abundant pollen flow. Today was a brilliant blue-skied day accented with gentle breeze and an instinctual message that Spring was very nearly underway. I love the sound of wind in the pines and I can capture that on audio, but I cannot capture the *smell* of the pines and the smell of the hive as it hummed away today gathering the new pollen and nectar of the season. The sunlight was intense. It was a good day and it felt like so many other Spring days long past. The sounds, the smells, the light – all of these characteristics come together to make a personal generalized memory that is pleasant and reassuring.

The difference this time

For many months now I have been struggling trying to describe both the excitement and the confusion that my job change has caused. I had a large, well equipped program with beehives and processing equipment to spare. That's all gone. I am once again a small beekeeper with the concerns and issues of a small beekeeper. As it were, I have come full circle. I am very near where I started in 1974. My energy for this project continues to be refreshing to me.

Don't get me wrong, I still like to look at large honey processing equipment and daydream about using a skid-steer loader to pick pallets of hives onto large, heavy duty trucks – but daydreaming is about as much of it as I want to do. That's real, rewarding work. I am happy at this point just to play and toy with my few developing colonies. While I am not retired, I am pursuing a different tact this time.

I miss not having my brothers involved in beekeeping, but people change and people's interests change. It has happened to many before them, but I am still loving apiculture and am still committed to the beekeeping craft. Though I may be aging a bit, beekeeping never gets old to me. It just changes flavor. BC

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All The Buzzz in...

Hello Friends,

Time to start thinking about your garden. Please plant bee friendly plants for me. Happy growing!

Bee B.Queen

Bee B. Queen Challenge

Send me a bee joke!

Abigail Liede, 8, PA

Maria Sanchez, 7, TX

Manisha Cooper, 8, TX

Head, Abdomen, and the Whatchamacallit

The bee body parts easiest to remember are the head and the abdomen. For some reason it is hard to remember the middle part, the thorax. Just think of the *Lorax* by Dr. Seuss. Thorax rhymes with Lorax.

Thorax in the Middle

The thorax is the middle section of the bee's body. The head is on one side, the abdomen is on the other. The wings and the legs are attached to the thorax. In other words, without the thorax the bee would not be able to move. It would just have to lie around eating popcorn and playing video games.

Photo by Mark Wieland

Let's look at the legs first. There are three pairs of legs connected to the thorax. That means six legs in all. Of course, you knew that already. The back legs carry the pollen in their pollen baskets. So without the thorax, there would be no legs. Without the legs there would be no pollen baskets. Without the pollen baskets there would be no way to carry pollen, for food, back to the hive.

See how everything is connected?

Very punny!

Photo by Zachary Huang

There are two sets of wings attached above the legs. That means four wings in all. Of course, you knew that already. Inside the thorax the nerve cord, heart and esophagus pass through, but most of the space is taken up by sets of flight muscles. The longitudinal and vertical muscles work together to power the wings. When it is cold, bees keep warm by gathering together in a group and vibrating these large flight muscles. The thorax is also covered in fuzz to help keep in heat.

... Bee Kid's Corner

Produced by Kim Lehman -www.kim.lehman.com
www.beeculture.com
April 2012

Rebecca Flora, 11, OH

Bees go round and round,
To the flowers on the ground.
Everywhere making honey here and there!
Rebecca Flora, OH

Riddle Me This

Arrange the boxes to make a riddle.

ING	WER	DO	Y F	?	MA	HAT	ERS
APR	FLO	BR	WER	S B	AY	LOW	IF
G M	S, W	SHO	IL	RIN			

IF					S B		
	FLO						Y F

Fill in the blanks for the answer to the riddle.

P _ _ G _ _ _ _

A Thorax For All!

When we say thorax we think of insects. Guess what? We also have a thorax. On humans it is considered to be the chest area from the neck to our abdomens.

Words in a Word

How many other words can you think of using the letters in the word thorax?

THORAX

Rachel Spencer

Bee Buddy

Meet one of our northern friends. Rachel Spencer, age 10, lives in Maine with her dad and beekeeping mom. They have been keeping bees for two years. Rachel loves to be outside swimming, climbing and watching bees bringing pollen to the hive. When Rachel is not outside, she enjoys drawing and playing her clarinet.

Beecome a Bee Buddy

Send two self addressed stamped envelopes and the following information to: Bee Buddies, PO Box 2743, Austin, TX 78768. We will send you a membership card, a prize and a

Name: ______________________

Address: ______________________

City, State, Zip Code ______________________

Age: ________ **Birthday:** ________

E-mail (optional)

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

Answer: If April showers bring May flowers, what do May flowers bring? Pilgrims
Answer: ax, tax, hat, rat, hot, rot, oar, oat, oath, art.

Beenglish Dictionary

Ann **Harman**

Our various pastime pursuits have a vocabulary all their own. It is important to have a good understanding of the terms used so that one does not appear to be a complete neophyte. The game of golf, for example seems to involve birds. You hear golfers commenting about "birdies" (little finches and sparrows perhaps?) and "eagles" (bald or golden?). Since the game is played outdoors such terms could be expected. Tennis players, on the other hand, seem obsessed with Love. At least you hear them shouting the word whenever someone hits a ball out of bounds. Football followers need to watch carefully when the announcer says "First Down" because it is really difficult to tell who fell down first.

Beekeeping, of course, has its own jargon. This is so beekeepers can talk to each other about their successes and problems in an intelligent way. Therefore, here follow definitions and explanations of terms that beekeepers may find helpful.

Top Bar. The Top Bar (opposite of topless bars) is the nicest bar in town. The bartender is knowledgeable, not easily stumped with requests by those from out of town. The wine cellar is extensive. The Top Bar is a nice place to take Granny for her birthday. There she can celebrate with her favorite champagne cocktail.

Side Bar. This bar is around the corner from Top Bar and is not quite so upscale. However it is a nice bar favored by the young professionals. The selection of beers is quite large and includes many from Germany, Japan, and other countries. Honey beers are also a favorite here.

Bottom Bar. This bar is quite some distance from both the Top Bar and the Side Bar. Its clientele can be a bit rowdy on weekends particularly if a big football game is on TV there.

This bar is not one you would take Granny to.

Excluder. This is the term used for the bouncer at the Top Bar. The management felt it is a more distinguished word than "bouncer." Since there is little need for the excluder in the Top Bar, you may well see him welcoming patrons or serving guests.

Drone Congregation Area. Every Friday night the regulars have their poker game at a beekeeper's home. The regulars take turns hosting the game. The poker table is nicknamed the Drone Congregation Area. In lieu of poker chips the players use the different-colored plastic cell cups. The poker games have been going for many years even though the regulars have changed from time to time.

Frame. You can find a large selection of frames for your pictures at the frame shop in town. There you will find ready-made ones in a variety of sizes including ones for certificates. If you wish custom framing the owners will be happy to help. The people at the frame shop have already put the **frame wire** on the backs of the frames for you.

8-Frame. At the frame shop you can find ready-made frames that will display eight photos, nicely matted. These frames display family photos very well and make nice gifts. An eight-frame with family photos makes a special present at a family event, such as birthday or wedding,

Veil. Very near the frame shop, in the downtown area, you will find a shop that specializes in veils and hats for special occasions. Whether it is a wedding veil or a stylish hat for a wedding guest, the staff there will help you find something attractive and appropriate.

Smoker. Every month cigar and pipe fanciers gather to sample tobaccos from around the world. The meetings alternate – one month for pipe smokers, the next for those favoring cigars. Each month a different tobacco is featured and everyone is invited to try the featured one and comment on it.

Comb. It is best to make a distinction between two types of comb. **Old Comb** is the one you have had in your back pocket for quite a while and is missing quite a number of teeth. **New Comb** is the one you just bought at the drugstore to replace the Old Comb that you finally threw out.

Bee yard. This is a unit of measurement in the beekeeping world. **Six bee feet make one bee yard.** This measurement is generally used to measure out the bee's home area.

Roping. This is a sport seen at rodeos sanctioned by the AFB. You need a quick, well-schooled and dependable horse and a quality lariat. The event is judged on your speed and proficiency at roping a steer. The performance of the horse also enters into your final score.

Queen cup. If you are planning a formal afternoon tea, it is best to have a set of bone china teacups, such as those made by Royal Doulton, that would be suitable if the queen came. Since her schedule probably would not include your afternoon tea, an elegant tea set still makes your event special.

Swarm. Short version of "it's warm." It is a term frequently heard in the Spring as the weather warms. Beekeepers seem to have mixed feelings about the warming weather. Some seem very pleased while others seem very upset.

Grafting. An often-heard term used in reference to politicians or possibly big businesses. Grafting seems to occur frequently but covertly. You may hear clandestine terms such as "the grafts were successful," meaning that some money or favors were successfully transferred. The term is used in a derogatory sense by the average person.

Nectary. The Nectary is a delightful juice bar in the downtown area near the frame shop. Daily specials are offered during the lunch hour. The summertime juice drinks are served over shaved ice for a refreshing moment on a sultry Summer day.

Patty. The secretary of the local beekeepers association. Always cheerful and very efficient.

Foundation. That part of any structure upon which the rest of the structure is built. For example, cement blocks are usually used for houses or other small buildings by most contractors. Large buildings may have deep foundations of poured concrete. After the foundation is complete, the outline and size of the structure can be seen.

Cell. The usual term for the enclosures in a jail. They come in various sizes, such as queen, worker, small, etc.

Queen muff. During the nineteenth century a muff was a very fashionable way for ladies to keep their hands warm on cold Winter days. Muffs went out of fashion during the twentieth century as women found warm gloves allowed the fingers to be free for various tasks such as driving. Today in the twenty-first century muffs seem to have come back in fashion.

Super. An exclamation denoting something wonderful. The word is also used in football. At the end of the season's games the championship game is called the Super Bowl. It is famous for its television commercials.

Cappings. In the downtown area, near the shop selling veils and hats, you will find a small shop named Cappings. Here you can find hundreds of baseball-style caps with logos and names of many different sports teams, names of cities, countries, and beers. Caps can be made to order with colors and emblems for local events, charities and organizations.

Extractor. This is a handy gadget for retrieving objects that have been dropped or rolled in an inconvenient place, such as behind a bookcase or under the refrigerator. A small extractor, also called tweezers, can be useful in removing splinters from fingers. One type of extractor is generally called a corkscrew.

Inner cover. A lightweight blanket usually found between the top bed sheet and the quilt. If the night was too warm to use the heavy quilt, the sheet and inner cover usually kept one warm enough.

Outer cover. The quilt.

Cloake Board. A very quaint term seen in its old form of spelling. It is a board that held pegs for people to hang their cloaks on.

Sticky board. A board used by chefs to keep bowls from sliding about during mixing of ingredients.

Moving screen. Thoughtful moving companies will use a screen while moving furniture either out of or into your home so nosy neighbors do not see the sorry state of your sofa or other rather derelict furniture.

You now have a good working vocabulary so that you can attend meetings and feel confident that you can have a good, useful conversation with beekeepers both novice and experienced. BC

Ann Harman communicates with beekeepers – old and new – from her home in Flint Hill, Virginia.

Using BAIT HIVES

The Right Box, In The Right Place At The Right Time.

Tom **Seeley**

The basic process of capturing honey bee swarms with bait hives is extremely simple. You just put up a box of the right design in the right location and at the right time of year.

This article will tell you how to capture swarms using bait hives. If you need additional colonies of bees, this can be efficient and fun way to get them. There is no need to dash off at a moment's notice to an unfamiliar address. And there is no need to coax the swarm bees to accept your hive as their new home. The bees will come to you and they will do so all on their own.

In most places where beekeepers keep bees in hives, there are also colonies living in hollow trees and buildings. Bait hives enable you to automatically harvest swarms produced by all these colonies. I have been capturing swarms in and around Ithaca, New York for over 30 years. In some years, nearly 80 percent of my bait hives are occupied by swarms, while in other years only about 20 percent of them are occupied. On average, I expect to capture one swarm for every two bait hives that I set up. Your success rate will depend on the density of colonies where you live. It might be much higher than you suspect.

Bait Hive Design

The first step toward success with bait hives is to build wooden boxes that will be attractive to honey bees looking for a home. In the 1970s, working with Professor Roger A. Morse at Cornell University, I conducted experiments aimed at learning what makes a dream home for honey bees. I offered wild swarms specially built bait hives (usually cube-shaped) in groups of two or three. The hives in each group differed in only one respect (cavity volume, entrance area, etc.), thus each group presented an array of candidate home sites that differed in just one property. I observed which hive within each group was occupied first by a swarm. Over the years, I recorded the choices of 124 swarms, and so learned what things do and don't matter to the bees as they choose their homes.

The results of these multiple-choice tests given to the bees yielded eight recommendations regarding bait hive design.

1. Cavity volume: 1.0 to 1.5 cubic feet.
2. Cavity shape: not important.
3. Entrance area: 1.5 to 2.5 square inches.
4. Entrance shape: not important.
5. Entrance position: near the floor of the hive.
6. Entrance direction: facing south or southwest is preferred, but other directions are acceptable.
7. Dryness and airtightness: dry and snug.
8. Odor: the odor of beeswax is attractive.

(A note regarding odor: commercially available scent lures that mimic the assembly pheromone from the Nasonov's gland of honey bees are helpful, but are not needed. They apparently work by making bait hives more conspicuous to scout bees.)

Some variables of bait hive design remain to be investigated, including the thickness of the walls. The experimental bait hives used in my research were built of 5/8-inch-thick plywood, but you can probably get away using thinner stuff. Lightweight molded papier-maché plant pots (available from nurseries and bee supply dealers) have been used with some success in the southwestern United States.

Building Bait Hives

Now that you know what bees seek in a home, you are ready to build your bait hives. You may find it easiest to use some of you old hives, because there will be a strong and attractive odor of beeswax inside them. I have made many of my bait hives out of old, full-depth, 10-frame Langstroth hives. They have a volume of 1.5 cubic feet. But I favor making my bait hives out of old "nucleus hives" that hold five or six frames and have a volume of

Bait hives used to determine what size cavity honey bees prefer when they get to choose their own nest site. The bait hives had volumes of 10, 40 and 100 liters (0.35, 1.4, and 3.5 cubic feet). Swarms usually chose the middle sized one.

Bait hive built from an old Langstroth hive, with an entrance hole drilled on the front and boards nailed on the top and bottom.

about one cubic foot. Both sizes of bait hive are attractive to the bees, but the smaller ones are much easier to set up, take down, and transport. If you use old hives, make sure to reduce the size of the entrance to about two square inches by blocking off most of the original entrance opening. Reducing the entrance opening to this size is VERY important. You will also want to attach the bottom board to the rest of the hive, so that it will be easy to move the whole thing about. Another way to convert an old hive into a bait hive is to drill a 1.5 inch diameter hole on one side of the hive, fasten a plywood board to the bottom, and install a removable lid. Be sure to hammer a nail across the entrance hole to exclude birds and squirrels.

Bait hive mounted on a simple platform at a suitable height in an oak tree. Notice the small entrance opening, as preferred by the bees. This bait hive has been repeatedly occupied by swarms.

If you are building your bait hives from old hives, you will want to equip them with standard frames filled with drawn comb or beeswax foundation. This will strengthen the odor of beeswax in each bait hive. Perhaps even more important, this will make it easy to transfer the bees from bait hive to regular hive when you collect a swarm. Furthermore, placing frames with foundation in your bait hives will enable the swarm bees to build you beautiful, new frames of comb.

The color of a bait hive's exterior appears to be unimportant; I have had good occupation rates with various colors. Darker boxes may overheat in hot climates unless they are fully shaded. If you use colors that make the bait hive inconspicuous (dark green or brown), you can reduce vandalism without discouraging the bees.

Positioning Bait Hives

All right, you have your bait hives built and you are ready to set them out. Where will you place them so they are conspicuous and attractive to the bees? My studies with Professor Morse yielded three recommendations regarding bait hive location.

1. Height: about 15 feet above the ground. The multiple-choice tests of the bees' housing preferences revealed that bees greatly prefer a residence that is high off the ground. You will find that bait hives only six to 10 feet high will attract swarms, but hives that are still higher are probably even more attractive. To get adequate height, you can set your bait hives on high porches, low roofs, or simple platforms built in the forks of trees (see Figure 3.).

2. Shade and visibility: well shaded, but highly visible. Bees tend to avoid or abandon bait hives in direct sun.

3. Distance from your apiary: at least 300 feet. I have had little success with bait hives mounted in trees near my apiaries. Bees may prefer to nest well away from other colonies.

Time to Set Out Bait Hives

To be successful with bait hives, you need to know when swarming is most likely to occur in your area. In my hometown, 80 percent of swarming takes place between May 15 and July 15, and another 20 percent takes place between August 15 and September 15. A similar pattern probably holds in other places in North America, except that swarming starts considerably earlier toward the south. I've read that swarming in Maryland starts in April, for example, and in Florida in late February or March.

Whenever swarming starts in your area, you will want to have your bait hives set out a few weeks in advance to maximize their chances of being discovered by scout bees. The departure of a swarm from its parent colony takes only five to 10 minutes, but noticeable preparations begin up to 10 days in advance. We now know, for example, that colonies preparing to swarm send out nest-site scouts to search for possible dwelling places several days before the entire swarm issues. You can see these scouts flying up and down tree trunks investigating knotholes and other openings. If you have your bait hives set up before the

Dates of swarming in the Ithaca, NY area. Data collected 1971-1976. Based on data reported in Fell, r.D. et al. 1977. Journal of apicultural Research 16:170-173.

start of swarming, then sooner or later you're apt to see scout bees investigating them too.

Checking and Taking Down Bait Hives

Let's say the day has come when you see a crowd of bees at the entrance of one of your bait hives. Before you take it down to collect your free bees, be sure that you spy bees entering the hive carrying loads of pollen. When several dozen scout bees are inspecting a bait hive together, it can look like it is occupied but actually it isn't. To avoid taking down your bait hive prematurely, check for pollen-bearing bees going into the hive; they are a sure sign that a colony has taken up residence. Nest-site scouts do not carry pollen.

Another way you can distinguish between scouts from a homeless swarm and foragers from a resident colony is by noting the pattern of flight around the bait hive. Bees scouting a potential nest site move repeatedly in and out of the entrance, sometimes taking short flights, but returning again and again to further inspect the hive's interior. Most foragers, in contrast, leave the entrance quickly or stand there for a while, rapidly groom themselves, and then fly off directly.

You should approach and handle an occupied bait hive just as you would any hive of bees that you are moving. Work when darkness, cool temperatures, or rain has caused all the bees to move inside. Gently puff smoke in the entrance and at any bees still clustered on the outside of the hive, to coax them inside. Then use duct tape or a staple gun to fasten wire screening over the entrance opening. You can also use tacks, but hammering them in will stir up the bees.

When using a ladder to take down a bait hive, use a rope to safely lower the hive to the ground. If there has been a good honey flow, your bait hive may weigh 50 to 70 pounds and it is not easy to climb down a ladder while holding such a heavy object. You can use one end of your rope to secure the hive and then pass the other end around a limb above the hive and tie it to the ladder. After you have the bait hive unfastened and hanging free of the ladder, untie the rope from the ladder and slowly lower the hive to the ground. Thinking ahead, perhaps a pair of large eye hooks on top would make this easier.

If you picked a cool morning or evening for your harvesting operation, you won't have problems of the bees overheating inside the bait hive, despite the bait hive's small entrance and the limited ventilation that it provides. Under no circumstances should a bait hive remain screened all day, especially if it is exposed to the sun, because the screened entrance cripples the bees' ability to cool the nest. Overheating can quickly kill a colony.

You will probably want to check your bait hives fairly often, maybe every week or so. For one thing, it is fun to see if scout bees are checking them out. More importantly, it is good to know when they have been occupied. It is much easier to take down a recently occupied bait hive than one that has been left in place until the weight of the honey and the population of bees have increased greatly.

By the end of the swarming season, if you built your hives properly and positioned them carefully, and if nature endowed your region with plentiful swarms, your bait hives should have yielded you several beautiful swarms of bees. If so, then congratulations, for you are now entitled to call yourself not just a bee keeper, but also a bee trapper! BC

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GLEANINGS

APRIL, 2012 • ALL THE NEWS THAT FITS

IRISH STUDY ON COLONY LOSSES LOSES COLONY

An Irish research program is in jeopardy after thieves stole three colonies from a Teagasc – Irish Agriculture and Food Development Agency – research apiary.

The colonies are part of the national apiculture research program, a joint project involving Teagasc and University of Limerick, on the control of pests and diseases.

The work is funded by the government's Department of Agriculture.

Teagasc says the thefts are causing a dilemma for the researchers. While it is accepted that colonies of bees have a value, the colonies are part of a national research program on colony losses.

Hence, when one of these colonies is stolen, the information from that hive is lost to the research program. To get meaningful results for the tests, the different treatments must be applied to a number of different colonies.

Researcher Mary Coffey says different treatments are being tested in different colonies. Some of these treatments are not yet generally available to the general beekeeper. Because of this, it is possible that residues might be in the honey from these hives and these have not yet been tested.

A Teagasc spokesman says the hives, worth a few hundred dollars each, were stolen in two separate incidents.

"They have a value in making honey, but they're certainly no pot of gold," the spokesman said. "They're of huge importance for our research, however, and any further thefts could jeopardize that."

Alan Harman

MONSANTO - 1 ORGANIC - 0

Organic farmers in the U.S. have lost a lawsuit claiming damages over Monsanto's genetically modified seed spreading into their fields.

The U.S. District Court for the Southern District of New dismissed the complaint by the Organic Seed Growers and Trade Association and dozens of other plaintiff growers and organisations, ruling the spread of the GM seed into the organic fields did not constitute harm.

The organic groups said they feared a patent-infringement lawsuit in the event the company's traits happened to enter their fields inadvertently through, for example, cross-pollination.

U.S. District Judge Naomi Buchwald ruled the plaintiffs had engaged in a "transparent effort to create a controversy where none exists."

She said there was no "case or controversy" on the matter as Monsanto had not taken any action or even suggested to take any action against any of the plaintiffs.

The court cited Monsanto's longstanding public commitment that "it has never been, nor will it be, Monsanto policy to exercise its patent rights where trace amounts of our patented seeds or traits are present in a farmer's fields as a result of inadvertent means."

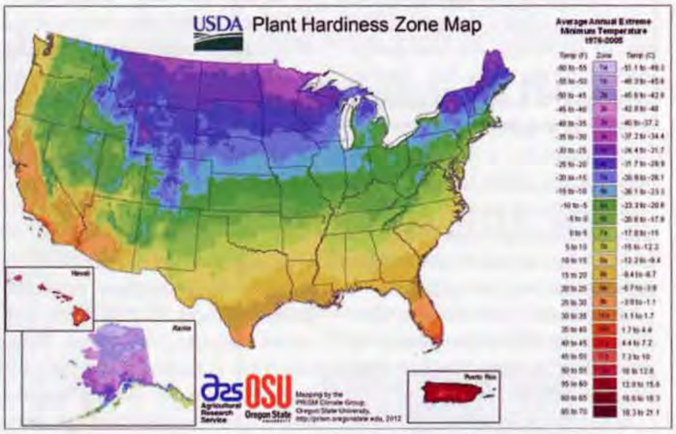
Monsanto executive vice-president David Snively called the ruling a win for all farmers as it underscores that agricultural practices such as biotechnology, organic and conventional systems continue to effectively co-exist in the agricultural marketplace.

"Importantly, this ruling tore down a historic myth which is commonly perpetuated against our business by these plaintiffs and other parties through the internet, noting that not only were such claims unsubstantiated but, more importantly, they were unjustified."

Snively says the ruling makes it clear there is neither a history of behaviour nor a reasonable likelihood

Continued on Next Page

USDA UNVEILS NEW PLANT HARDINESS ZONE MAP



The U.S. Department of Agriculture (USDA) today released the new version of its Plant Hardiness Zone Map (PHZM), updating a useful tool for gardeners and researchers for the first time since 1990 with greater accuracy and detail. The new map – jointly developed by USDA's Agricultural Research Service (ARS) and Oregon State University's (OSU) PRISM Climate Group – is available online at www.planthardiness.ars.usda.gov. ARS is the chief intramural scientific research agency of USDA.

For the first time, the new map offers a Geographic Information System (GIS)-based interactive format specifically designed to be Internet-friendly. The map website also incorporates a "find your zone by ZIP code" function. Static images of national, regional and state maps have also been included to ensure the map is readily accessible to those who lack broadband Internet access.

"This is the most sophisticated Plant Hardiness Zone Map yet for the United States," said Dr. Catherine Woteki, USDA Under Secretary for Research, Education and Economics. "The increases in accuracy and detail that this map represents will be extremely useful for gardeners and researchers."

Plant hardiness zone designations represent the average annual extreme minimum temperatures at a given location during a particular time period. They do not reflect the coldest it has ever been or ever will be at a specific location, but simply the average lowest winter temperature for the location over a specified time. Low temperature during the winter is a crucial factor in the survival of plants at specific locations.

The new version of the map includes 13 zones, with the addition for the first time of zones 12 (50-60°F) and 13 (60-70°F). Each zone is a 10°F band, further divided into A and B 5-F zones.

Some of the changes in the zones, however, are a result of new, more sophisticated methods for mapping zones between weather stations. These include algorithms that considered for the first time such factors as changes in elevation, nearness to large bodies of water, and position on the terrain, such as valley bottoms and ridge tops. Also, the new map used temperature data from many more stations than the 1990 map. These advances greatly improved the accuracy and detail of the map, especially in mountainous regions of the western U.S. In some cases, advances resulted in changes to cooler, rather than warmer, zones.

Kim Kaplan

RISK TAKERS AND HOMIES

Some honey bees are more likely than others to seek adventure.

University of Illinois entomology professor and Institute for Genomic Biology director Gene Robinson says he has found that the brains of these novelty-seeking bees exhibit distinct patterns of gene activity in molecular pathways known to be associated with thrill-seeking in humans.

Robinson says in a report in the journal Science that his findings offer a new window on the inner life of the honey bee hive, which once was viewed as a highly regimented colony of seemingly interchangeable workers taking on a few specific roles (nurse or forager, for example) to serve their queen.

It appears that individual honey bees actually differ in their desire or willingness to perform particular tasks, Robinson says, and these differences may be due, in part, to variability in the bees' personalities.

"In humans, differences in novelty-seeking are a component of personality," he says. "Could insects also have personalities?"

Robinson and colleagues from Wellesley College and Cornell University studied two behaviors that looked like novelty-seeking in honey bees – scouting for nest sites and scouting for food.

When a colony of bees outgrows its living quarters, the hive divides and the swarm must find a suitable new home. At this moment of crisis, a few intrepid bees – less than 5% of the swarm – take off to hunt for a hive.

These bees, called nest scouts, are on average 3.4 times more likely than their peers to also become food scouts, the researchers found.

"There is a gold standard for personality research and that is if you show the same tendency in different contexts, then that can be called a personality trait," Robinson says.

Not only do certain bees exhibit signs of novelty-seeking, he says, but their willingness or eagerness to "go the extra mile" can be vital to the life of the hive.

The researchers wanted to determine the molecular basis for these differences in honey bee behavior. They used whole-genome microarray analysis to look for differences in the activity of thousands of genes in the brains of scouts and non-scouts.

"People are trying to understand what is the basis of novelty-seeking behavior in humans and in animals," Robinson says. "And a lot of the thinking has to do with the relationship between how the (brain's) reward system is engaged in response to some experience."

The researchers found thousands of distinct differences in gene activity in the brains of scouting and non-scouting bees.

"We expected to find some, but the magnitude of the differences was surprising given that both scouts and non-scouts are foragers," Robinson says.

Among the many differentially expressed genes were several related to catecholamine, glutamate and gamma-aminobutyric acid (GABA) signaling, and the researchers zeroed in on these because they are involved in regulating novelty-seeking and responding to reward in vertebrates.

To test whether the changes in brain signaling caused the novelty-seeking, the researchers subjected groups of bees to treatments that would increase or inhibit these chemicals in the brain.

Two treatments (with glutamate and octopamine) increased scouting in bees that had not scouted before. Blocking dopamine signaling decreased scouting behavior, the researchers found.

"Our results say that novelty-seeking in humans and other vertebrates has parallels in an insect," Robinson says. "One can see the same sort of consistent behavioral differences and molecular underpinnings."

The findings also suggest that insects, humans and other animals made use of the same genetic "toolkit" in the evolution of behavior, Robinson says. The tools in the toolkit – genes encoding certain molecular pathways – may play a role in the same types of behaviors, but each species has adapted them in its own, distinctive way.

"It looks like the same molecular pathways have been engaged repeatedly in evolution to give rise to individual differences in novelty-seeking," he says.

•

Being a honey bee scout is dangerous business requiring bold behavior and now researchers have discovered why some bees head for high adventure and others stay at home.

It's all in the genes.

Zhengzheng Liang of the University of Illinois and colleagues at Wellesley College in Wellesley, MA and Cornell University in Ithaca, NY, have identified specific differences in gene expression the brains of honeybees with specific behaviors.

They found only some honeybees participate in the scouting efforts. Some bees leave their nests in search of new food sources, others leave to look for a new home, and some bees hardly ever leave their nests at all.

The researchers report in the journal Science they then rearranged the honeybees' food sources in a large, screened outdoor area and kept an eye on the bees that were bold enough to leave their nests and go searching for new food sources.

Liang and colleagues then collected the adventurous honeybees and used a technique known as whole-genome microarray analysis to compare the gene expression in their brains to that in the brains of bees that stayed closer to the hive.

The research team says the honeybees that were out looking for new food sources and new places to live had dramatically different signaling levels in their brains than the other, homebody bees.

By treating bees with octopamine and glutamate, the researchers found they could increase scouting behavior. On the other hand, when the bees were treated with a dopamine blocker they seemed to decrease scouting.

Liang and the researchers suggest that these genetic mechanisms of scouting in honeybees are very similar to those associated with novelty-seeking behavior in vertebrate species, including humans. Future studies might help researchers to understand exactly how such behavior evolved across various species and lineages.

The researchers could even adjust this brain-gene expression in the bees with certain chemicals, which caused the bees to either scout more or stay closer to home.

The genes that cause these honeybees to leave home and scout for new items are very similar to the genes associated with novelty-seeking behavior in higher organisms, including humans.

Liang and the researchers suggest that their findings may eventually help researchers to understand exactly how such behavior evolved in different species over time.

Alan Harman

MONSANTO ... Cont. From Page 77

that Monsanto would pursue patent infringement matters against farmers who have no interest in using the company's patented seed products.

Buchwald said the plaintiffs had overstated the magnitude of Monsanto's patent enforcement, noting the company averaged about 13 lawsuits a year. This, she said, "is hardly significant" when compared to the number of farms in the U.S., about two million.

Snively said Monsanto believes all farmers should have the opportunity to select the production method of their choice – whether that be organic, conventional or the improved seeds developed using biotechnology. – *Alan Harman*

Display Advertisers

The Beekeeper's Wife

Ed **Colby**

My Aspen ski patrol buddies were already whooping it up in the locker room after work when Marilyn arrived all gussied up. "Hey, Valentine!" I cried, as I threw my arm around her and announced, "My gal Marilyn and I are going to the Redstone Inn tonight to celebrate Valentine's Day!"

"Valentine's Day was yesterday," my boss Artie observed.

"Not for cheapskates," I said. "The Valentine bargains all start the day after."

"Valentine's Day the day after? Eddy, you are a cheapskate," one of the girls hooted.

As my date and I strolled out the door, that old patrol room echoed with shouts and laughter. They can be so rowdy!

Valentine's Day is not my favorite holiday. It always felt to me like it was invented by florists and greeting card manufacturers. But Marilyn doesn't look at it that way. Her instructions were explicit: "Just take me out, ask me to be yours, and everything will be OK, OK?"

I don't have time for this. I've got a girlfriend, finally. But I run short on sleep. I have Spring bee work to do, and overtime on the job. Sometimes you have to balance what you need to do with what you have to do. And I have to keep Marilyn happy, right? At my age, if she dumps me, I'm in trouble.

The road from Carbondale to Redstone, along the Crystal River, is as pretty as it gets. I told Marilyn about Derrick pioneering commercial beekeeping in this remote valley. He has Summer yards as far up as Marble. Sometimes his little darlings do pretty well.

It felt like we were on vacation. We made it to the inn before dark.

On the way back the next day we stopped at the Penny Hot Springs, a 10 by 30-foot, natural hot-water soak pool at the river's edge. There's no sign. You have to know where it is. In the old days, hippies frolicked in the nude here, to the shock and dismay of upright citizens who peered down at them from the road above. Now, swimsuits are the norm, which is fine by me. In the pool we met a charming young couple making short work of a bottle of red wine. They lived a couple of hours away. Suddenly the young man said, "We've gotta go. I have to be at work."

"What do you do?" I queried.

"I sterilize surgical instruments," he said.

Marilyn rolled her eyes. "Drive carefully," I cautioned.

Next we shared the pool with a woman of a certain age, which is to say she might have been my age. She had the loveliest waist-long silver hair. She slipped into the water beside us.

Mary Jane told us she and her carpenter husband raised seven kids in the Wisconsin countryside, with no running water. They had a 34-degree spring on their two acres. I suppose they liked it that way. Now three of her children live between Aspen and Carbondale.

Back home Mary Jane was midwife to the Amish. She told how when they needed major medical care, they would take the train to San Diego, and Dr. Contreras in Tijuana would send a car across the border for them.

When we were parboiled, Marilyn jumped into the icy Crystal River. I thought, "No way!" Then Mary Jane followed her. Back in the hot pool afterwards, Marilyn said, "I hope I never get too old to jump into the river."

Of course I had to one-up the girls now, so I dove in headfirst. Suddenly I was in midstream. The water might have been 34 degrees, like Mary Jane's spring, but I didn't feel cold. This was pure shock!

Back in the hot pool, the women were dominating the conversation. I cut in to mention that I was a beekeeper. Mary Jane's eyes lit up. "My husband's a beekeeper," she exclaimed. Not just a garden variety backyard apiarist, but a former Peace Corps beekeeping advisor in Gambia, West Africa, who "showed the Gambians how to take the bees out of the trees and put them in hives." Robin runs 100 colonies now, and a little queen rearing business, while Mary Jane dips candles on their wood cook stove. He's a carpenter, remember, so he can build what he needs, not order it out of a catalog.

I felt a twinge of envy. Here was someone truly immersed in our noble craft. He had a houseful of children, a 34-degree spring, and a kind of independence and self-reliance that I'll never have as long as I'm punching a time clock. And he has a woman with the loveliest silver hair.

Maybe I'll have one, someday.

BOTTOM BOARD

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Science Of Bee Culture

Vol. 4 No.1

INSIDE

The Effects of Pollen-Enriched Pollen Substitute on Winter Cluster Size and the Prevalence of *Nosema ceranae* in Russian Honey Bee Colonies

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Summary

This study determined the effects of feeding a pollen substitute enriched with pollen and feeding protein in plastic frames placed directly in the brood nest on the growth of Russian honey bee colonies through the winter. Colonies were fed: 1) a mixture of 1/2 pollen and 1/2 commercial pollen substitute as a patty (P/PS/P), 2) a mixture 1/2 pollen and 1/2 commercial pollen substitute pressed into a plastic frame and inserted into the brood nest (P/PS/F), 3), commercial pollen substitute as a patty (PS/P), or 4) commercial pollen substitute fed in a plastic frame (PS/F). All colonies were fed sugar syrup as a slow drip from a pail. Feeding began November 30, 2010 and the experiment ended February 15, 2011.

Feeding P/PS/P resulted in colonies that averaged 10.4 frames of bees, grew by 2.3 frames of bees, and had 4.0 frames of brood in mid-Febuary. The same diet fed in a frame (P/PS/F) inserted into the brood nest produced colonies that were numerically, but not statistically, smaller. Feeding pollen substitute without natural pollen (PS/P and PS/F) produced significantly smaller colonies. Overall, there was a significant positive relationship between the final size of colonies and the amount of protein diet they consumed.

Colonies fed P/PS/P had comparatively elevated levels of *N. ceranae* (1.8 x 10^7 spores per bee). Although this number is below the operational economic threshold for treatment of some beekeepers, the costs of producing larger colonies of bees may include treating the colonies for the control of *N. ceranae.* Treatment for the control of *N. ceranae* should be in autumn, since colonies that began the experiment with low but comparatively elevated infections of *N. ceranae* (7.1 x 10^5spores per bee) died prior to February while surviving colonies started the experiment with lower (4.1 x 10^5 spores per bee) infection levels.

Key Words: *Apis mellifera*, supplemental feeding, *Nosema ceranae*, protein substitute, almond pollination

Introduction

Russian honey bees have good resistance to the parasitic mites *Varroa destructor* and *Acarapis woodi,* good honey production and strong overwintering abilities (de Guzman *et al.* 2001, 2002, Rinderer *et al.* 2001a, 2001b, 2001c). A breeding program for these traits is being continued by the Russian Honeybee Breeders Association (Brachmann 2009). The Russian honey bee stock can be used successfully, with only minimal treatment for parasitic mites, for honey production and spring and summer pollination throughout the country.

After 1998 the income base for many beekeepers changed in the United States from primarily relying on local pollination and honey production to almond pollination. Renting honey bee colonies for almond pollination has provided an increasingly larger share of the income of many commercial beekeepers. Colonies rented for almond pollination must meet size standards established in rental contracts with growers. These contracts vary but, generally, larger colonies command higher prices. Since colonies tend to be smaller in winter, many beekeepers who intend to rent colonies for almond pollination use intensive colony management in an attempt to produce large colonies for mid-February (Traynor 1993).

Russian honey bee colonies build large colonies in the spring after reliable natural pollen becomes available (Tubbs *et al.* 2003). Until then, the colonies are generally small and exhibit traits that favor winter survival, such as using food frugally and producing a restricted late winter brood nest. However, their restricted winter growth is a disadvantage in attempts to produce large colonies by mid-February for almond pollination (Danka *et al.* 2006).

Typically, even among keepers of Italian honey bees, most beekeepers rely on special management procedures to build large colonies by mid-February. Italian honey bees usually respond favorably to these techniques and reasonable proportions of them become or stay large enough to be rented for almond pollination. Mostly these management techniques involve feeding individual colonies both a liquid sugar feed and a protein substitute, usually in patty form. Protein feeding is known to stimulate brood rearing (Danka and Beaman 2009, Degrandi-Hoffman *et al.* 2008, Mattila and Otis 2006, Nabors 2000, Peng *et al.* 1984, Standifer *et al.* 1973). A diet high in protein is important for brood rearing, since a 30% protein diet proved optimum in a comparison of diets containing a variety of protein proportions (Herbert *et al.* 1977).

The best methods of feeding to prepare colonies for almond pollination rental are less well studied. In one study, intermittent feeding of protein and carbohydrate syrup resulted in colonies that dwindled slightly while unfed controls dwindled by half (Degrandi-Hoffman *et al.* 2008). Rinderer *et al.* (2010) found that Russian honey bee colonies in eight-frame hives which were intermittently fed protein and carbohydrate syrup from October to February (2007-2008) only dwindled slightly (0.3 frames of bees) by February. Unfed colonies lost 2.3 frames of bees during the same period. In a second experiment (2008-2009), colonies in eight-frame hives fed from November to February grew by 3.2 frames of bees. Colonies in 10-frame hives that were fed grew less (2.5 frames of bees). Unfed colonies in eight-frame hives grew by one frame of bees and unfed colonies in 10-frame hives remained about the same size. In a third study, hives painted black in an attempt to increase absorption of solar radiation to produce heat failed to encourage more brood rearing (Rinderer *et al.* 2011a). Nevertheless, continuous feeding of sucrose syrup and pollen substitute patties from mid-November produced colonies that averaged 8.6 frames of bees compared to an average of 5.8 frames for colonies that were fed with only one gal (3.8 L) of sucrose.

Feeding colonies is conducive to producing large colonies to meet the needs of almond pollination, especially for Russian colonies. As part of our efforts to determine optimum feeding methods, we studied the effects on colony size of Russian honey bees of feeding protein substitute enriched with pollen and feeding protein in plastic frames placed directly in the brood nest. We also evaluated the effects of protein feeding on the intensity of *Nosema ceranae* infections.

Materials and Methods

The study began November 30, 2010 and final data were collected on February 14 and 15, 2011. One hundred sixty four colonies were established. Colonies were in two eight-frame hive bodies with 16 Langstroth "deep" (9 5/8 in) frames of comb. They were placed in four apiaries on four-way hive pallets. When established, the colonies were evaluated for the presence of a Russian queen and colony size.

At the beginning and at the end of the experiment, both the amount of sealed brood and the amount of bees were estimated. The amount of sealed brood on each side of each frame was estimated as tenths of the frame side covered with sealed brood to produce counts reported as "full frames." Frames of bees were estimated in a hive from a visual inspection of the top and bottom of each box (G. Wardell, Paramount Farms, pers. comm.). This procedure is used for grading a large number of colonies prior to almond pollination. For the top box, the number of bee spaces between frames with at least 1/4 of the length having bees at the top was added to the number bee spaces with at least 1/4 of the length having bees at the bottom. The result was divided by two. For the bottom box, first the number of bee spaces with bees at the top was counted. Then, for the bottom box, the number of bee spaces with bees at the top was added to two times the number of bee spaces with bees at the bottom and the total was divided by two. (The doubling of the number of frames of bees at the bottom of the box is an adjustment to fully account for the bees in a winter cluster large enough to reach to the bottom of the hive.). Adding the frames of bees in the two boxes resulted in the "commercial count" of frames of bees. The count was adjusted for temperature by adding one frame of bees when temperatures are below 60°F or above 65°F. Colonies were equalized at the beginning of the experiment and averaged 7.5 ± 0.2 commercial frames of bees.

Colonies were randomly assigned to one of four combinations of feeding methods and food: a) colonies were fed with a plastic frame containing one lb (0.45 kg) of a commercial pollen substitute (PS/F), b) fed with a plastic frame containing 1/2 lb of pollen mixed with 1/2 lb of a commercial pollen substitute (BeePro®) (P/PS/F), c) fed with a one lb commercial pollen substitute patty placed between the hive bodies (PS/P), or d) fed with a patty made with 1/2 lb of pollen and 1/2 lb of commercial pollen substitute placed between the hive bodies (P/PS/P). All colonies were also fed a thin sucrose solution (1:1 by weight sucrose:water) contained in a 2 gal (7.6 L) pail. The pails had two small holes (1/8") so that the bees only received a small but regular intake of syrup.

Each week, colonies were inspected. For colonies being fed with food in plastic frames, frames were replaced when the protein was at least half consumed. Consumption was measured by weighing frames with the partially consumed food. For colonies being fed patties, an additional patty was added when the existing patty was half consumed. Consumption was recorded for each colony. Consumption of the sucrose solution was also recorded weekly for each colony. Pails were refilled every week.

Plastic frames (SuperCell ®) were prepared by pressing half of the diet into the raised cells on each side of the frame. The pollen was a mixture (50:50, w:w) of pollen trapped locally in Louisiana throughout the previous summer and fall that was vacuum packed and frozen (-70°F) and irradiated pollen obtained from a commercial vendor. An industrial mixer was used to thoroughly blend the pollen and protein substitute prior to use in frames or as patties.

Final colony evaluations were made on February 14 and 15, 2011. Once again colonies were inspected frame by frame, and colony size, amount of sealed worker brood, amount of sealed drone brood and survival were estimated using the same procedures as mentioned previously. Colony growth was determined using baseline and final evaluations. Total food consumption for each colony was determined from weekly records.

During the evaluations at the beginning and the end of the experiment, samples of approximately 300 bees were taken from the brood nest of each colony and evaluated for *V. destructor* infestation levels. For these evaluations, the samples were processed with a soap-washing technique (Rinderer *et al.* 2004) to remove varroa mites. Counts of both bees and mites in each sample were made and rates of infestation were determined. Rates of infestation for each colony from the beginning and end of the experiment were used to determine mite population growth (MPG).

Samples of worker bees were also taken from the peripheral area of the hives to evaluate *N. ceranae* infections. Samples of bees were placed on ice for transport and frozen shortly after collection. Frozen samples were processed to determine the average number of *N. ceranae* spores per bee (Bourgeois *et al.* 2010). Briefly, this entailed grinding 100 whole bees in 100 ml dH_2O and centrifugation of 100 ml of the homogenate at 800 x g for six min. The supernatant was then removed and the pellet was resuspended in 10 ml dH_2O. A sub-sample of the 10 ml resuspension was then removed and centrifuged for sample concentration. The sub-sample pellet was then incubated in H_2O_2, digested in lysis buffer and proteinase K solution, proteins were precipitated with 7.5 M NH_4OAc, and genomic DNA was precipitated with isopropanol. DNA samples were then processed with quantitative real-time PCR to determine the amount of *N. ceranae* DNA present. This value was then converted to the number of *N. ceranae* spores per bee through a calibration factor as described by Bourgeois *et al.* (2010). Detection and quantification were performed on a StepOne™ Real-time PCR System (Applied Biosystems, Carlsbad, CA). Protocols for FAST PCR and reagent specifications followed those described by Bourgeois *et al.* (2010). Modifications to the protocol were made by elimination of primers and probe reagents for *N. apis* and addition of distilled water to adjust the reaction volume to 12.5 µL. All other reagents and specifications remained the same. All samples were run in triplicate and were directly quantified by comparison to a standard curve of known levels of *N. ceranae* DNA copy number. Standards were generated from serial dilutions of a cloned PCR product of the target sequence from *N. ceranae*.

The data analyzed were "commercial frames of bees" for final colony sizes and for growth, "full frames" for worker brood and drone brood, lb of protein food consumed, gal of sugar syrup consumed and number of *N. ceranae* spores per bee for *N. ceranae* infection levels. MPG was standardized (z-score transformation) across apiaries to control for any apiary differences and a correlation analysis was used to determine if larger colonies at the end of the experiment also had larger MPG (SAS 9.2, SAS Institute 2008). Using feeding method, food type, and apiary as fixed effects, the data were analyzed by randomized block, multi-factor analyses of variance. Data from 100 colonies were analyzed. Survival data were analyzed using chi-square goodness of fit tests. All data were analyzed using SAS 9.2 (SAS Institute 2008). Linear regression was used to determine the relationship between final colony size and food consumption (SAS Institute 2008).

Results

Sixty-four colonies (39%) were lost owing to queen losses, storm related mishaps (falling trees and hive covers blown off in storms) and other causes. Losses were equally distributed across apiaries (χ^2 = 1. 68, *df* = 3, *P* = 0.64), feeding method (χ^2 = 0.22, *df* = 2, *P* = 0.64) and food type (χ^2 = 0.14, *df* = 2, *P* = 0.71). Colony loss was related to the initial levels of *N. ceranae* (*P* = 0.005). Colonies that survived until February started with infections which averaged 4.1 x 10^5 ± 4.2 x 10^4 spores per bee and those that were lost started with infections of 7.1 x 10^5 ± 1.0 x 10^5 spores per bee.

Final colony sizes, in frames of bees, were significantly (*P* = 0.0002) different between those fed pollen substitute (PS= 6.64 ± 0.60) and those fed the pollen/pollen substitute mixture (P/PS= 9.5 ± 0.66). Also, those fed protein in patties (8.66 ± 0.66 frames of bees) were larger (*P* = 0.05) than those fed protein in frames (7.43 ± 0.68 frames of bees). Effects of apiaries were not significant (*P* = 0.16) and there were no significant interactions among the main effects. The combination of the P/PS fed as a patty produced colonies having more (P = 0.05) frames of bees than other combinations of food and feed type (Table 1).

The growth of colonies, in frames of bees, was also influenced by type of food and method of feeding. Colony growth was less (*P* = 0.003) in those colonies fed pollen substitute (PS = -0.63 ± 0.71) than in those fed the pollen/pollen substitute mixture (P/PS 2.03 ± 0.70). Also, the size of colonies, in frames of bees, fed protein in patties (patty = 1.39 ± 0.63) were numerically larger (*P* = 0.096) than those fed protein in frames (frame = 0.24 ± 0.86). Apiaries had no effect (*P* = 0.45) and there were no significant interactions among the main effects. The P/PS/P produced colonies having growth that was greater (*P* = 0.05) than all other combinations of food and feed type (Table 1).

By the end of experiment, the protein feeding treatments also resulted in different amounts of brood in colonies. The amount of full frames of worker brood was less (*P* = 0.005) in colonies fed PS (2.47 ± 0.31) than in those fed the P/PS (3.56 ± 0.). Also, more frames of brood (*P* = 0.015) were produced by colonies fed protein in patties (3.48 ± 0.34) than those fed protein in frames 2.57± 0.32). The effects of apiary were not significant (*P* = 0.26) and there were no significant interactions among the main effects. The P/PS/P produced colonies having more worker brood (*P* = 0.05) than all other combinations of food and feed type (Table 1). Drone brood production was still very limited at the end of the experiment and no effect of feeding on the amount of drone brood was detected (Table 1).

Protein food consumption paralleled the growth of colonies. The pounds of protein food consumed were less (*P* = 0.008) by those colonies fed PS (3.17 ± 0.23) than for those fed the P/PS (4.19 ± 0.24). Also, those fed protein in patties (4.08 ± 0. 24 lb) ate more (*P* = 0.008) than those fed protein in frames (3.34 ± 0.26). Apiaries had insignificant effects on consumption (*P* = 0.24) and there were no significant interactions among the main effects. The P/PS/P was consumed more (*P* = 0.05) than other combinations of food and feeding method (Table 1). There was a positive relationship (*P* = 0.001, r^2 = 0.50) between the final colony size and the amount of protein food consumed regardless of the type of food or method of feeding.

The amount of sucrose syrup consumed was similar among the four protein food groups (*P* = 0.53) (Table 1). Numerically, the group that had the smallest final colony size (PS/F) consumed an average of 1.6 gal of syrup while the group that had the largest final colony size (P/PS/P) consumed an average of 1.2 gal. Hence, there was no suggestion that the larger colonies consumed more syrup.

November levels of *V. destructor* were low (4.6% ± 0.003%, mean ± SE) and did not differ for colonies assigned different treatment groups (*P* = 0.26). In February, levels remained low (4.7% ± 0.003%) and did not differ for colonies in different treatment groups (*P* = 0.92). There was no significant correlation between the final size of the colonies and the MPG (*P* = 0.16).

At the beginning of the experiment, the numbers of *N. ceranae* spores per bee were similar for the four groups ($P = 0.42$) and the overall average number of spores per bee was $5.6 \times 10^5 \pm 1.8 \times 10^5$. However, the analysis of the average number of *N. ceranae* per bee at the end of the experiment indicated an interaction ($P = 0.02$) between the method of feeding protein and the type of protein fed. An analysis of *N. ceranae* infection in the four groups showed that most groups had similar average numbers of spores (ranging from 7.2×10^6 to 7.9×10^6) while the group that was fed P/PS/P had more than twice (17.8×10^6) the number of *N. ceranae* spores per bee as the other groups ($P = 0.004$) (Table 1).

Discussion

The combination of continually feeding colonies in 8-frame hives with P/PS/P from November 30, 2010 to January 24, 2011 produced the largest colonies (averaging 10.34 ± 0.92 frames of bees). The P/PS/P also produced the largest colonies in this series of experiments (Rinderer *et al.* 2010, 2011a and this study). Comparisons between years are uncertain, partially because of variation in winter conditions. However, the conditions of the winter of 2010-2011 had longer cold periods with colder days that the prior years. (Weather data are available from the Louisiana Agriclimatic Information System, **http://www.lsuagcenter.com/weather**). Hence, the large final size of the colonies fed the P/PS/P was not the result of especially favorable experimental conditions.

The other data from this experiment further support the conclusion that feeding P/PS/P produced larger colonies. Colony growth and the amount of worker brood at the end of the experiment are all the largest for the group of colonies fed P/PS/P (Table 1). All these measures of colony size are consistent with the greater protein consumption displayed by these colonies. Clearly, the pollen portion of this diet had good nutritional value and may have also had a phagostimulant value as well. By simply "tasting better" the pollen-enriched diet may have encouraged bees to eat more which resulted in larger colonies with more brood.

Feeding protein in a plastic comb was less successful than feeding protein as a patty. Certainly a positive effect of feeding the P/PS was found with frame feeding, but results of the frame method were numerically inferior to the results of the patty method (Table 1).

Adding pollen to a protein diet adds to the cost of feeding colonies. The cost of materials for feeding the P/PS/P averaged $18.06 per colony. The cost of the materials for feeding the PS/P averaged $4.73 per colony. The more expensive P/PS/P diet resulted in colonies averaging 10.34 frames of bees, with 87% of colonies being at least eight frames of bees. Feeding the PS/P resulted in colonies which averaged 6.88 frames of bees with 42% of the colonies being at least eight frames of bees (Table 2). Whether or not the additional expense of feeding pollen enriched patties is economically beneficial depends on the specific pollination contract between beekeeper and grower, the benefits of a higher percentage of colonies meeting the minimum grade and the comparative value of the colonies when the colonies are released from the pollination contract.

In February, the numbers of *N. ceranae* spores found in all groups was high, having risen more than ten-fold from the beginning of the experiment. Also, field colonies of Russian honey bee stock that were not fed protein in an otherwise similar experiment (Bourgeois *et al.* 2011) had substantially lower numbers of *N. ceranae* spores per bee in the same season. It is unlikely that the pollen contained viable spores since it was either frozen or irradiated. Frozen pollen was kept at -70°C for several months and freezing at -18°C for 1 week rendered almost all *N. ceranae* spores non-infective (Fries 2010). Most likely, the colonies that had more bees (i.e., grew more and had more brood as a result of the protein diet) also had conditions that favored growth of *N. ceranae*. This is true for all the treatment groups but especially true for the group fed P/PS/P. This result is congruent with cage studies (Porrini *et al.* 2011) that found both a rapid formation of *N. ceranae* spores and a longer survival of infected worker bees when the bees were fed pollen. The same result was found in cage studies (Rinderer and Elliott 1977) using worker bees infected with *N. apis*.

It may be that the infection levels of *N. ceranae* in February are inconsequential since the infected colonies appeared to be both large and vigorous. Also, although spore formation is more rapid in pollen-fed worker bees, their longevity was greater than that of infected bees not fed pollen that had produced fewer *N. ceranae* spores (Porrini *et al.* 2011). Also, worker bees fed *N. apis* spores and pollen produced large numbers of spores but lived as long as worker bees not infected and not fed pollen (Rinderer and Elliott 1977). So far, no economic threshold for *N. ceranae* has been established. However, these results suggest that worker bees with

Table 1

Treatment Group	N	Final Colony Size (CF) Protein (lb)	Growth (CF) Sugar Syrup	Worker Brood (FF)	Drone Brood (FF)	Food Consumption		*Nosema ceranae* (spores per bee)
						Protein (lb)	Sugar Syrup (Gal)	
Pollen mixture as patty (P/PS/P)	28	10.34 ± 0.92[a]	2.33 ± 0.92[a]	4.03 ± 0.50[a]	0.04 ± 0.01[a]	4.6 ± 0.36[a]	1.2 ± 0.10[a]	$17.8 \times 10^6 \pm 3.3 \times 10^6$ [a]
Pollen mixture in frame (P/PS/F)	26	8.55 ± 0.94[ab]	1.71 ± 1.08[a]	3.05 ± 0.44[ab]	0.11 ± 0.02[a]	3.8 ± 0.30[a]	1.5 ± 0.13[a]	$7.6 \times 10^6 \pm 1.8 \times 10^6$ [b]
Substitute as patty (PS/P)	26	6.88 ± 0.81[b]	0.33 ± 0.52[ab]	2.89 ± 0.42[ab]	0.05 ± 0.03[a]	3.5 ± 0.25[ab]	1.2 ± 0.12[a]	$7.2 \times 10^6 \pm 1.5 \times 10^6$ [b]
Substitute in frame (PS/F)	20	5.95± 0.98[b]	-2.32 ± 0.92[b]	1.93 ± 0.42[b]	0.03 ± 0.01[a]	2.6 ± 0.41[b]	1.6 ± 0.50[a]	$7.9 \times 10^6 \pm 1.7 \times 10^6$ [b]

Table 1. Measures of colony status in February presented as means ± standard errors for the indicated measurements. CF= Commercial Frames, FF = Full frames. Differing letter designations represent significant differences between groups ($P < 0.05$).

an enriched protein diet may have a higher economic threshold than bees that have had a comparatively protein-deprived diet. Although no economic threshold for *N. ceranae* has been established, some beekeepers use counts of 20 million (20 x 10^6) spores per bee from apiary samples to guide treatment. All treatment groups in this experiment had average numbers of spores below this level although the group fed P/PS/P approached this level (Table 1).

The numbers of *N. ceranae* spores per bee at the beginning of the experiment in November were generally low. However, colonies that had comparatively higher numbers of spores were disproportionately represented among the colonies that died. Certainly, *N. ceranae* was not the only cause for colony death since storm damage or queen loss was evident for some of them. However, many of the dead colonies simply dwindled and died which is consistent with descriptions of Colony Collapse Disorder (CCD) (vanEngelsdorp *et al.* 2009). The protein diets combined with higher initial infections may have favored more rapid manifestation of the disorder. These results do not establish *N. ceranae* as the cause of the differential mortality observed in this experiment. The comparatively elevated levels of *N. ceranae* may have either contributed to or been a result of the cause of the differential mortality. Also, the results do not conclusively identify *N. ceranae* as the cause of CCD and thus, the cause of CCD remains unclear (Bromenshenk *et al.* 2010, Cox-Foster *et al.* 2007, vanEngelsdorp *et al.* 2009). However, the results do lend support to the findings of Higes *et al.* (2008) and Martin-Hernandez *et al.* (2007) that *N. ceranae* is a parasite capable of causing substantial colony losses.

The differential loss of colonies that had higher but modest infection levels at the beginning of the experiment suggests treatment for *N. ceranae* is appropriate, even for colonies with low levels of infection. Since we did not follow the course of infections through time, we can only speculate that infections rose and resulted in colony mortality. However, the surviving colonies did have substantially higher levels of infection at the end of the experiment. Consequently, until more is known about the long-term fate of colonies with a good protein diet and also infected with *N. ceranae*, their treatment to suppress *N. ceranae* levels is prudent in the autumn months and probably also in early spring when feeding has ended.

Other techniques might be found that will further enhance the development of Russian honey bee colonies through autumn and winter. However, feeding Russian honey bee colonies syrup with a slow rate of intake and simultaneously feeding patties of pollen substitute enriched with pollen resulted in Russian honey bee colonies in February that warranted a premium grade for almond pollination. This conclusion provides guidance, at least for beekeepers who overwinter their colonies in the southern United States prior to moving them to California in February. Further research is needed to determine the value of these management techniques in other locations.

Conclusions and Recommendations

Russian honey bee colonies can be managed in the southern United States through autumn and winter to produce colonies which average more than eight frames of bees in February.

Colonies that are fed both sucrose syrup and pollen-enriched protein supplement continually from November to February are much more likely to grow to a large size.

A mixture of pollen and pollen substitute fed as a patty is likely to produce larger colonies with more brood and also more *N. ceranae*. The benefits of larger colonies in February may justify the expense of treating the colonies for *N. ceranae* control. The treatment for *N. ceranae* is prudent for both colonies with low infections in the autumn and colonies with higher infection levels in early spring.

Every successful change in beekeeping procedures requires learning and refinements by individual beekeepers. Beekeepers interested in changing their methods to include Russian honey bees, 8-frame hives, or different feeding regimes should first attempt to make changes in half the colonies in one or a few apiaries. Doing their own controlled experiment will provide both an opportunity to evaluate the usefulness of changes in individual beekeeping enterprises and help develop the experience needed to perfect and adapt the changes to specific environments.

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Table 2. Treatment Group	N	All Colonies	Colonies > 6 frames			Colonies > 8 frames		
		Average size	N	Percentage	Average size	N	Percentage	Average size
Pollen mixture as patty (P/PS/P)	28	10.34ᵃ	27	96ᵃ	11.70	24	86ᵃ	12.16
Pollen mixture in frame (P/PS/F)	26	8.55ᵃᵇ	21	81ᵃ	10.67	17	65ᵃᵇ	11.86
Substitute as patty (PS/P)	26	6.88ᵇ	13	50ᵇ	10.71	11	42ᵇ	11.60
Substitute in frame (PS/F)	20	5.95ᵇ	9	45ᵇ	9.94	9	45ᵇ	9.94

Table 2. The number and average size of colonies that were fed with four different combinations of food type and feeding method and the number, percentage and average size of the groups that were greater than six and greater than eight frames of bees in size. Differing letter designations represent significant differences between groups ($P < 0.05$).

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Honey bee colony winter losses and treatments against Varroa destructor in New Jersey, USA, 2010-11

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The number of managed honey bee (*Apis mellifera* L.) colonies in the United States decreased during the period of 1947 to 2008 by 61%, from 5.9 to 2.3 million colonies. Over this time period, a variety of factors including bacterial, fungal and viral diseases, parasites, pesticide usage, climate, genetics, land-use change, and socio-economics have all had measurable effects on managed honey bee populations (vanEngelsdorp and Meixner, 2010). Since 2006 Colony Collapse Disorder (CCD) has been implicated in widespread losses in the United States and has prompted the deployment of surveys aimed at quantifying losses, especially due to CCD (e.g., vanEngelsdorp *et al.* 2008,vanEngelsdorp *et al.* 2011). However, some U.S. states, such as New Jersey, have few reports of the main symptom of CCD (complete absence of bees in dead colonies), yet still report high levels of colony loss. Here we report results from asurvey conducted in New Jersey to quantify the number of colonies lost during the winter of 2010-2011 and to determine the relative importance of managing the mite *Varroa destructor* on winter colony survival.We use this initial survey to illustrate the applicability of using simple standardized surveys to monitor managed bee colonies and evaluate best management practices.

On April 1, 2011, we distributed a survey by e-mail to the approximately 900 members of the New Jersey Beekeepers Association. We requested respondents to report the number of colonies they managed that were alive on December 1, 2010 and the number which survived until March 15, 2011, the location of their apiary by county, whether or not they treated for mites, if so which treatment was used and in which month they started the treatment. In all, 217 respondents, representing 1,939 colonies in all 21 counties of New Jersey, responded to the survey. Respondents operated an average of nine colonies. Out of 1,939 colonies reported alive in 2010, 1,290 were still alive on April 1, 2011, representing a total mortality rate of 33%(Table 1).We modeled individual hive survival with a generalized linear mixed model (glmm) by using a binomial error distribution as implemented in package *lme4* ofthe statistical environment R (**http://www.r-project.org/**). The mite treatment was included as a fixed factor with the operator as a random factor in order to take into account the non-independency of the data. Colonies receiving no mite treatment had an overallmortality rate of 65%. The best performers were ApiGuard® (thymol gel), formic acid, andApiLifeVar® (74.08% thymol, 16.00% eucalyptus oil, and 3.70% L-menthol),with mortality rates of 18%, 23% and 25%, respectively (Table 1). Coumaphos treated colonies averaged lower mortality rates than untreated colonies but the difference was not significant, probably because of the low number of operators that used this treatment (two operators representing 23 colonies). Both Apistan® (synthetic pyrethroid tau-fluvalinate) and powdered sugar treatments were not statistically distinguishable from untreated colonies(Table 1).Because a large number of operators treated with ApiGuard®(72 operators representing 1,207 colonies) we were also able to examine the relationships between colony mortality and ApiGuard® treatment timing. Most operators using ApiGuard® began treatment in August (84.3% of colonies treated) with the remainder beginning treatment in July, September or October. Sixteen percent of colonies treated with ApiGuard® in July did not survive compared with 17% for treatment beginning in August, 24% in September, and 47% in October. Only the October treatment was significantly different from the other ApiGuard® treatment timings, although we must acknowledge that the uneven distribution of treatment timings (i.e., that the vast majority of operators began treatment in August) makes determining statistical significance problematic.

Interestingly, overall losses reported in our survey were similar to those of the United States in recent years, 35.8% in the winter of 2007-2008 and 34.4% in 2009-2010, but were larger than the 15.1% and 10.4% losses reportedfor those years in New Jersey in national surveys (vanEngelsdrop *et al.*2008, vanEngelsdorp *et al.* 2011). While the greater losses captured in our survey could be the result of year to year variation or differences in various components of survey methodology, we believe that they represent differences based on which operators participated in each survey. vanEngelsdorp *et al.* (2008, 2011) employed a surveying strategy which, for New Jersey, captured predominantly large operations. They surveyed fifteen operators representing 23,532 colonies in 2007-2008 and 31 operators representing 3,966 colonies in 2009-2010. That is an average of 1,569 and 128 colonies per operator compared with our average of nine colonies per operator. Therefore we believe we are capturing a sample of smaller scale operators in our current survey. The fact that our survey records over twice the winter loss in New Jersey than vanEngelsdrop *et al.* (2008, 2011) may indicate that smaller scale operators are employing less successful hive management strategies than larger, and in many cases migratory, operators. Since vanEngelsdrop *et al.* (2008, 2011) do not record any specific management practices related to disease and pest control, we cannot directly compare management strategies of small and large scale operators. In any case, small operators constitute an important fraction of the managed colonies in New Jersey and warrant study. We recorded 65% colony mortality when no *V. destructor* treatment was employed; hence, we hypothesize that mite pressure is the single greatest challenge to colony winter survival in New Jersey. This hypothesis is strengthened by recent research indicating that failure to control *V. destructor* may be the main factor explaining winter colony losses in Canada (Currie *et al.* 2010) and specifically in Ontario (Guzmán-Novoa*et al.* 2010).

In conclusion, our survey suggests that *V. destructor* is sometimes being improperly managed in New Jersey, at least by smaller operators. ApiGuard®, formic acid, and ApiLifeVar® are clearly superior treatment options. Coumaphos and Apistan® are not significantly more effective than no treatment. Though the number of respondents using these two chemistries precludes any strong statements, it is possible that their observed lack of efficacy could result from evolved resistance of *V. destructor* which has been noted in both coumaphos and Apistan® (Pettis 2004) or could be a result of improper usage. In our single most successful cohort, operators beginning ApiGuard® treatments in July and August, the colony mortality rate was only around 18%. These results indicate that with proper management strategies, even smaller scale beekeepers in New Jersey should be capable of achieving winter losses below 20%. Clearly, there are limitations in interpreting survey results from a single year. We plan to repeat this survey

	Summary Statistics			Generalized linear mixed model estimates compared against a baseline of no treatment			
Treatment	No. or colonies	No. or operators	Colony mortality (%)	Estimate	Std. Error	z value	Pr(>|z|)
ApiGuard®	1,207	72	18%	1.76	0.36	4.93	<0.001
Formic Acid	91	19	23%	1.96	0.59	3.33	<0.001
ApiLifeVar®	28	8	25%	2.10	0.88	2.38	0.017
Coumaphos®	23	2	48%	1.48	1.42	1.04	0.300
No treatment	453	97	65%	0.00	0.00	-	-
Apistan®	16	4	69%	-0.35	1.12	-0.32	0.751
Powdered Sugar	121	15	72%	0.94	0.63	1.50	0.134
All Treatments	1,939	217	33%				

Table 1. Results of winter colony losses and *Varroaa destructor* treatment deployed by 217 operators (beekeepers), representing 1,939 colonies, from New Jersey (2010-2011). Percent mortality is calculated blind to operator for ease of interpretation.

next year from a larger and more diverse subset of New Jersey beekeepers. Furthermore, we believe that this survey illustrates a simple and cost effective strategy for elucidating management factors which may be contributing to mortality rates among managed bee populations. Adding basic questions to beekeeper surveys regarding use and timing of acaricides, other pesticides, fungicides, antibiotics, feeding, and other cultural practices has the potential to inform management recommendations and research throughout the beekeeping community.

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A Note on Introducing Four-Day-Old Virgin Queens into Nucleus Colonies Using Artificial Queen Cells in Alberta, Canada

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Short Title: Introducing Virgin Queens into Nucleus Colonies

Beekeepers on the Canadian prairies frequently produce large numbers of queens for the production of nucleus colonies in the spring (Nelson *et al.* 1992). These nucleus colonies are typically initiated with a single frame of sealed brood, covered with queenless adult worker bees and a single 14-day-old queen cell. We investigated the possibility of modifying this procedure by introducing virgin queens rather than queen cells. This would offer a number of advantages over cells, including decreasing the time needed to produce a mated queen, eliminating queen losses prior to emergence and facilitating queen phenotyping or genotyping prior to introduction (Perez-Sato and Ratnieks 2006).

Virgin queen introduction, however, is highly inconsistent compared with the introduction of virgins following their natural emergence from a queen cell (reviewed by Perez- Sato *et al.* 2007). One method that appears to overcome this variability is to introduce incubator-emerged virgin queens using an artificial queen cell consisting of a 4-d-old virgin placed in a plastic queen cell protector (JZs BZs, Menlo Park, CA) covered with paper and masking tape. The hole at the top of the artificial cell is closed with a plastic queen cup (JZs BZs) and at the tip with a thin wax-honey plug. This method has previously yielded over 90% acceptance (Perez-Sato *et al.* 2007). The objective of this study was to confirm the success of introducing virgins via this method and evaluate it against the use of mini queen cages or natural queen cells.

On 1 July 2010, 40 nucleus colonies were established at the AAFC Research Farm near Beaverlodge, Alberta, Canada (55° 12′ 34″ N, 119° 25′ 45″ W). Colonies were randomly allocated into four treatment groups and received one of the following: 1) 14-day-old queen cell, 2) 4-day-old virgin introduced using an artificial queen cell sealed with a wax-honey plug, 3) 4-day-old virgin introduced using a California mini queen cage (C.F. Koehnen & Sons, Inc, Glenn, CA) sealed with soft candy made from four parts liquid glucose syrup (# 11 Nulomoline, Grandma Food Products St. John, NB) and one part Drivert® (**Industrial Commodities, Inc.** Glen Allen, VA), or 4) 4-day-old virgin introduced using a California mini queen cage sealed with a wax-honey plug. All queens were daughters of an instrumentally inseminated hybrid of Minnesota Hygienic (Spivak *et al.* 2009) and a line selected for high Varroa Sensitive Hygiene (Danka *et al.* 2008) and were reared using the standard Doolittle method (Laidlaw and Page 1997). Queen cells were transferred from cell finisher colonies when queen cells were 14-day-old and either installed into colonies, or incubated at 34°C until emergence into glass vials containing soft candy. The successful release of virgins from cells or cages was inspected four days after introduction. If the queens had not been successfully released by this date they were manually released. Colonies were inspected for the presence of the virgins on day 10 and the presence of newly-laid worker eggs on day 21.

We did not observe the high levels of acceptance using artificial queen cells reported by Perez-Sato *et al.* (2007) as less than a quarter of virgins introduced using this method survived to egg-laying (Table 1). Although not significantly different from other treatments, the use of natural queen cells had the highest level of survival (Table 1).

The poor performance of the artificial queen cells may be attributed to the composition of the wax-honey plugs used in our study. Perez-Sato *et al.* (2007) used a wax-honey plug derived from the colony in which the virgin was to be introduced. Our wax and honey, in contrast, was of mixed origin. We hypothesize that the colonies familiarity with volatiles in the wax may be a significant variable in determining acceptance.

Although all but one of the virgins in the artificial cells was released by day four, virgins in cages with wax-honey plugs largely remained in their cages. In the cages we observed that while most of the honey in plugs had been consumed, small amounts of wax continued to block the passage for queen release on day 4. Though the total volume of plug material was standardized among introduction methods, the hole of the artificial cells presented a larger diameter of material for bees to interact with than cages, while plugs in cages were slightly deeper and possibly more compacted. It is, subsequently, unclear whether the marginally higher acceptance of caged virgins with wax-honey plugs compared with those caged with candy was a consequence of the type of plug material or the fact that virgins with candy-plugged cages all self-released in less than four days.

Overall, our study suggests that artificial queen cells may not provide consistent queen release across all apicultural conditions. We speculate that the use of honey and wax from nucleus colonies where virgins are introduced may improve success.

Introduction method	Introduced	Accepted	*P*
Natural queen cell	10	7(70%)	-
Artificial cell (wax-honey plug)	10	2(20%)	0.0698
California mini queen cages (candy plug)	10	3(30%)	0.1789
California mini queen cages (wax-honey plug)	10	5(50%)	0.6499

Table 1. Number of queens accepted and laying eggs 21 days after introduction as natural queen cells or as 4-d-old virgins using three different introduction techniques. The null hypothesis that virgin acceptance did not differ from that of natural queen cells was tested using a two-tailed Fisher's exact test (SAS Institute 2001).

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